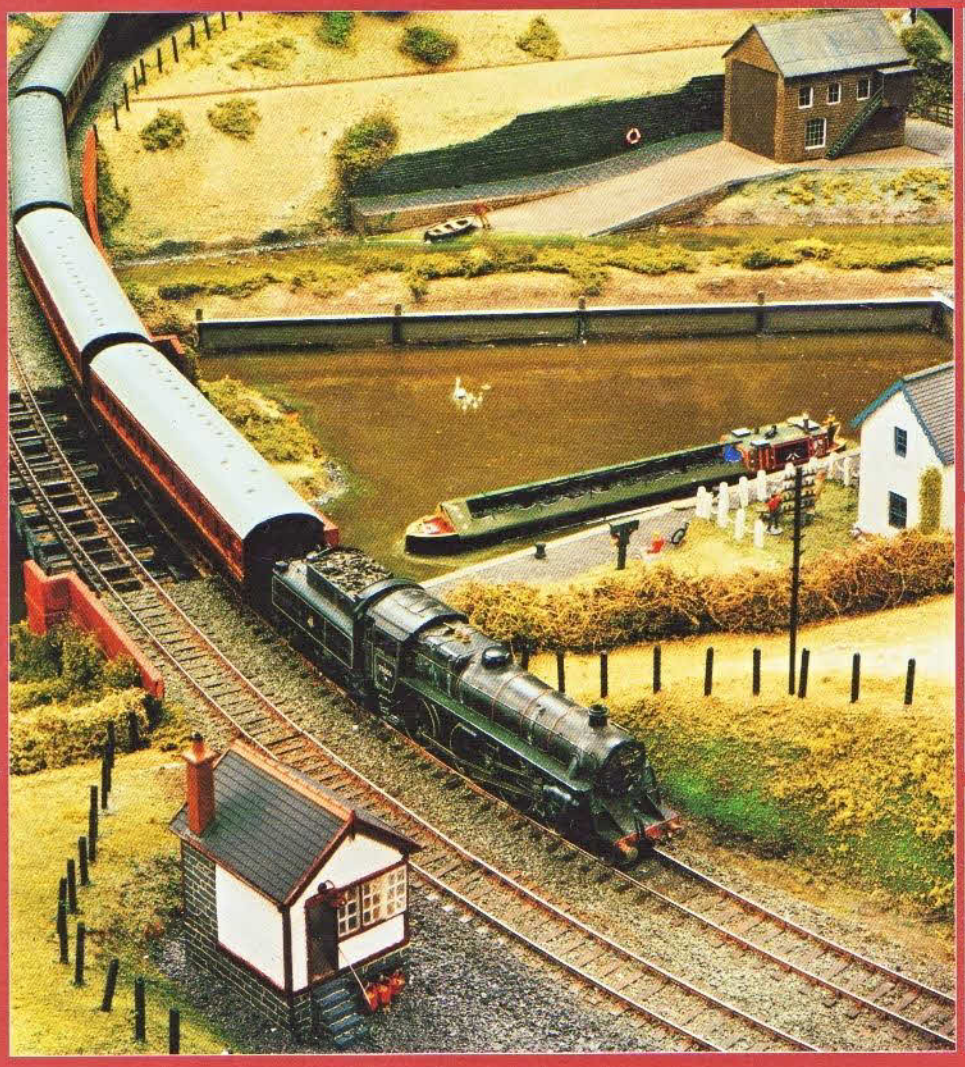
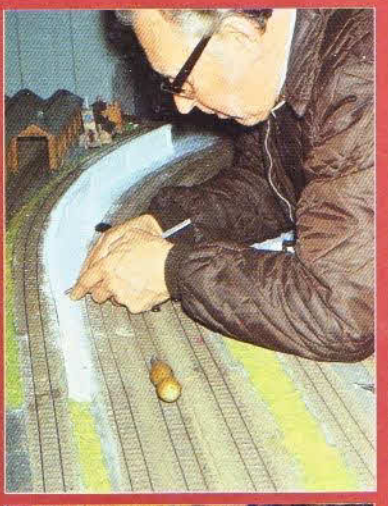
THE MODEL RAILWAY MANUAL





A step-by-step guide to building a layout

C.J. FREEZER

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Introduction

A model railway is both large and complex, consisting as it does of a collection of many individual items, most of them models in their own right, brought together to form a complete layout. This allows each individual railway modeller to tailor the end result to suit his or her own opinion of what represents the best aspects of the full sized railway system. It also makes the task of anyone asked to write a basic manual on the hobby very formidable.

A comprehensive account of every worthwhile facet of the hobby would require a very large volume indeed. Worse, to present every constructional technique in one volume would merely confuse the newcomer who, presented with two or three ways of carrying out a task, has no means of knowing which is best for him or her. I have therefore adopted a straightforward approach, and have stuck to my way of doing things. The photographs will, I trust, convince you that they do work. I am not suggesting that they are the only way, or even the best way. In any case, 'best' on its own is a meaningless term; you need to say for what purpose and under what circumstances. No manual on model ship construction even suggests that it might be a good idea to carve them from bone with a sailor's knife, but for the Napoleonic prisoners of war, this was the best available technique. What I will say is that the methods I describe do not require an elaborate workshop and do not demand exceptional skills and produce an acceptable result in a reasonable time.

I should add that I am left-handed, which may make some illustrations look a little odd. If this leads you to think, so much the better. One of the great advantages of being left-handed in a right-handed world is that you learn not to take too much for granted. A very sound rule in engineering workshops is 'Before starting machine, engage brain'. A craftsman may appear to perform his tasks in an effortless fashion, but in practice he has not only decided in advance how he is to do the job, but also while he is doing it he is asking himself if the next time he could not do it better.

It might be thought that I have given the most significant part of the model the least attention. Locomotives, coaches and wagons form a special sub set in the complex gestalt of a model railway because they are readily removed from the layout. In addition, since they are, for all of us, such a vital part of the whole, there is a ready demand for complete models. This in turn has led to there being an excellent selection of good quality ready-to-run models at affordable prices for OO, HO and N gauges. As one can now assemble a basic stud of locomotives and a representative selection of coaches and wagons for a model based on most British, European or US prototypes since the mid-1930s, there is no urgent reason for a newcomer to get deeply involved with extensive modification of commercial products or kit assembly, let alone scratchbuilding, until the layout itself is in a fairly advanced state with all tracks in an operable state.

It will not have escaped notice that many of the illustrations depict a model based on a British steam age branch line, specifically GWR sometime before the Second World War. This is my personal choice and owes a good deal to the fact that in 1939 I was evacuated to Weston-super-Mare. The constructional principles will of course apply to any prototype or period.

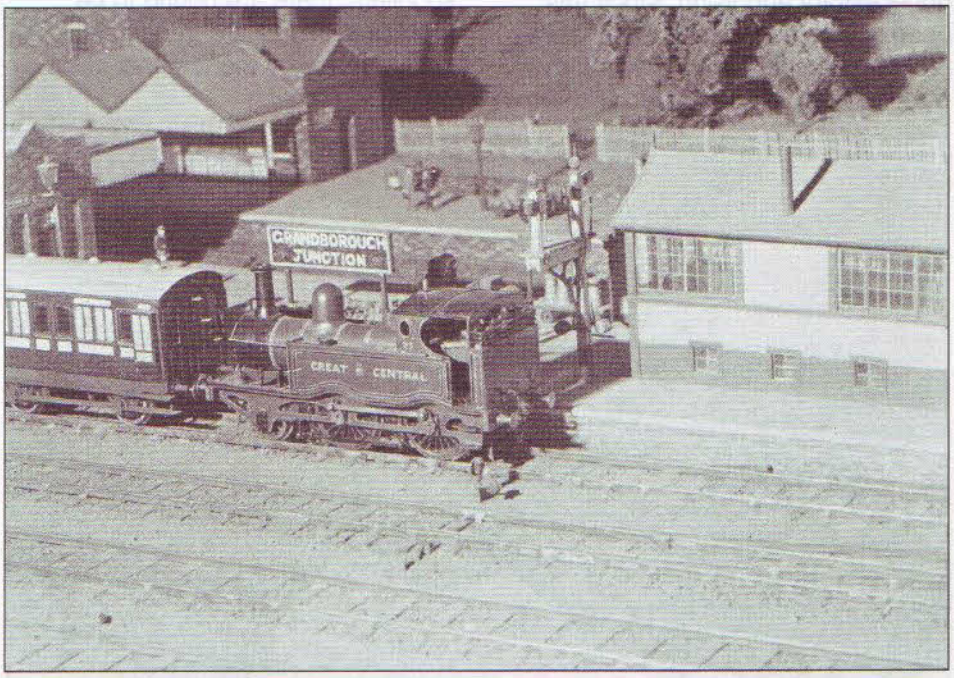
C.J. Freezer
Hemel Hempstead, 1994

Chapter 1

Before we Begin

In a little over 100 years model railways have evolved from their primitive tinplate beginnings with the toy makers of Nuremberg to their present sophisticated form without losing any of their charm and attraction. That there has been some increase in complexity is undeniable. The old tinplate systems, which were still a major force in the hobby when I was young and were to linger on to the 1950s, had an endearing simplicity about them. Your track came in fixed units which could be rearranged on the floor at will, but could be transferred to a bench when you were satisfied with the layout and screwed down. Locomotives were powered by coiled springs and yet were remarkably easy to control once you knew how; three turns and two clicks took the three-coach train to the next station, an extra click caused an over run and too few meant that the train `ran out of steam' just short of the platforms. There was a limited choice of locomotives and rolling stock, accessories were standardised and many of the lineside fittings were woefully inadequate even by the more relaxed standards of the times. But these could be readily overcome by any determined boy armed with a fretsaw and a small collection of empty wooden crates (one penny each from the local grocer) and at least one tea chest, a wonderful source of cheap plywood.

There were of course, far better models on the market but as they cost serious money one tended to look longingly at the catalogues and dream. The prices asked in the '30s look remarkably cheap to untutored eyes, the Bassett-Lowke O gauge Flying Scotsman, for example cost all of four guineas. I deliberately use an archaic currency since the present day 'conversion' to £4.20 conceals the fact that this was considerably above the weekly wages of the great majority of workers. In comparison, a modern OO gauge *Flying Scotsman* by Hornby at just over £50 (1993) is far more affordable. It is also a more accurate model and, even more to the point, readily obtainable from many High Street retailers rather than from a single firm with only two retail outlets.



Peter Denny's Buckingham is the seminal 4 mm scale British layout. Most good model railways today were either inspired directly by this superb recreation of the old Great Central in late Edwardian times, or were influenced by the pioneering work carried out on this model. Although a few features are slightly dated, the overall ambience of the model is such that it can hold its own with anything the finescale school can produce from commercial kits and components.

The photo shows part of the Grandborough Junction station, with a train of six-wheeled coaches headed by a GCR `Altrincham' 2-4-0 tank. The coaches are now getting on for 50 years old and have lasted longer in `revenue service' than their prototypes. All models in this picture, including the track, were built by Peter in a very basic workshop. Indeed, Buckingham is almost completely scratchbuilt from raw materials. The major tool in the workshop is a pre-war Hobbies treadle-operated fretmachine. The key is a consistently high standard of craftsmanship, coupled with a meticulous attention to detail. I make no bones about the fact that my own approach to the hobby is greatly influenced by my old friend's work since, quite apart from its visual attractiveness, Buckingham is worked as if it were a full size steam age railway. There are few things in life more satisfying than to sit at the controls at Grandborough Junction and be transported gently back to the time when the British steam railway was at its peak.

Where to buy your model railway

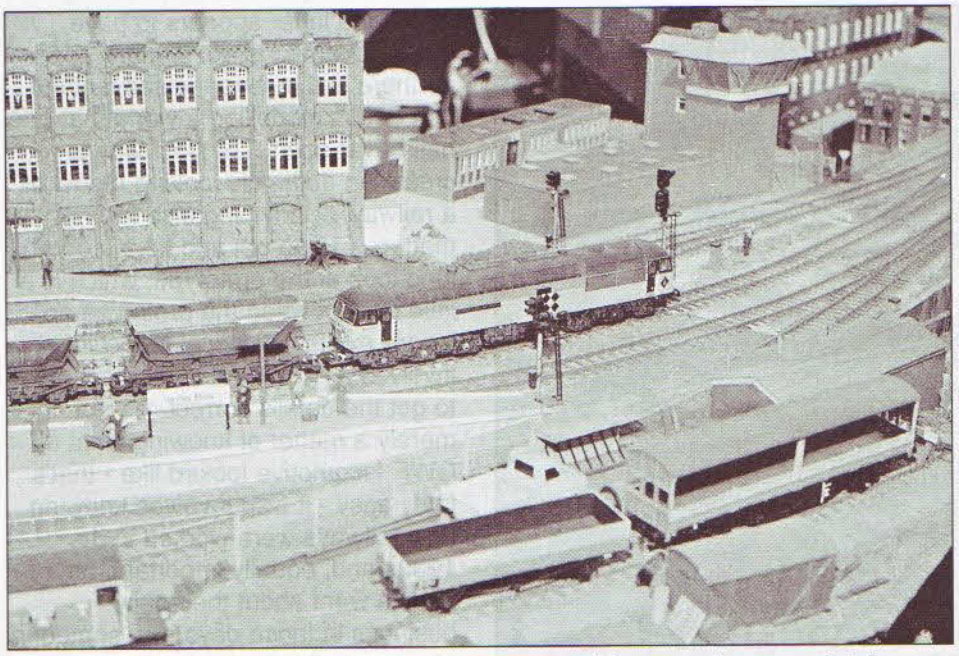
Good railway models are so common today that I would be very surprised if many purchasers of this book do not already have in their possession most of the key elements needed for a good, interesting model railway. In such cases these items will almost certainly have been bought from a High Street store rather than a specialist model shop or, if purchased by mail order, they formed a train set offer from a large distributor. In such a case the choice of gauge and scale has been made, saving a good deal of unnecessary agonising. Much has been written concerning the relative merits of the different sizes and even more concerning the especial charms of specific prototypes, the full size railways on which the models are based. For the experienced such matters are of grave concern and can lead to heated argument and acrimony. For the newcomer, it is as well to reflect that while any prototype railway can form the basis of a good model layout, and that the scale or gauge chosen has no direct bearing on the ultimate results, the availability of the essential equipment and its affordability does have a direct bearing on the ease with which the model can be built. No matter what the technical advantages may be, if the basic equipment is only available from a handful of specialised suppliers, there are bound to be problems. These are frequently compounded by the fact that costs are often higher.

In the 1930s the preferred gauge was O; 7 mm to the foot, 32 mm gauge, though most of us began with Hornby tinplate models which were anything but accurate. The hope was to graduate to 'scale' models on proper permanent way, using solid drawn rail in cast chairs pinned to wooden sleepers - 'just like the real thing'. Even these products were crude by today's standards, though in skilled hands a very convincing railway-like picture could be created. This photograph shows part of the extensive clockwork-powered Sherwood Section, nominally owned by Norman Eagles, built to the best standard model practice of the late '30s and in its final stage represented an imaginary section of the old LMS as it might have appeared in 1938. The photograph, taken across the final version of the layout towards Gretley Colliery, shows the overscale, unballasted track which was, for the average modeller in the '30s, the epitome of high class model permanent way. Strange as this seems to modern eyes, it is understandable when you remember what tinplate sectional track looks like.

British prototype models are widely available at very affordable prices, and an extensive selection is on offer through the advertisement columns of the model press. However, mail order is not always a good idea for the newcomer, since a good deal of experience is needed to make sense of the extensive lists one finds in the full page advertisements. Mail order is also slow and often inconvenient since Parcel Force and other couriers have an uncanny ability to call when no one is at home. On top of this, should there be a fault the goods are not only more difficult to return, but there is also inevitably a much greater delay in getting satisfaction. There is a lot to be said for inspecting the stock of your nearest dealer, going home, thinking it over carefully and then having another look a week later. It's even better if you can deny yourself the pleasure of using a credit card or writing a cheque, but instead put a small sum away each week until you can pay cash for what you need, since by the time you've saved up enough you'll certainly know if you need it or not.

Basic requirements

This brings me to that all important question, how much will it all cost? The best answer I can give is to say that a simple, basic beginner's layout need not cost more than a good portable colour television set. The outlay will be spread over some considerable time, the end product can last a good deal longer than a TV, and will not incur an annual licence fee. Of course the larger layouts one sees featured in model railway magazines have cost a good deal of money one way and another, but in most cases this outlay has been spread irregularly over a number of years. It is also a fact that the more money you can put into the project the less bother you will have, because one of the best ways of solving a



Modelling the present-day diesel and electric-hauled railway offers many advantages. The most important of these is that most of the information you need to create an authentic portrait of the prototype can be gained by visiting the railway itself, armed with notebook and camera.

Hayley Mills, the OO gauge layout built by John and Stephen Emerson, is the result of careful study of the prototype. The emphasis is on freight working, with varying block trains hauled by appropriately branded diesel locomotives. The area is somewhere in the industrial north-east. Here we have a train of HBA modernised 1980s coal hopper wagons headed by a coal sector class 56.

The layout is provided with correct colour light signalling, controlled from the modern box seen in the background. This is one of the few modern touches in the surrounding buildings, most of which hark back to the Victorian age, providing a contrast with the up-to-the minute trains.

problem is to throw money at it. Anyone who says otherwise is either lying through his teeth or has never solved a problem in his life.

Your basic requirements are a locomotive, some coaches and wagons, track and points on which to run them, and a power unit to supply electricity. At the most elementary level you can use sectional track and lay the lot out on the floor, since even in the smallest practical size you will find a normal table inadequate. This is the train set end of the hobby, perfectly valid in the initial learning stages. However, because it takes so long to assemble anything but the simplest of layouts, it is necessary for the layout to be laid out on a baseboard, or, better still, a number of baseboards linked together to form a larger unit. This allows you to develop the scenic side of the model, initially by adding the major railway structures and later by developing the landscape and adding buildings outside the railway fence to create a miniature community. This side of the hobby has developed considerably in the past 50 years.

This development has been encouraged by the steady growth in availability of both ready-to-run equipment and the introduction of a rapidly expanding selection of kits. These have revolutionised the approach to the hobby and it is no longer necessary for a railway modeller painstakingly to construct the key parts of his layout from raw materials and a small selection of basic components. Locomotives, coaches and wagons can be taken straight from the box, track and points can be bought ready assembled. Often these finished products, with their implicit guarantee of reliable performance, cost less than the bits and pieces needed to fabricate the models the old-fashioned way and avoid the need for elaborate workshop equipment and the acquisition of metalworking skills.

Choice of scale

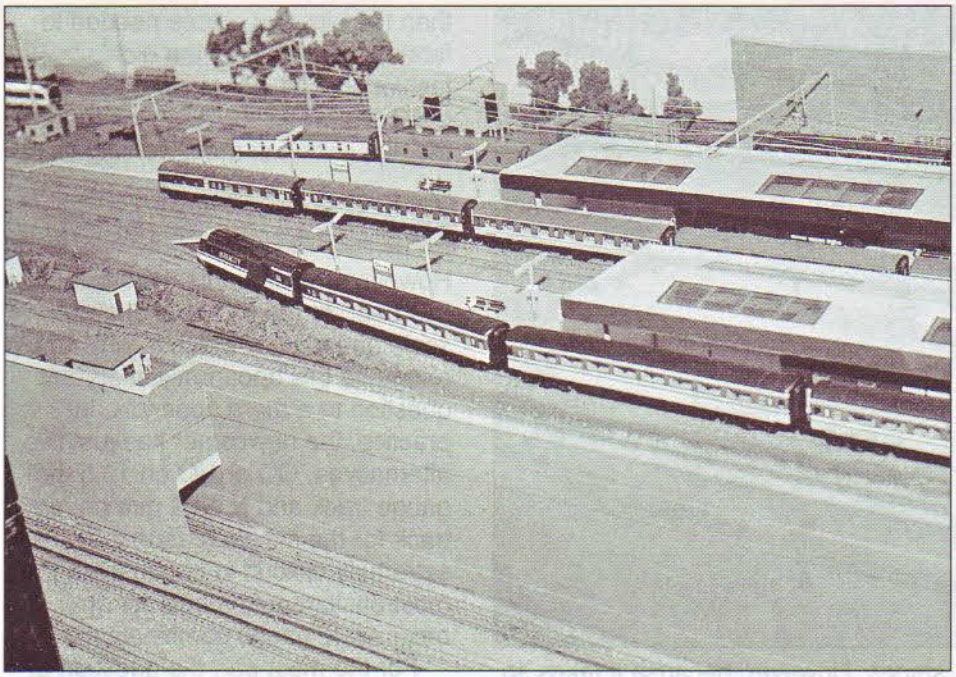
However, much of this development has been at the expense of choice in scale and gauge, which is why I have relegated this apparently important question to a mere appendix. In practice, the newcomer has just two alternatives, OO or HO on 16.5 mm gauge track and N on 9 mm gauge track for the simple reason that it is extremely difficult to obtain even the most basic requirements for any other scale gauge combination.

For the most part the question of scale, which is in some quarters regarded as the most important feature of the hobby, is quite irrelevant since, when using either ready to run or kit built models, the scale of the model is determined by the manufacturer and if he has introduced errors, there isn't a lot you can do about it once you've bought the product. Happily, in the overwhelming majority of current commercial models of locomotives, coaches and wagons any errors in scale are very small. While some zealots make a great deal of fuss over this, it is virtually impossible to tell simply by looking at a model whether the major dimensions are within 1 mm of the scale size. It's fairly difficult to do so even when armed with a vernier gauge and an accurate set of prototype dimensions.

For the most part, there is a very strong bias in favour of OO gauge for a newcomer, since N gauge equipment is less widely available.

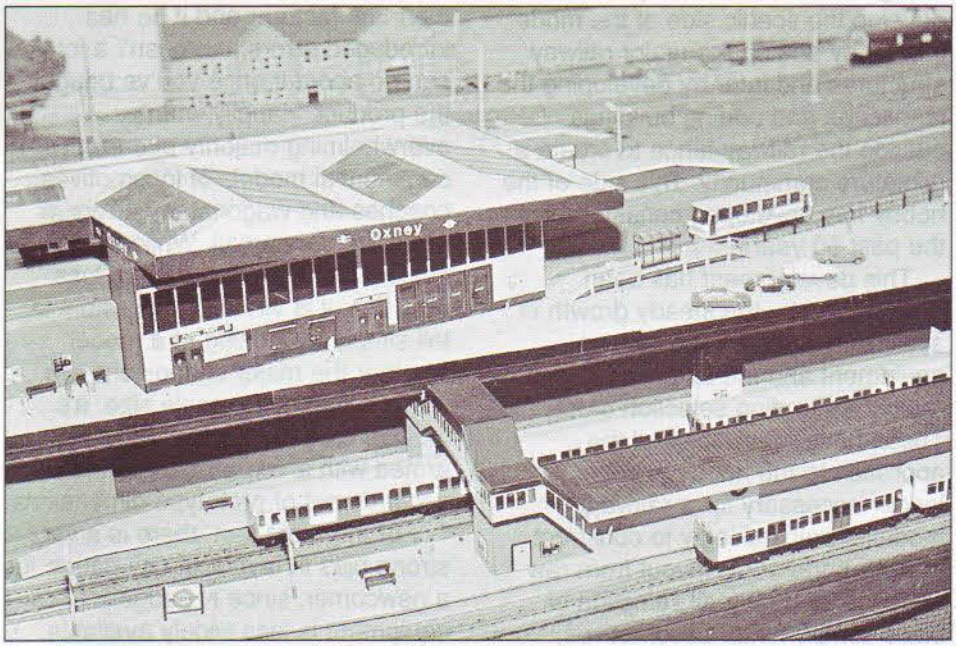
Choosing a time period

There is also the choice between the modern diesel and electric scene and the nostalgic steam age model.



Another interesting layout at the 1994 IMREX was Oxney, an N gauge model built by John Hazelton. This layout is set in the London area, with both diesel and electrified services. The rolling stock is mainly ready-to-run, but has been `breathed on' to add extra authenticity.

In the foreground we have the ubiquitous HST with Mk III coaches sandwiched between two power cars, whilst in the middle roads there is a charter train made up of Mk I coaches. At the back, `under the wires', is the tail end of a parcels train.



An interesting feature of Oxney is the addition of local services. At the low level, appropriately, is a London underground station, with a pair of scratchbuilt surface line trains. The train in the background is a refurbished C stock of the Circle and Hammersmith & City lines, whilst the rear train is one of the ageing A stock trains from the Metropolitan line as running on the East London line.

To the immediate right of the ultra-modern Oxney station buildings is a light rail feeder line, operated by a single unit electric railcar. The light railway platform, with its `bus stop' type glazed shelter contrasts with the solid Railtrack structures alongside.

Whilst the latter appears to have many advantages, for anyone under 40 there is the severe disadvantage that one is modelling a world that one has never seen. The best way to create an authentic-looking model of a railway, or anything else for that matter, is to go out and take a good, long look at the prototype, which is a little difficult when the prototype no longer exists. Historical modelling involves a good deal of study in order to get the details correct. It's not merely a matter of knowing what a GWR locomotive looked like - that's fairly easy - it also involves knowing how railways were worked in the 1930s and, equally important, how people went about their daily business in those days. For someone of my age, this last point is not too difficult. An old photograph will trigger memories, and it's usually one of my own photos that does the trick. Of course, one can learn a lot simply by talking to older people, but one can't go much further back than half a century this way.

Luckily, whether you're modelling the contemporary scene or trying to recreate a mid-Victorian railway, the basic principles of baseboard construction, tracklaying and track construction, electrification and control, landscape modelling, building construction, kit assembly and even scratchbuilding locomotives and rolling stock remain unchanged. Furthermore, apart from the difference in size, the scale of the model has little bearing on these factors, except where a specialised component is only available in 4 mm scale. There is, of course, the point that the smaller the scale the smaller the parts you will be handling and the greater the difficulties you will meet. In particular one must never forget that small parts do get dropped and that the smaller the part, the more difficult it is to find it on the carpet!

Chapter 2

Get Organised!

A model railway is a large and very complex entity which takes some considerable time to build and assemble. It is only practical if the overall task is broken down into individual projects of manageable size, and this means that you have to determine some order of priority in your tasks.

At the outset there is a natural priority. You can't run trains over the layout until you have wired the tracks to the controller; you can't do this before you lay the tracks, and to do that you need to construct a baseboard. However, there is nothing to stop you making your model buildings before you start construction of the layout. If you do not intend to use ready-to-run locomotives, coaches and wagons, it could be a good idea to build a few of these before you even think of buying the timber for the frames. However, in the final analysis, the order in which you tackle the project is largely up to you.

The danger lies not in having too many projects in hand at any one time, but in tackling them in a completely haphazard fashion. An even greater error is failing to make provision for interruptions, so that projects are effectively abandoned rather than put on hold. To avoid this happening you need to establish some form of organisation.

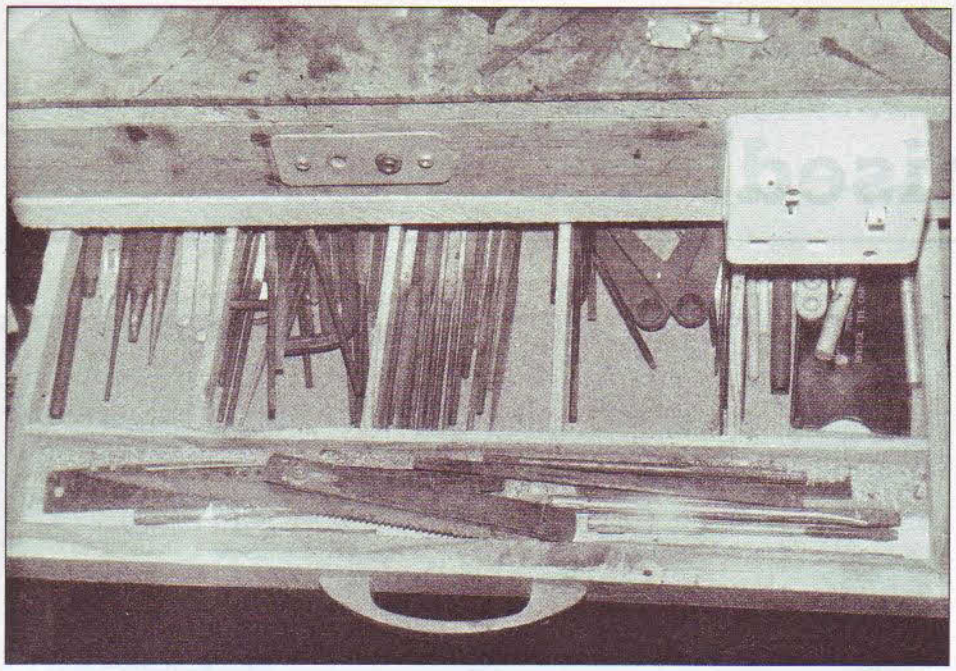
The ideal arrangement is to break jobs down into small sub-assemblies that can be completed quickly before the initial enthusiasm wanes. Given a free weekend, or a few evenings that can be set aside for the hobby in a week, a straightforward project can be started and finished in a continuous session. As this is not an ideal world, more often than not things don't work out this way. Even if some outside event doesn't intervene to bring your modelling to an abrupt halt, then the project itself may throw a spanner in the works. You may find you're short of some vital component, either through oversight or because you have broken or lost the part. You may have relied on being able to get something from your local model shop, only to discover that five other modellers not only have had the same idea but were there before you, and the shop is temporarily out of stock. Agreed, you ought to have drawn up a list of the parts you needed beforehand, but as I said, this is not an ideal world. Then again, the project might go sour on you and you find there is no joy in carrying on.

The rear storage wall of my old shed workshop. The clutter is typical of many model makers' dens and is caused by attempting to house the bulk stores in the workshop proper. In this instance it is accentuated by my practice of acquiring kits I would like to build long before I intend doing so. One visitor suggested I was better stocked than some model shops.

It is best to establish a separate storage area where your reserve stocks can be kept neatly stacked and reserve space in the workshop for tools, basic sheet, bar and rod stocks, screws and small fittings in labelled drawers together with a small area for the kits you are currently building. If this last area gets cluttered, you're trying to do too many jobs at once.

Storing your materials

When a project is interrupted, *it is essential to put all the parts together in a suitable container and label it*



A place for everything . . . The top drawer of my tool chest, a home-made cabinet which I have screwed beneath the workbench. This drawer contains a selection of small, useful tools. The location of the drawers ensures that a certain amount of dust and debris falls into them from time to time, but this is a minor nuisance. Every now and then, I empty the lot on to the workbench and reorganise the collection, relegating little used tools to less convenient storage places.

clearly. If this is not done, something will get lost. The container should then be placed on a shelf or in a cupboard until you're able to resume construction. It can help if you make a few notes in a workshop record rather than rely on your memory. Which brings up the matter of records.

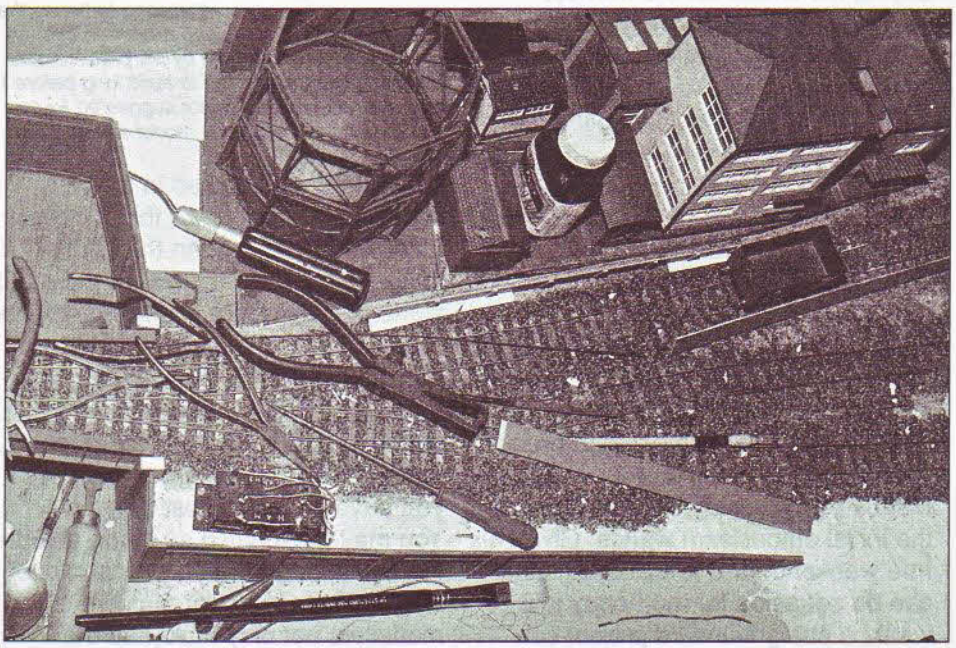
Keeping records

During construction it is a good idea to make a few sketches and diagrams to help organise your ideas. While these can be made on any old scrap of paper I find it best to use tear-off pads of squared paper. I prefer the type with fairly large squares at roughly 4 mm spacing, readily available on the Continent, but rather difficult to track down in Britain. Whatever paper you favour, be it the back of used envelopes or the finest cream laid notepaper, it needs to be stored safely where it can be easily seen.

The best solution I have found so far is the A4 sized transparent plastic pocket which is provided with a stiffer back with punch holes to fit a ring binder. Any paper of importance should be put into one of these, because not only does it keep material clean and legible, but it also means you are unlikely to throw it away. The pockets should be stored in one or more ring binders and, ideally, kept on a suitable shelf or in a handy cupboard. In addition to your own notes, you should store instruction sheets and other manufacturers' literature in this way.

The most important information to put on file in this fashion is the details of your wiring. The actual form the wiring book should take is determined by the complexity of your electrification. The Model Railway Club's *New Annington* OO gauge layout, which has an extremely complex control system, has a correspondingly complex wiring book, which lists every connection on the layout on something like 100 separate sheets. A simple single track, one controller layout without any frills can get along with one basic wiring diagram and perhaps two sheets listing the tag strip

. . . and nothing in its place. During work on the layout, it is convenient to put the tools you are using on the tracks and leave them there overnight should the task in hand be incomplete. This haphazard array of pliers, wire stripper, screwdriver and other odds and ends greeted me one morning. It seemed worth putting on record to dispel any illusions that everything must be orderly at all times.

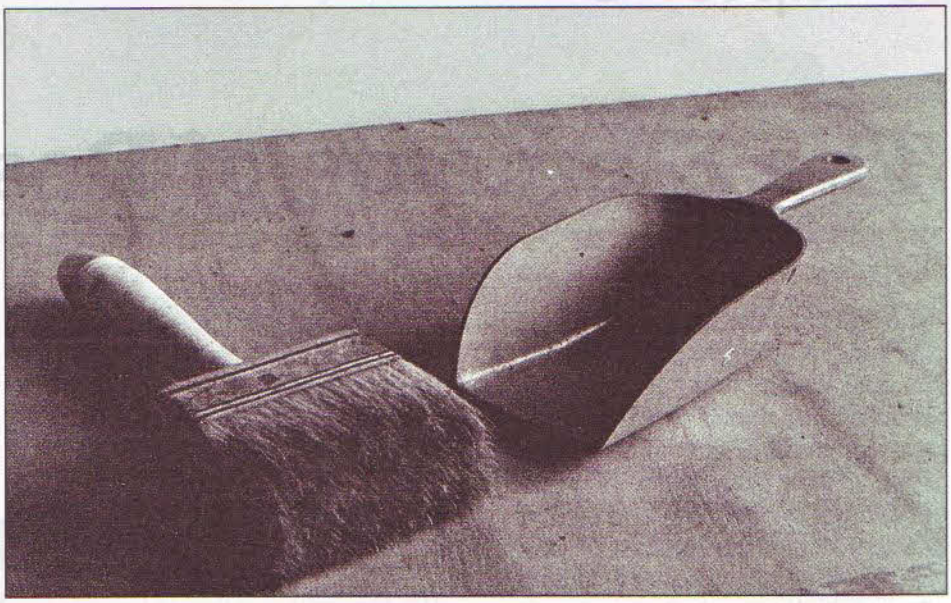


connections. In neither case can one check or alter the wiring without this guide. I've known cases where the only way to deal with the absence of a wiring book has been to rip out all existing wiring and start afresh.

Storing tools

I have mentioned the importance of having a proper home for tools so that you know where to lay hands on the one you need. This should not be interpreted as a rigid rule, since repeated replacing of a small selection of tools at the end of each evening's work, only to take them out again the following day is tedious in the extreme. During the progress of a project they may be left on the layout, or placed tidily on a small tray or in a box ready for the resumption of work. It is only necessary to clear the tools away at the end of each project, or whenever you need to suspend work for more than two or three days.

There is one proviso, and that is that the job is fairly straightforward and only a small number of tools are needed. You can find that tools are beginning to accumulate on the workbench and not only do they encroach on the modelling area, you also find yourself having to sort through a small pile to find the one you want. At this point, a complete clearance is going to save a lot of time. The only time when it is essential to put everything away is when you are working in a clubroom, since a tool left lying about will be borrowed by someone else and may prove impossible to retrieve.



Possibly the most useful tools in my toolkit, or at least they are the most used. The brush is a decorator's dusting brush, which performs the same function on workbench and on larger areas of the layout. However, when cleaning around the tracks I find a cheap artist's flat brush more useful. The dustpan is a scoop found in the kitchen section of a large departmental store. Several kitchen implements make useful model making tools, but in such cases, get your own. Borrowing things from the kitchen is bad: it leads to friction within the family, which is bad enough, but also carries a distinct risk of poisoning your food!

Cleaning up

Where a modelling project generates a good deal of mess, a regular sweep of the working area is vital. After many trials, I have settled upon a small decorator's dusting brush and a large plastic kitchen scoop. These are as effective cleaning up around the baseboard as they are on the workbench. For tidying up around models, a clean, soft paintbrush takes a lot of beating. The largest size of a cheap carded set of artist's flat brushes has proved an excellent tool for this purpose.

A little organisation is a good thing, but as with so many aspects of life, taking it too far can spoil the pleasure. This is particularly true of a hobby. One of the great virtues of railway modelling is that it provides so many different ways of enjoying our leisure moments that it would be folly to eliminate any of them in order to stick rigidly to a plan which looked good last week. By all means be organised, but arrange matters so that when a particular task palls, you can put it aside for five hours, five days, five weeks, five months or even five years, get on with something else and then pick up where you left off when you are once again in the right mood.

Chapter 3

The Elements of Design

The first consideration in any model railway project is, where is it going to be put? Whilst there have been circuits of track built inside disused television sets or accommodated on such unlikely sites as the wide brim of a lady's summer hat and even a 45 rpm single (the smallest railway on record?), a layout that is to give its owner pleasure in its construction, development and subsequent operation is going to occupy a fair amount of space. It will be built up from many individual modules, each of which is a model in its own right. Ideally, it should live in its own railway room – which for most of us is rather like saying that a large private income is a good idea. No one will disagree with the proposition, most will ask wistfully how it is to be achieved.

The small GWR branch terminus fiddle yard scheme, Brill, *which features in many photographs in this book. It consists of two main sections, a folding terminus with a variety of industries around the tracks, and a separate diorama, which was originally to contain the coal yard but proved able to house the local gasworks as well. A five-track traverser fiddle yard completes the model.*

I have dealt with this subject in some depth in *A Home for Your Railway* (Peco, 1990). In brief, model railways can be divided into three basic groups: permanent, portable and transportable.

Permanent layout

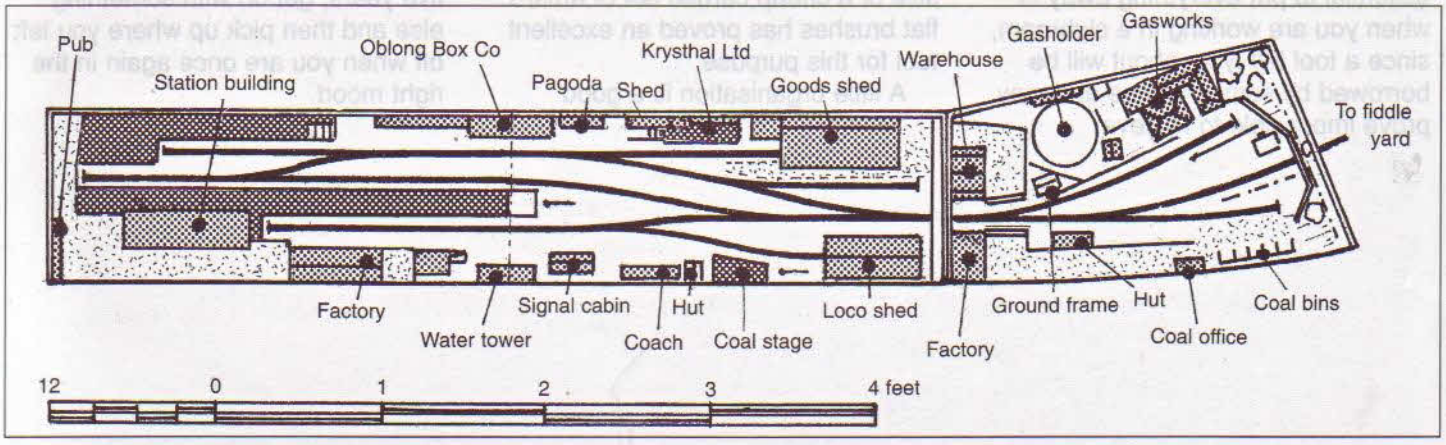
The permanent layout is housed in its own room, and this can be a loft, a cellar, a commandeered garage, a spare room in the house or a purpose made outbuilding, such as a garden shed or a house extension. In all such cases it is essential to have a long 'lease' on the site, since there are few more frustrating experiences than to discover, just as the layout is reaching an interesting condition, that the space it occupies is needed for some other purpose.

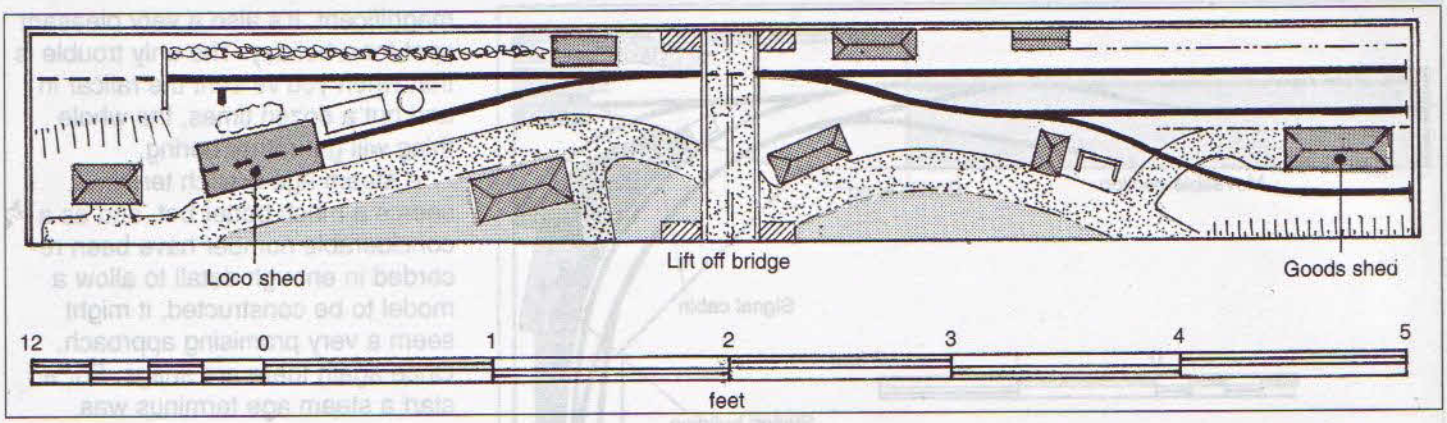
Portable layout

When there is no obvious spare room in the home for the layout, a portable layout that can be easily taken down and stored between operating sessions is a popular solution. This is best done by building the model on sectional baseboards rather than on one large unit. The need to store the layout out of the way for most of the time, sets an upper limit on the size of the model. This is reinforced by the need to be able to erect the layout after work, enjoy a full operating session, dismantle and store everything, and still get to bed by midnight. In addition, one could say that unless the layout fits into the family car, it isn't really portable. This type of layout is to be seen at most model railway exhibitions.

Transportable layout

The transportable layout is also built in sections which are often bolted together. Unlike the portable line it remains erected for most of the time, so speed of assembly and dismantling is unimportant. The overall size of baseboard sections can be larger since one can hope to have a helper when moving the model to another location. Many club layouts seen at exhibitions fall into this category. They usually take an experienced team two to three hours to erect and





This plan is a close copy of A. R. Walkley's 1926 HO gauge Railway in a Suitcase, *the first truly portable model railway ever to be described. Way ahead of its time it featured two-rail traction and an automatic coupling, the progenitor of the current tension lock pattern. It was only a shunting yard with no exit. The loco shed was probably included because, at the time, it was a conventional addition; `you can't have a model railway without somewhere to house the locomotive.'*

The design has been successfully revived, without the folding feature or the loco shed by Alan Wright, whose Inglenook Sidings *have been a popular feature at several northern exhibitions.*

connect electrically, and another hour in which to set out the stock and check that everything is still in running order. Where a permanent site is available for a private layout, this type of construction is often adopted in the belief that should one move house it can be readily dismantled and re-erected in the new home.

This is a fallacy. For a start, you stand a better chance of winning a luxury weekend for two in Jersey or a consolation prize in a national promotion than you do have finding a space into which the layout will comfortably fit. I speak from personal experience. There is a further difficulty, if the layout remains erected for more than five years, there is a tendency to build additions across the baseboard joints so that it becomes difficult to dismantle it without doing a good deal of damage.

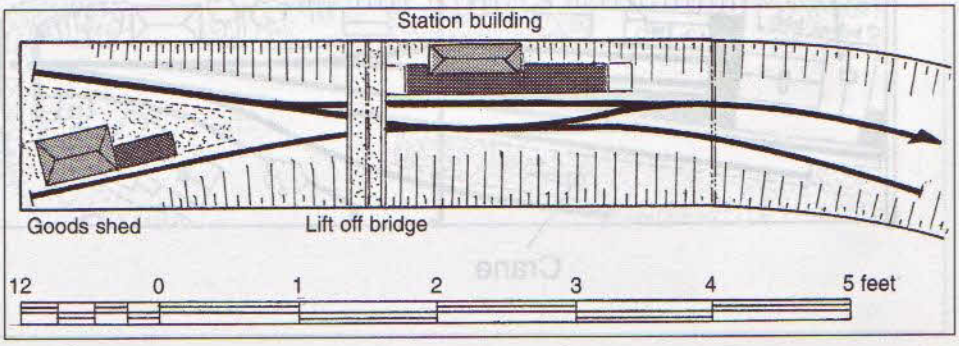
For the private individual, the advantage of the transportable layout is that it can be dismantled should the room be needed for another purpose. It is a good way of putting a layout into a spare bedroom without losing the advantage of being able to welcome a guest from time to time. Alternatively, it is feasible to build a sectional layout within the garage so that an elaborate system can be set up over a weekend, with the car standing out on the drive meantime. At other times, the layout is stored at the rear of the garage, leaving room for the car to be driven gently inside.

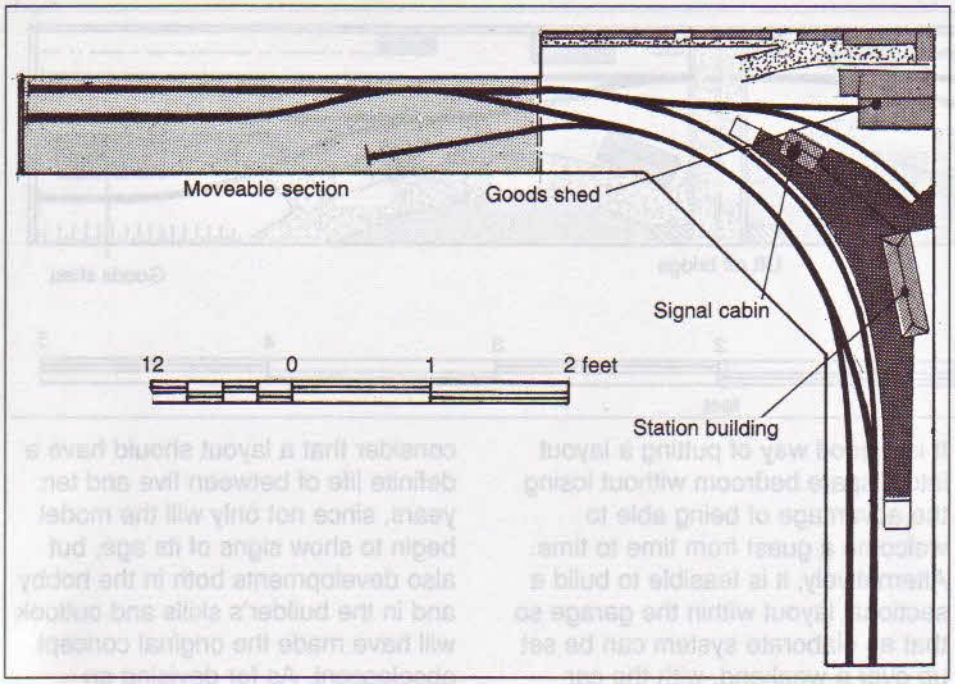
Choosing a design

Whether it is to be portable, transportable or permanent, we need to arrive at a workable layout design. At this point many newcomers fall into two traps. First they believe that they are only going to build one model railway, and therefore it must be very elaborate. They also feel that the design should be absolutely original. In practice, most enthusiasts build several layouts before finally arriving at an ideal. Sectional layouts lend themselves to reconstruction and revision; indeed some modellers consider that a layout should have a definite life of between five and ten years, since not only will the model begin to show signs of its age, but also developments both in the hobby and in the builder's skills and outlook will have made the original concept obsolescent. As for devising an original scheme, by now every workable layout suitable for a newcomer has already been built, several times over. Even so that doesn't mean the end product can't be original, because although the basic track plan may be identical, the treatment of the model can vary in detail.

Apart from this, the best layouts are based on prototype practice. There is a body of thought that says one ought to model an actual station.

Another small and simple layout, based on Peter Denny's Stoney Stratford *addendum to an early* Buckingham. *The two sidings leading off the run-round loop provide some interesting shunting movements, whilst the long release spur at the far end increases the operating potential. It is a little too simple for sustained use, but this very simplicity makes it an excellent test bed for advanced baseboard construction and scratchbuilt tracklaying. Details of the baseboard construction are given in Chapter 6.*



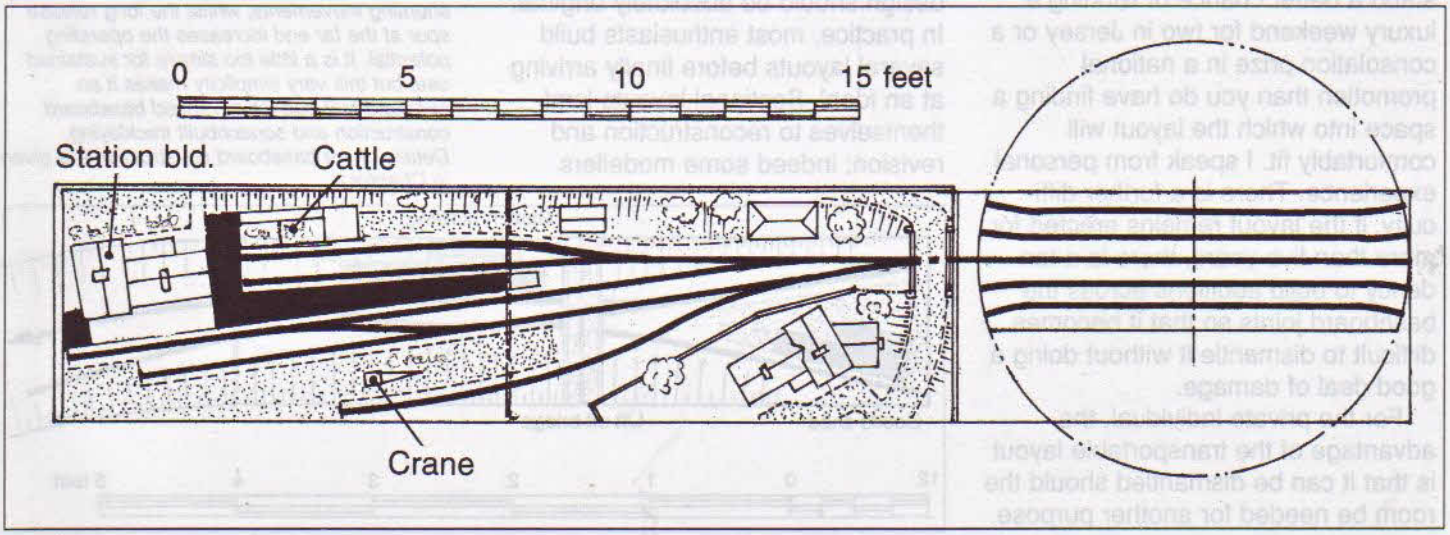


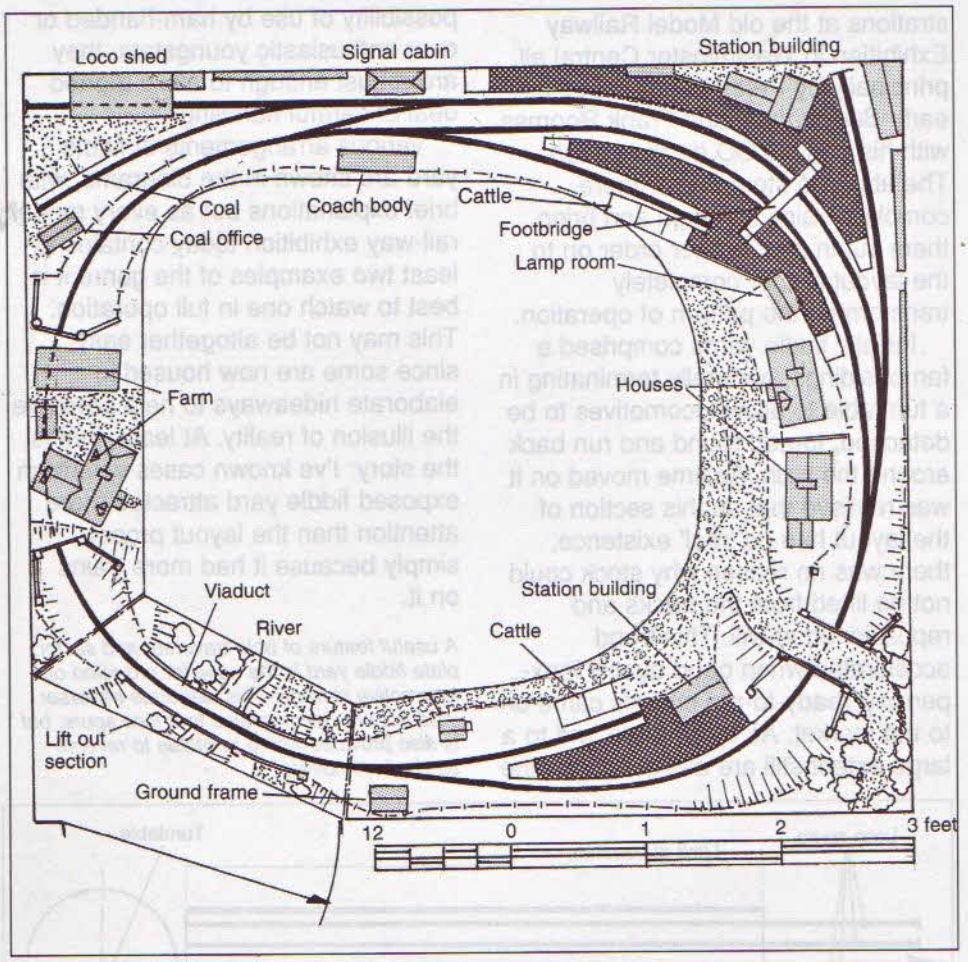
Tregunna Mk I, *a small layout I built in an understairs cupboard in the '50s. The design is based on St Ives in its steam days and was the result of a remark by my wife when we visited the town on our honeymoon. She took one look at the station, nestling under the cliffs and said 'Wouldn't that make a good model?' It did. The shaded baseboard extended across the passage and was devoid of scenery. The two fiddle sidings are somewhat inadequate by today's standards, but in 1955 I only had two working locomotives.*

This is a good idea on paper, but in practice it is riddled with problems, not the least of which is the difficulty of discovering the details of a steam age station when the site has been levelled and developed as an industrial estate. Of course this doesn't apply to a model set in the diesel era, but the danger here is that the operating pattern may be too simple. Build a model of a station where very little variety in working takes place and you have a model where operation is going to be extremely dull. If you are in any doubt, make a model of St Ives (Cornwall). It isn't difficult – a single track spur with a simple platform and basic facilities, operated by a diesel railcar shuttling to and fro from the junction at St Erth – but the setting is magnificent. It's also a very pleasant spot for a holiday. The only trouble is that when you've sent the railcar in and out a dozen times, the whole thing will get rather boring.

A steam age branch terminus seems a much better bet, and as a considerable number have been recorded in enough detail to allow a model to be constructed, it might seem a very promising approach. Once again there are snags. For a start a steam age terminus was usually quite a large entity, although the track formation would be simple and straightforward. The reason is that these stations were usually built on green field sites on the edge of the town and sufficient land was bought to allow for expansion. Maybe the usual branch train was only two coaches in length, but the platforms could take anything from six bogie coaches upwards. Built precisely to 4 mm scale, the majority of steam age stations would occupy twice the length of a normal home garage, and in fact several city termini with much better traffic potential are small in comparison.

Dendale, *a project plan on a three-fold baseboard – see Chapter 7 for a sketch. The layout is fairly conventional, and incorporates a five-road train turntable, a form of fiddle yard which has many advantages and only one serious fault, namely that it requires a good deal of lateral space for the table to swing through 180°.*

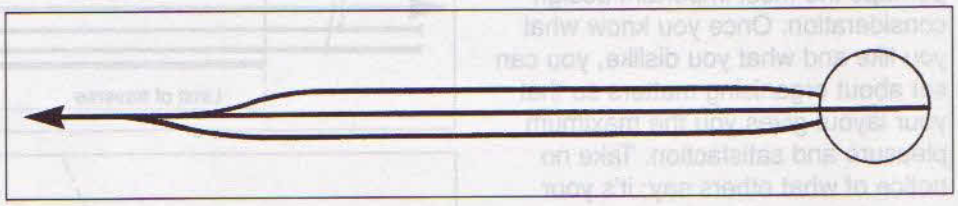




A simple round the houses scheme for a nominal 7 x 5 ft garden shed. Two stations are shown, a small halt with a single siding, and a single track passing station. Operationally it is little more than a developed train set oval. The scheme is based on one I built in my workshop to provide a good test bed for the loco kits I was assembling, and despite the small size, the main radii are reasonably generous. Except for the point in the siding, Peco large radius straight and curved points were used throughout. The lift-out section across the doorway features a three-arch curved bridge. This type of treatment does not require a backscene since we expect such a structure to stand out against emptiness.

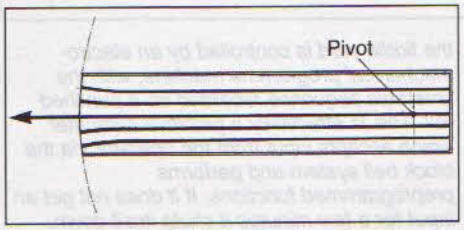
Apart from this, most branches had a very simple operating pattern. Besides the one goods train a day, the service was provided by a shuttle train working as far as the junction and back. A through working, usually a single coach detached from a semi-fast main line train, plus the occasional special provided a little variety, but in the main the motive power was a single tank engine. In the late 1940s when branch line modelling began to make an impact this had considerable appeal, since most of us had to scratchbuild everything. A model that only needed one locomotive had a distinct attraction, but today, when you can go out and buy half a dozen different locomotives any time your bank balance allows it, restrictions on rolling stock simply don't exist.

Despite this, the small single track model has considerable advantages for the newcomer's first serious essay in the hobby. It makes few de-mands on resources of space or money and can be brought into a working condition in a reasonably short time

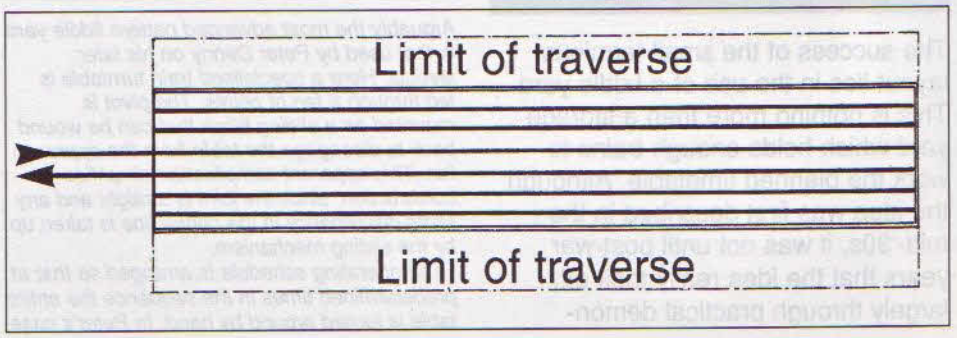


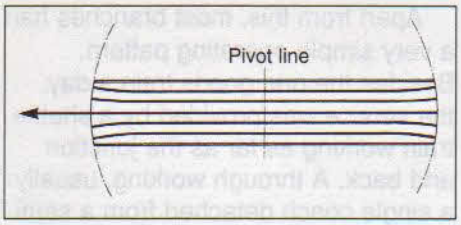
***Above:** The fan fiddle yard antedated the sector plate and initially incorporated a turntable for locomotive release. It has the undeniable advantage that entry and exit can be remotely controlled and is thus very suited to single-handed operation. It does, however, take up more space, and involves the cost of extra points and point motors.*

***Below:** The traverser appears to be a little more trouble to build than the sector plate, but against this the tracklaying is greatly simplified. In addition, the traverser table can double up as a stock box, saving a good deal of trouble with portable layouts. It is also much more suited for double track systems.*



The sector plate is the most elementary form of fiddle yard, and the most common type in general use. It has many advantages: it takes up very little lateral space, the construction is straightforward, and it is fairly low in first cost.





The train turntable has two main disadvantages. The most obvious is that it needs a good deal of space in the sideways direction, but it also calls for very careful construction. It is greatly favoured for exhibition oriented layouts, where the width consideration does not arise. In the home environment it can be used as a traverser.

span. The controls are about as simple as they can be, but with a four or five track fiddle yard an interesting operating pattern can be arranged. There is considerable scope for detailed modelling and the layout can not only provide interest and amusement for several years but will also prove a valuable test bed where you can explore the various techniques available to the railway modeller. You will not only find out what you enjoy doing, but you will also discover what you positively dislike.

These two personal factors are perhaps the most important design consideration. Once you know what you like and what you dislike, you can set about organising matters so that your layout gives you the maximum pleasure and satisfaction. Take no notice of what others say; it's your own private world and, for once, you can do exactly what you like within the space at your disposal. This, more than anything else, is why railway modelling is such fun.

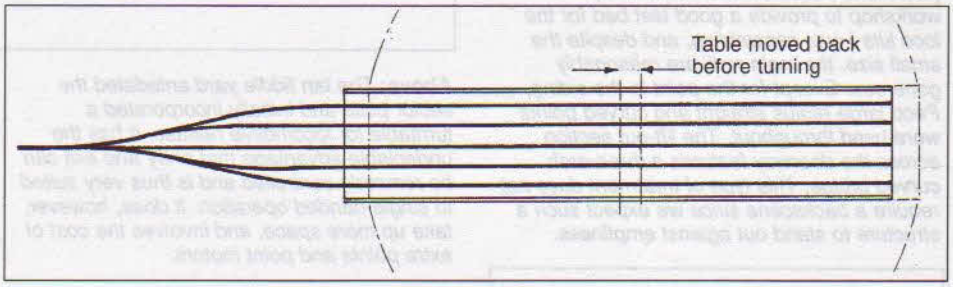
Fiddle yards

The success of the small terminus layout lies in the use of a fiddle yard. This is nothing more than a storage yard which holds enough trains to work the planned timetable. Although the idea was first described in the mid-'30s, it was not until post-war years that the idea really took off, largely through practical demonstrations at the old Model Railway Exhibition in Westminster Central all, principally by Peter Denny with the early *Buckingham* and Frank Roomes with his original OO gauge *Lutton*. The ability to store five or more complete trains off stage and bring them out in their proper order on to the layout proper completely transformed the pattern of operation.

Initially fiddle yards comprised a fan of sidings, generally terminating in a turntable to allow locomotives to be detached, turned round and run back around the train. As time moved on it was realised that as this section of the layout had no 'real' existence, there was no reason why stock could not be lifted from the tracks and repositioned at will. This trend accelerated when good quality inexpensive ready-to-run models came on to the market. As these were and to a large extent still are designed with the possibility of use by ham-handed or over enthusiastic youngsters, they are robust enough to allow a good deal of careful handling.

Various arrangements of fiddle yard are shown in the diagrams, with brief explanations but as every model rail-way exhibition today contains at least two examples of the genre it is best to watch one in full operation. This may not be altogether easy since some are now housed in elaborate hideaways to help preserve the illusion of reality. At least, that is the story: I've known cases where an exposed fiddle yard attracted more attention than the layout proper, simply because it had more trains on it.

A useful feature of both traverser and sector plate fiddle yard is the ease for provision of locomotive storage. This elaborate traverser yard not only incorporates four loco spurs, but is also provided with a turntable to reverse tender locomotives.



Arguably the most advanced pattern fiddle yard is that used by Peter Denny on his later layouts. Here a specialised train turntable is fed through a fan of points. The pivot is mounted on a sliding block that can be wound back to disengage the table from the approach fan. This apparent complication simplifies construction, since the joint is straight and any slight discrepancy in the centre line is taken up by the sliding mechanism.

The operating schedule is arranged so that at predetermined times in the sequence the entire table is turned around by hand. In Peter's case the fiddle yard is controlled by an electro-mechanical programme machine, with the timetable sequence recorded on a punched roll. This is effectively a primitive computer which accepts input from the operator via the block bell system and performs preprogrammed functions. If it does not get an input for a few minutes it shuts itself down, goes into a standby mode and stops the layout clock for good measure. One stroke on the block bell restarts the sequence, so that the entire automation is subservient to the operators. This is true intelligent programming.

Chapter 4

Workshop and Tools

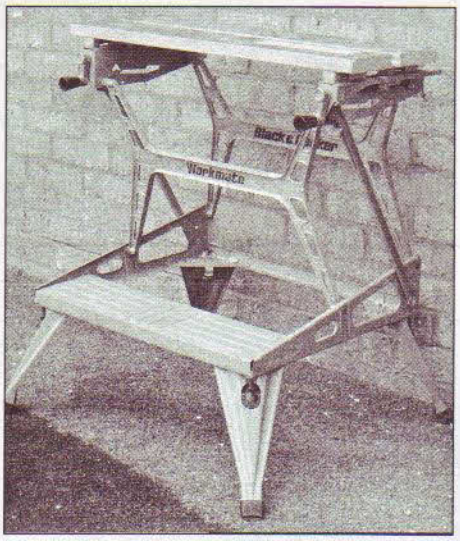
Railway modelling calls on a wide selection of skills, as will be clear from subsequent chapters. However, the demands are by no means exacting, and moreover many of the divisions that are erected between crafts are in the mind rather than in the task itself. There is no fundamental difference between cutting a slice of bread and sawing through a piece of timber other than the obvious point that you use a bread knife for one and a woodcutting saw for the other. It's a case of using the right tool for the job: cutting a slice of bread with a tenon saw or sawing wood with a breadknife is technically feasible, but I wouldn't like to try. In the same way, just as it is best to cut a slice off a loaf whilst the bread is held on a breadboard lying on a kitchen working surface, so it is much easier to carry out any craft operation in an appropriately laid out workshop.

A corner of the workbench in the Devonshire workshop. This shows the gash bag, 'Versa-Vice' and the original low voltage power supply. The lightweight bench was adequate for model making, but had a little too much 'bounce' for comfort.

The modelling toolbox. On the left are the larger tools, a selection of small files, a pair of small pliers and wire cutters, a light hammer and, completely hidden, a calliper gauge. At the top are an Xacto mitre block and a selection of craft knives and a scalpel, together with some short rules and razor saws. The 2 in engineer's square is in a bottom compartment with a Wishbone drill sharpener, and alongside are a selection of adhesives. On the right we have a box full of craft knife blades, and a selection of adhesive tapes. The collection varies over time.

This begs the question, what is a well laid out workshop? Rather than expounding theory and specifying an ideal workshop, I will instead describe my own approach, based on some 50-odd years' practical experience. The most important thing I have discovered during this time is that, for the amateur, the biggest difficulty is finding somewhere for a permanent workshop. This is compounded in our hobby by the fact that we also need to find a home for the railway, and this has a distinctly higher priority.

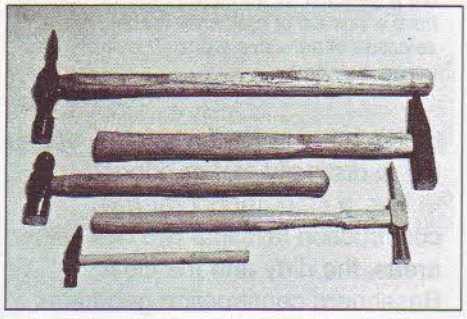
For a start, model railway construction falls into two distinct areas, the dirty and the clean. Baseboard construction generates a good deal of mess, either as sawdust and wood chippings, and this is aggravated if you use power saws for speed. A good deal of the work on baseboard sections, particularly extensive landscape construction, using large quantities of plaster, is carried out in my garage.



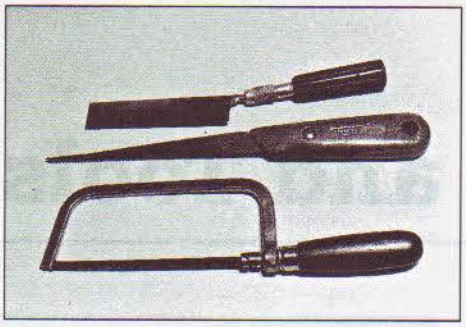
The ubiquitous Workmate portable bench, probably the most useful workshop innovation of this century. This is an old photograph, when my model was comparatively new. It is now showing signs of use but is as good as the day I bought it. Although it looks flimsy, it is extremely rigid and takes less than a minute to erect or fold down for storage. Quite apart from its obvious use for general carpentry and DIY jobs, it is a firm platform for reaching high up in a room and has even, with the addition of a cushion, served as a seat for layout operators. The only maintenance it has ever needed has been an occasional smear of oil on the moving parts.

Basic equipment

I use a 'Workmate' bench, which I consider to be essential. It is by far the best woodworking bench I have ever owned and folds flat when not in use. I also have a portable circular saw bench, a luxury which allows me to produce sawn timber to virtually any size I require.



Hammers come in many shapes and sizes. This selection is from the inside workshop; from top to bottom we have a cross peen cabinet-maker's hammer, a square head hammer, continental pattern and bought in Switzerland, a small engineer's ball peen hammer, a jeweller's hammer and at the very bottom a tiny model maker's hammer the like of which I haven't seen for years. It's on its second shaft, which is a little too short.

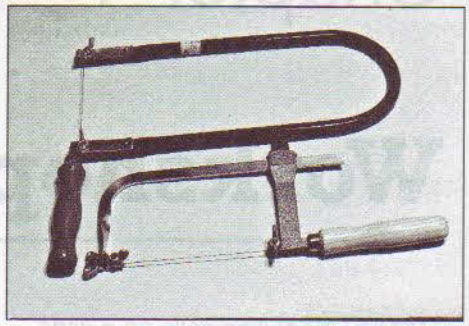


Small saws for model making. The razor saw at the top is excellent for fine work, but I prefer the more solid 6 in pin-ended hacksaw for general use. This is an unusual pattern, and I'm not sure if it is still available. The blade is held in tension by screwing the handle. There is a miniature hacksaw pattern widely available; avoid the cheap bent wire type, they do not provide proper tension for the blade. The centre tool is a keyhole sawblade made to fit the Stanley pattern knife. It's the only saw that will go into awkward places to cut away a timber that is obstructing a part of the layout.

I keep a large selection of tools in the garage, most in a proprietary tool cabinet that a DIY chain offered at a bargain price some years back. This is supplemented by a couple of other racks which hold the more commonly used tools.

My basic collection of tools includes a variety of hammers. Using a hammer correctly is an art. The shaft is held at the end and the head swung at the appropriate speed. For most model work, the movement should be largely in the wrist, you only need to swing your arm when using a larger hammer to drive in large nails. Practice is needed to be able to judge the swing so that you can vary your blows from a light tap to a heavy strike.

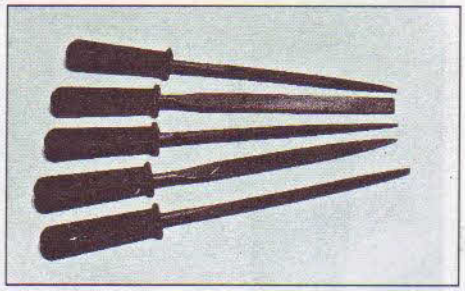
Various sizes of saw are needed. A razor saw is excellent for fine work, but I prefer a 6 in pin-ended hacksaw for general work. In my youth the fret saw was the tool for the home craftsman. Every toolshop, ironmonger's and high class toyshop had at least one fret saw set, the cheapest of which cost, as I recall, 6d. Modern fret saws come without the bench fitting and clamp that was – and is – an essential part of the outfit, and yet still cost anything up to £10 apiece, including the blister card.



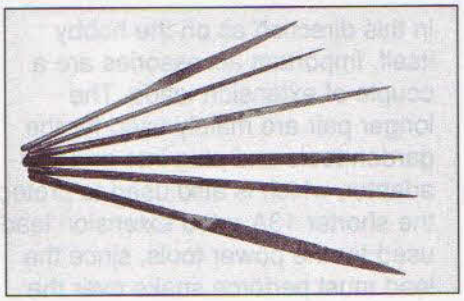
The good old fret saw and its less well-known baby version, the piercing saw. The fret saw here is unusual: it came without packing from a Swiss chain store and only cost SFr2.75 – a little over £1 at the time. With its tubular frame it happens to be a better tool than the usual modern version. The lower piercing saw is a little out of the ordinary, having a tensioning screw at the top. It is still being sold by Shesto, who attend many major exhibitions up and down the country.

Both saws will take the same length blades, but it is customary to use coarser blades in the fret saw and finer blades in the piercing saw. However, there is nothing to stop you swapping them over if the need arises, though the larger fret saw is more difficult to control when using the finer and more fragile piercing saw blades.

Top quality files are fairly costly and are not found hanging up in DIY stores with plastic handles attached. They are only needed for serious scratchbuilding where a great deal of metal work is undertaken. Although

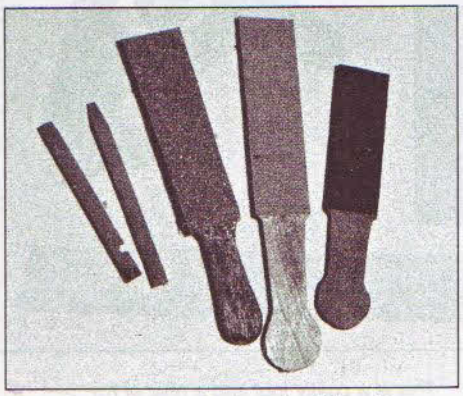


This array of small files with plastic handles is a relative newcomer on the scene. Although sold as warding files, they are nothing of the sort, but are a set of small second-cut files covering the standard range of sections. Moderately priced, they are second quality tools but quite useful for rough work around the layout.



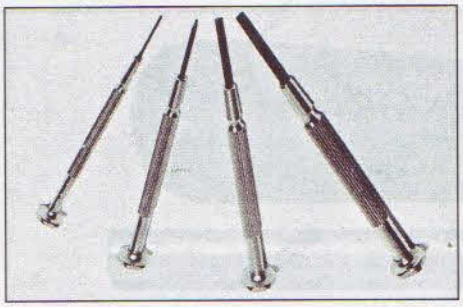
A set of needle files. At one time these were known as Swiss files, having, I understand, originated in that country. Initially they were used by watchmakers, and like many tools for that trade are equally suited to our needs. Whilst intended for metalworking, they are extremely useful for clearing flash from plastic mouldings and fine fitting of plastic parts. For this purpose a cheap set of files is perfectly adequate, and the more expensive pattern, often of Swiss origin, are only needed for serious scratchbuilding.

Swiss-made files are often regarded as superior, in my opinion the best Sheffield brands are just as good. It is vital to have a handle on every file. The tang is sharp enough to give you a serious and extremely painful wound in a sensitive part of your palm. Traditional wooden handles are



Not all tools have to be bought. This picture shows a selection of home-made devices which will be found invaluable. The three larger units are sanding blocks. The body is cut from 3 mm ply, the abrasive is standard sandpaper and wet-and-dry emery paper glued to the ply. They are used to smooth rough edges and surfaces on wood and plastic parts. As the abrasive is flat it is easy to get a true edge.

The two smaller items are spatulas made from short lengths of stripwood with one end tapered. They are used to spread adhesives along joint lines and are much more convenient that the pointed matchstick that is so frequently suggested for this purpose. They also serve to mix and apply two-part epoxy resins (Araldite) and plastic body fillers.

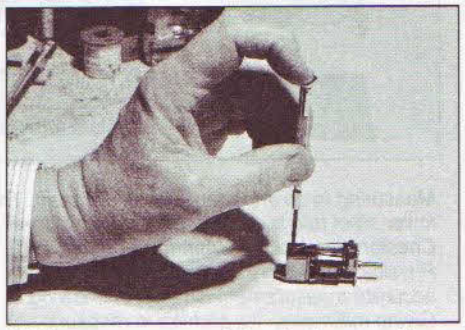


Another watchmaker's tool that is invaluable in our hobby is the watchmaker's screwdriver. Generally sold in sets of four, they have a knurled body and a pivoting top, with a very hard, short, small blade and are intended for small machine screws. Unofficially, these screwdrivers also make rather good scrapers.

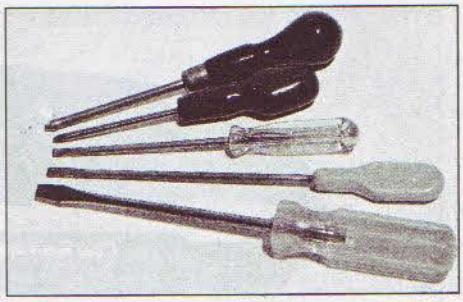
supplied by proper tool shops. Try to keep a couple of spares in the tool chest.

An important point to grasp with all files is that once used on iron or steel, they will not be much use with brass. Furthermore, when filing aluminium or lead and lead-based alloys clogging is an ever-present problem. A file card – a wire brush with short 'hairs' – is needed to clear the swarf out of the teeth of the file.

Needle files have a built-in round handle rather than the tang of a normal file. You can buy special handles to fit on to the file, but I can't get along with them. For me, they upset the balance of the tool and,



While you can use watchmaker's screwdrivers in the obvious way, they are designed to be twirled between the thumb and second finger, with the forefinger placed on the pivoted top to keep the instrument upright while the workpiece lies on the workbench. This is initially a trifle awkward, but soon becomes second nature and has the undeniable benefit that you can more readily see where you are putting the blade. This is rather important as the hard sharp end can easily scratch soft metals.



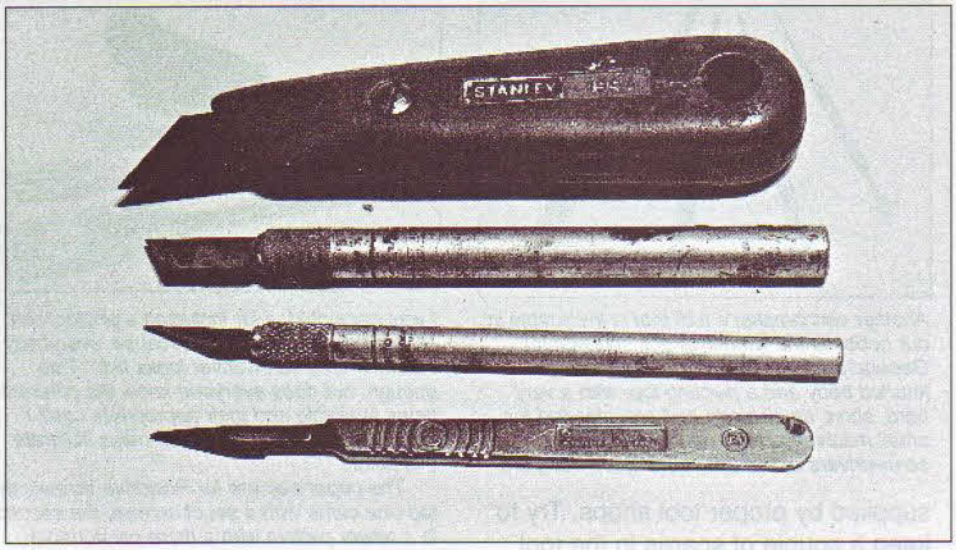
I was once chided for including a photograph of screwdrivers in a book because 'everybody knows what a screwdriver looks like'. True enough, but does everyone know the different types available and their appropriate use? I think not. This small selection helps illustrate this point.

The upper pair are for Posidrive screws; the top one came with a set of screws, the second is a newer pattern with a more comfortable handle and a better point, and is the one I have in the rack. The middle one in the set is a good general purpose screwdriver, mainly used for larger metal screws. The one immediately below is a particular favourite as the flat handle allows me to exert more force. The bottom one is used for the larger wood screws needed for baseboard construction.

bearing in mind that these files are intended for precision work, this is a serious matter. Apart from this, these small files are easily broken if not used correctly. For this reason, newcomers should practise with the cheaper brands before moving on to top quality tools.

The basic rule for any screwdriver is that the blade should fit firmly into the slot of the screw. The longer the shaft, within reason, the more force you can exert on the screw. Good screwdrivers should, in the main, only be used for their proper purpose. If you want to prise lids from paint tins, or wedge pieces of nailed or glued wood apart, there are plenty of cheap and nasty screwdrivers on the market which, whilst tolerably useless for their advertised purpose, are excellent in this role.

There is a place for everything and, because at the end of the day I put the car away, practically everything goes back in its place. However, I also have a small flat-topped trolley, which began life as the support of a TV set, but now has



Most fine model making involves the use of what are loosely grouped as craft knives. The four seen here are my personal favourites.

The Stanley knife, in this instance the genuine article, is always used for heavy cutting, because it alone has the strength to do the job. In addition, the handle holds replacement blades, so there is no excuse for continuing to use it when the cutting edge has gone. Blunt blades are more difficult to guide, and are much more likely to end up slashing into your other hand.

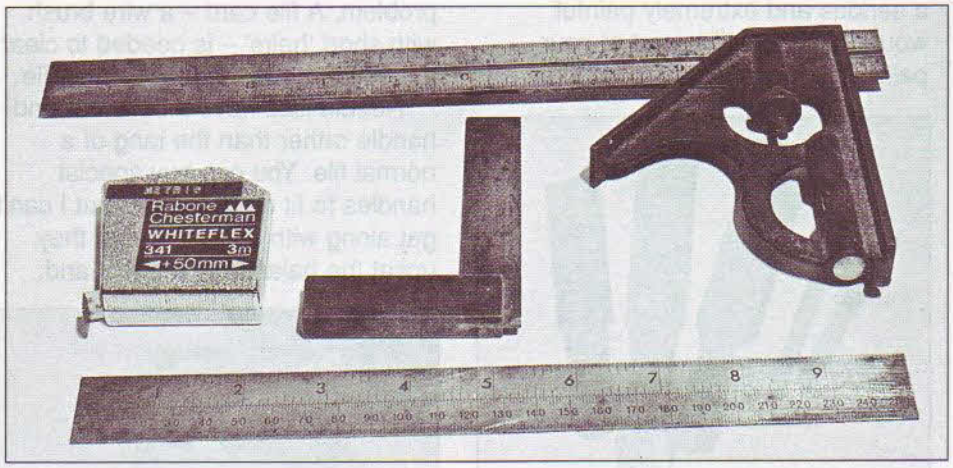
The centre pair are Xacto Nos 1 and 2 handles, both of which have seen a lot of use since I bought them in 1948. The No. 2 is fitted with an angled blade which I find very useful for scraping surfaces. It's an excellent tool for removing ballast and scenic scatter materials from where they shouldn't be. The No. 1 handle has seen a lot of use and is due for replacement fairly soon. I prefer the angled blade shown, with the stencil cutter as a second choice. This type of blade can be sharpened on an oilstone slip.

The scalpel has become the model maker's preferred tool for fine work since the handle is very comfortable in use. The disposable blade must be removed and replaced with flat-nosed pliers: remember, its original purpose was cutting flesh. Wrap the discarded blade in the paper provided and seal with tape before putting it in the gash bag. This tool should only be used for light cutting because the blade is easily broken, and that frequently spells trouble.

a sheet of chipboard screwed to the top. This holds the tools I'm using on a job and occasionally I just push it to the back of the garage leaving some equipment lying there.

My circular saw bench lives here, too. It is extremely useful, enabling me to produce wood sections to any size I require, but neither it nor the power plane is at all essential. On the other hand both the power drill and the jigsaw are invaluable tools, and their cost can be more than justified by their value for household maintenance. Indeed, most of the garage tool kit has seen as much use in this direction as on the hobby itself. Important accessories are a couple of extension leads. The longer pair are mainly used for the garden tools and plug into an RCD adaptor, which is also used to protect the shorter 13A rated extension lead used for the power tools, since the lead must perforce snake over the floor with a small, but real risk of damage.

Work in the garage is timed to allow 15 minutes minimum for clearing up. It takes this long to put the tools back tidily, wind the extension leads back on their cleats and then, having extracted any offcuts that might come in useful, sweep up the chippings. A broom, brush and small shovel are an essential part of the equipment. For obvious reasons, serious work in the garage stops in November and rarely begins again before spring.

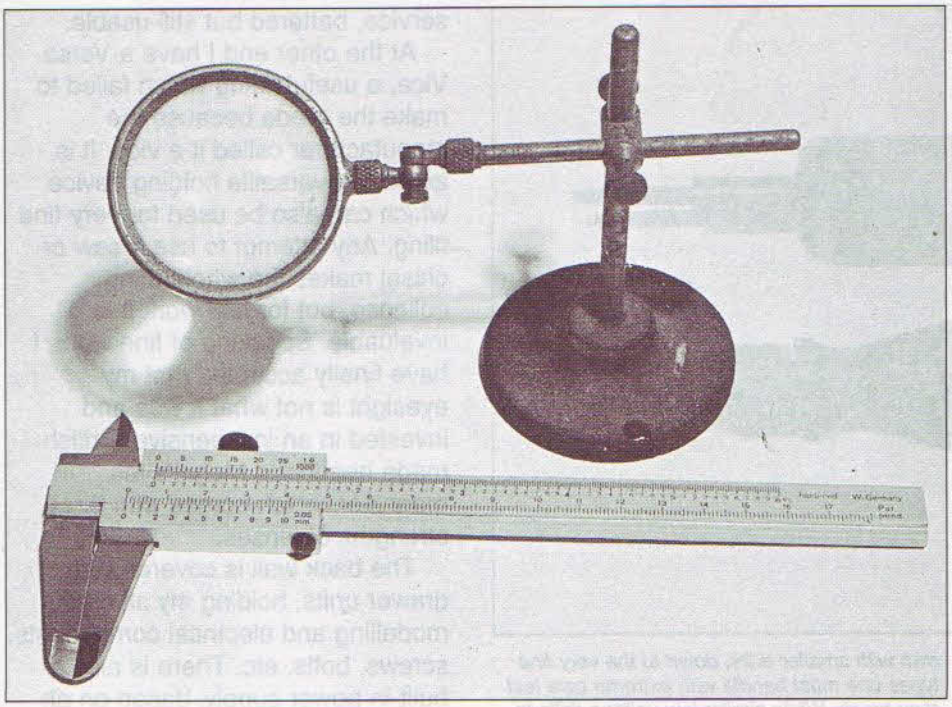


Measuring is an important part of our craft. The lower steel rule is an NPL pattern by Rabone Chesterman, No. 33. What the National Physical Laboratory doesn't know about accurate measurement isn't worth knowing. Giving millimetre, 1/32 and 1/20 in measurements, it meets most requirements for setting out for hand tools. The NPL found that their highly skilled craftsmen could estimate a half millimetre more accurately from this rule than they could from a rule divided in half millimetres.

The combination square is by Brown and Sharp and was bought in the early 1940s. It's an engineer's tool and has additionally an angle protractor and a 45° centre square. The main 45°/90° body incorporates a spirit level (as does the protractor) and a small scriber. This is a costly tool and a relic of my apprenticeship. A cheaper version, intended for general work and without the trimmings, is as useful for our purpose. I have one in the garage workshop.

The 4 in engineer's square is the one I use all the time. It slips into a little slot to the right of the vice so it is always to hand for marking out and checking. It, and its baby brother from the toolbox, will appear in several photos in later chapters. The steel tape is used for longer measurements.

The important point to remember is that cheap steel rules are fine for cutting and straight edges, but if you want inherent accuracy you need to pay top prices for a machine-engraved rule.



A vernier calliper gauge, measuring both metric and imperial sizes with considerable precision. There are cheaper versions on the market more suited for rough and tumble work, which pretend to high precision, but are only accurate to 1/10 mm or 1/64 in. This is perfectly adequate for general model making.

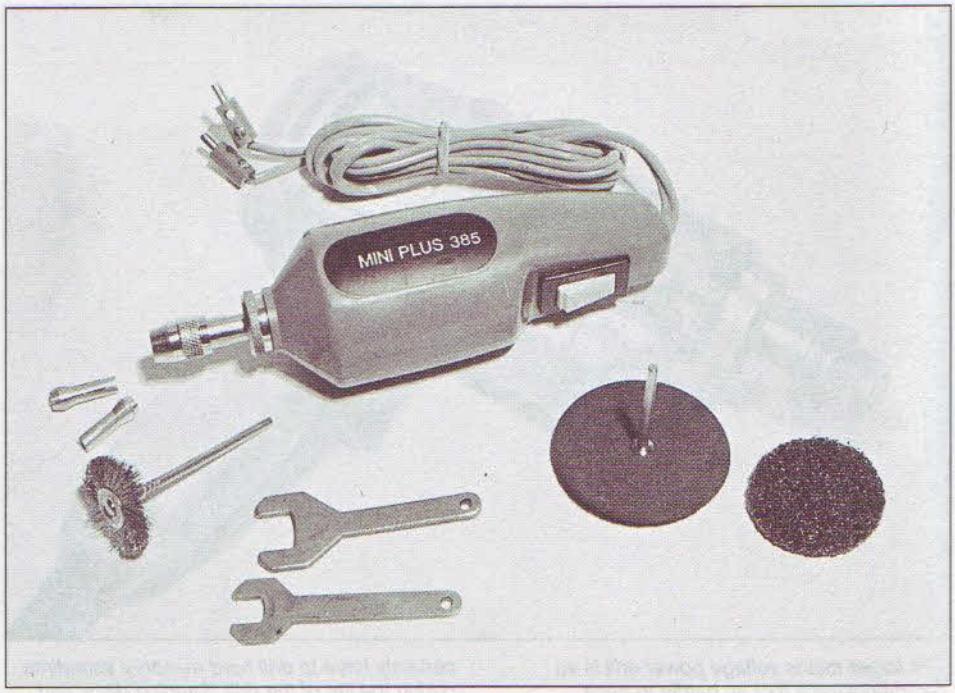
Also shown is a very old magnifying glass on a stand. I don't know if this pattern is still in manufacture since it has been effectively superseded by both the bench-mounted illuminated magnifier and the headband mounted magnifying glasses. It's shown with the vernier calliper because the only way one can comfortably read the fine divisions on this tool is to use some form of magnification. If you want to invest in a precision measuring tool, there are now some lovely – if a trifle costly – callipers which give their readings on an LCD screen and can be seen with ease in all but the poorest light.

Indoor work area

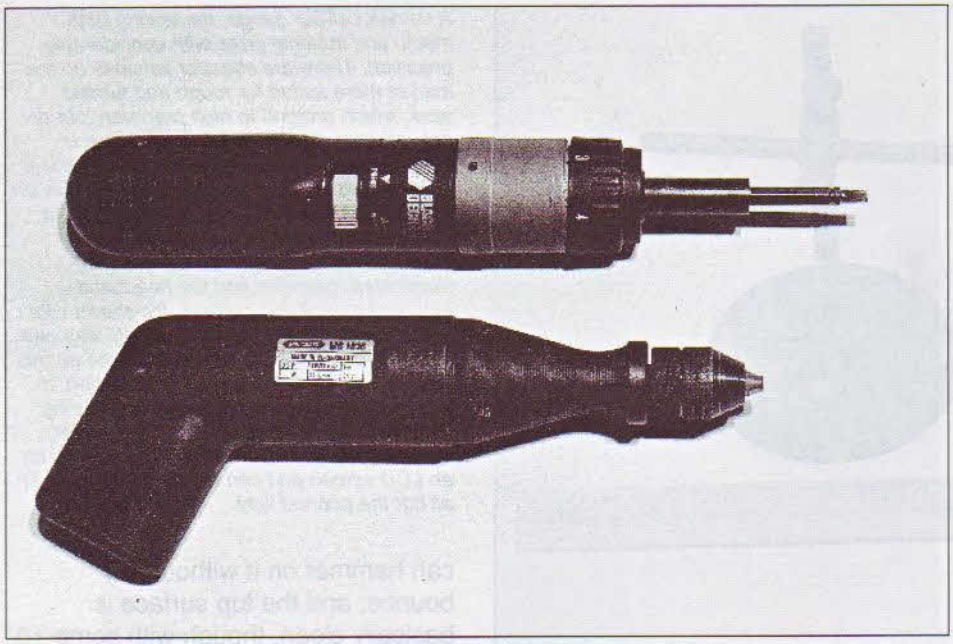
Pure model making takes place inside in my 'den'. This room also houses most of my fairly extensive railway library, the computer and printers, a desk, together with drawing boards and the workshop area. As it is only just big enough for its purpose, once again it is a case of having to arrange a place for everything so that, from time to time during a project, everything can be put back in its place.

The workbench is made from an offcut of 21 mm melamine-faced chipboard, intended primarily for kitchen working tops, which I found in a local shop at the crucial moment. It is by far the best workbench I have ever owned. It is completely 'dead', I can hammer on it without any bounce, and the top surface is basically clean, though with some 10 years' usage it has become stained. A No. 1 Record engineer's vice is securely bolted on the right-hand end, more convenient for a left-handed workman. This, incidentally, is my second Record vice. The first was retired after 40 years' hard

We need to make a lot of small holes in the course of model making. The traditional tool for this is the wheel brace shown here, but it has its limits. The maximum size drill it will take is 6 mm (1/4 in) and it is apt to break very small drills. For fine work, I place my elbow on the bench and hold the drill against my forearm whilst turning the handle with the other hand. Today, I find its main value is as a back-up to my power drills.

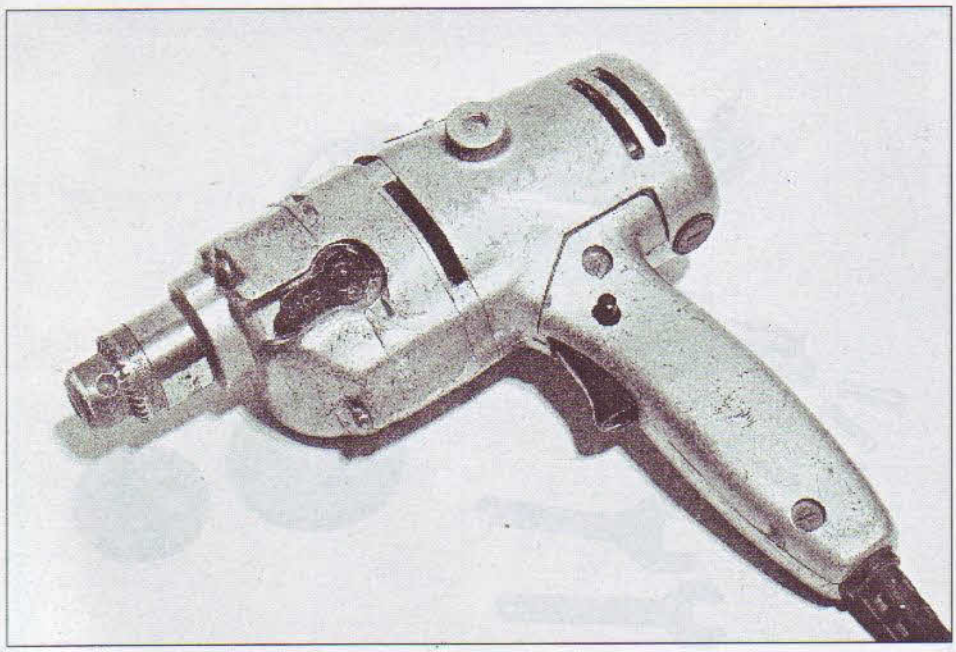


A low voltage drill is the most convenient type for very small drills. You can get a selection of other tools, including small abrasive mops, wire brushes, burrs and, above all, a mandrel to hold thin abrasive discs. These can be used to cut through rails and virtually anything else you care to mention, including hardened steel. As they are brittle, protective goggles must be worn.



Two recent additions to my tool kit are the power screwdriver and a small rechargeable drill. The former is invaluable during baseboard construction, but is of no value when working with small screws.

The drill is the answer to a long-felt want. It will take up to around 3 mm diameter twist drills, though it's not too happy when asked to do any heavy work at this size. It comes into its own with smaller drills, down to the very fine types one must handle with extreme care lest they break. While similar low voltage drills to use with a transformer are also available, the great advantage of this tool is that you can take it anywhere on the layout. All you have to do is to remember to recharge it after a long session, but once charged it will comfortably serve for at least a full day.



The larger mains voltage power drill is so commonplace a tool as hardly to need introduction. A wide selection can be found in any DIY store. Go for a 10 mm diameter pattern with two-speed geared drive and hammer action. While you don't need the latter function for railway modelling as such, you will certainly have to drill hard masonry sometime during the life of the drill. Sanding discs and other attachments increase its versatility.

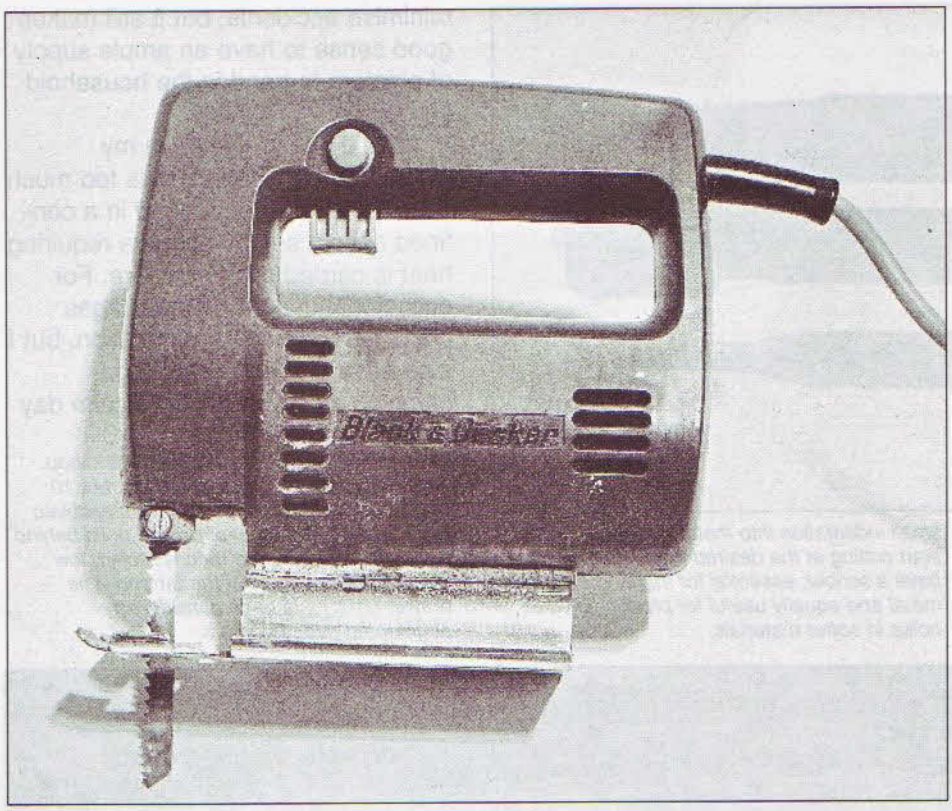
The rechargeable drill is a good second string tool. It has many advantages but unless you invest in a spare battery pack and follow a strict recharging routine it can let you down.

service, battered but still usable.

At the other end I have a Versa-Vice, a useful fitting which failed to make the grade because the manufacturer called it a vice. It is actually a versatile holding device, which can also be used for very fine filing. Any attempt to use a saw or chisel makes the whole thing collapse, but for fine work it is invaluable. Speaking of fine work, I have finally accepted that my eyesight is not what it was and invested in an inexpensive, British-made headband Magnifeyes magnifier, which comes with three strengths of lenses.

The back wall is covered with drawer units, holding my stock of modelling and electrical components, screws, bolts, etc. There is also a built-in power supply, based on an ex-equipment transformer with a mass of tappings which allows me to set the output at anything from 1.5 to 18 V ac or dc, which is essential for testing. It also powers both a 12 V drill and a 12 V soldering iron. Beneath the vice I have a tool chest. There is a wall of pliers, screwdrivers and other regularly used tools which are within comfortable reach from the working place. A padded folding step stool not only provides a seat, but gives safe access to the higher storage shelves. A pair of reflector spotlights, downgraded from the kitchen, provide the lighting, but I have plans to add a third light on the other side to kill shadows. Three switched 13 A sockets are mounted on the front of the bench for soldering irons, power drill and anything else that needs 240 V ac. These and the rest of the electric supply are fed through a heavy cable from the wall socket, which, surprisingly, happened to be in the right place.

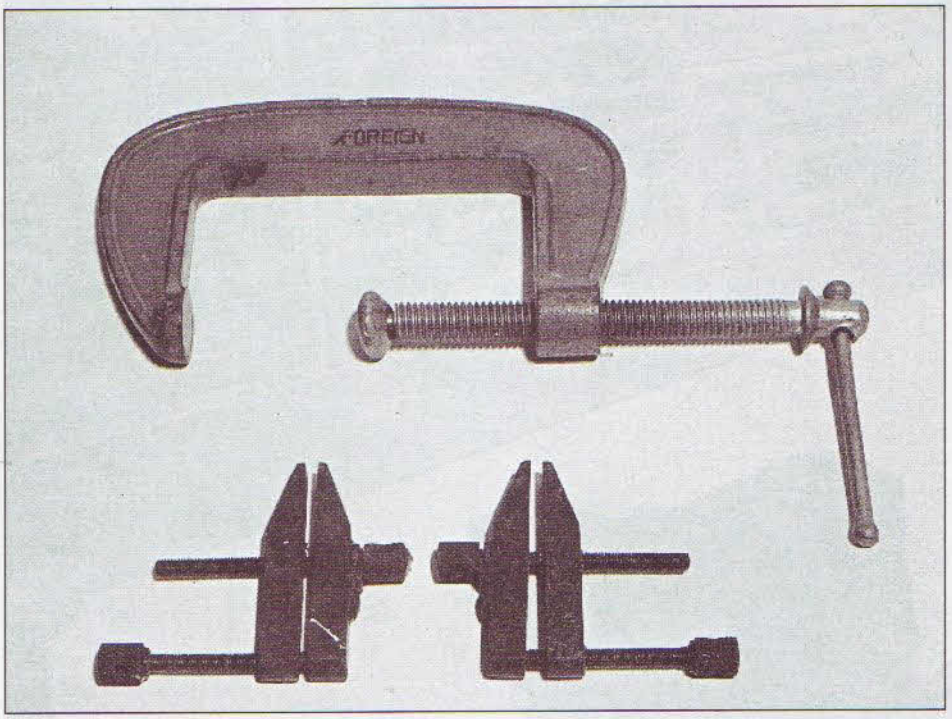
At right angles I have my 'machine shop', in practice a Unimat SL, which can be converted to a vertical drill or precision sawbench. It is a little



Left: *The only other power tool you will find invaluable is the powered jigsaw. It will make straight and curved cuts through sheet material and will cut through 65 mm (3/4 in) thick timber. With the correct blade it can cut sheet metal as well. As any but the most elementary of baseboards have their top surfaces cut into intricate curves, this tool will get a lot of use. Unlike the circular saw, it is not prone to take charge. Indeed should things go wrong the first casualty is usually the brittle blade, rendering the tool fairly innocuous. However, never hold the sheet in front of the saw. Ideally secure big sheets with G clamps.*

Recent patterns have a swivelling base and will make angled cuts. This is fine in theory, but in practice most cuts need to be dead square and so you have to align the base with great care and tighten the screw as hard as possible. As they say, no gain without pain.

There are many other power tools available for the home workshop. Most have only limited value in our hobby and are not cost effective. The circular saw is a borderline case, but its inherent dangers are such that I would not recommend it. The same consideration applies doubly to the bandsaw.



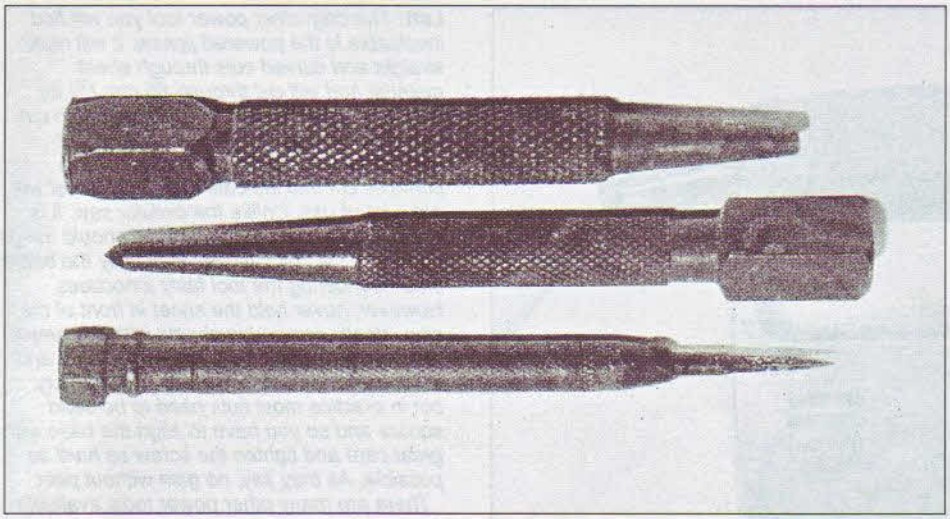
Clamps are extremely useful in model making. The larger one at the top is used for holding baseboard sections together, while the lower pair are toolmaker's pattern clamps. Don't be put off by the name. They are extremely versatile devices and will hold layers of plastic or ply just as effectively as they do pieces of steel in a toolroom. Their great virtue is that you can get the wide jaws to grip evenly by just twiddling the knurled knobs. They are provided with toggle bar holes for tightening, but for most model making tasks, finger tight is ample.

luxury which gives me a good deal of pleasure, but would only be regarded as essential for advanced locomotive scratchbuilding. The power supply is interlocked with the lighting, two 60 Watt tungsten strip lights.

Safety

Safety is an important aspect of workshop arrangement. It is advisable to use tungsten lighting in any workshop with power tools, because fluorescent lights can produce a strobe effect and make a revolving part appear stationary. Avoid trailing leads, these can easily trip you. By the same token, keep the floor clear of all obstructions during working sessions.

Treat all cutting edges with respect, and remember that you're more likely to cut yourself with a blunt tool because of the unnecessary force needed to use it. Electric soldering irons should always be housed in a proper stand, with the hot bit nicely protected by a relatively cool steel spiral. Above all, keeping the working area in order and planning each job to avoid unnecessary risk is the best way to

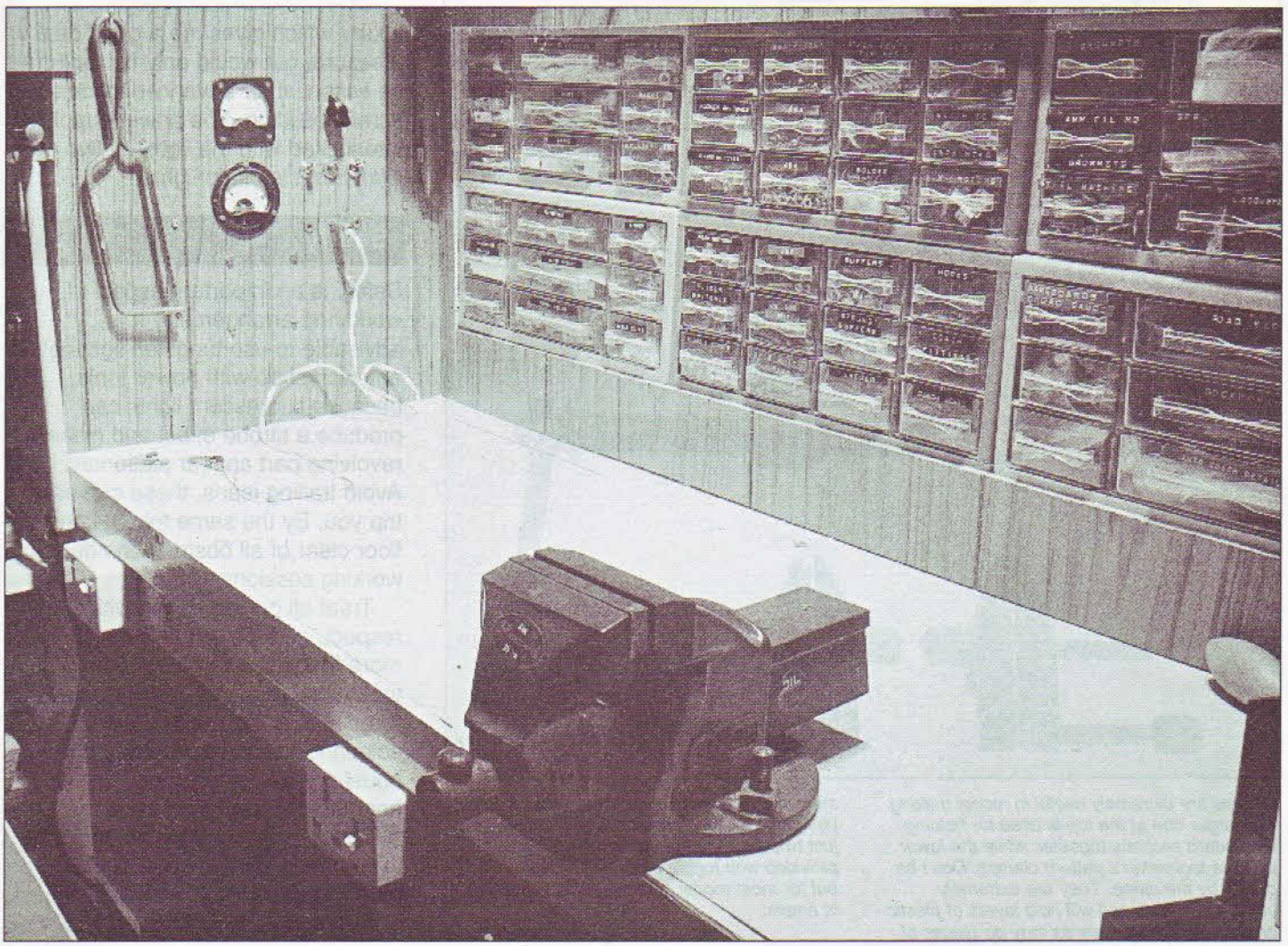


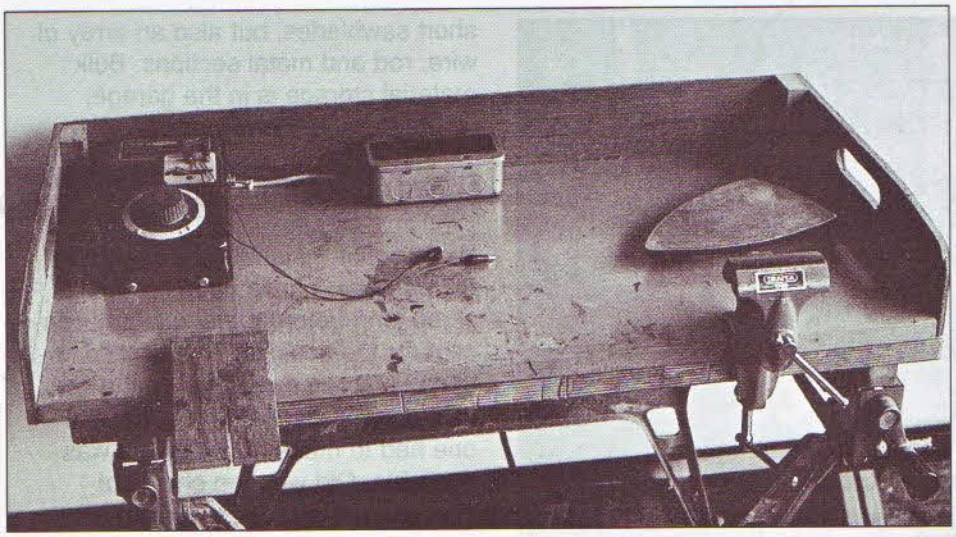
Above: *Three small but essential items in the toolkit. The upper tool is a flat punch which allows you to direct a hammer blow on to a small, precise area. The centre item is, appropriately, a centre punch. This makes a small indentation into metal to allow a drill to start cutting at the desired place. Finally we have a scriber, essential for marking out sheet metal and equally useful for producing small holes in softer materials.*

minimise accidents, but it still makes good sense to have an ample supply of plasters to hand in the household first aid kit.

I avoid naked flames in my workshop, because there is too much flammable material around in a confined space, so any process requiring heat is carried out elsewhere. For occasional use the domestic gas cooker is the traditional location, but I also have a small propane gas camping stove, which on a calm day

Below: *Early days in my current workshop. This shows the pristine workbench, but 10 years' use has stained the once immaculate surface. Note the array of drawer units behind the workbench and the reconstructed, low voltage power supply at the far end. The drawer units have been considerably augmented over the years.*





A portable workbench. At the back a twin-switched socket is fixed to the bench and marked 'Maximum 5 A', the rating of the plug's fuse. The lead is rated at 13 A, erring on the side of safety. A lead from this socket feeds the power unit, an old Triang product with a metal casing which has been modified by the addition of an on-off switch. A pair of wander leads, terminating in crocodile clips, are semi-permanently fitted.

In front of the power unit is a fret saw/piercing saw bench, a strip of 6 mm ply with a wide sawcut. This is held down by two 2BA countersunk screws which go into a brass plate. On the right, the soleplate of an old electric iron serves as an anvil, while the portable vice also acts as a clamp to hold the workbench secure on the desk top.

can be used on the patio, well away from anything flammable.

Portable workshop

Where no permanent workshop site is available a good deal can be done on a desk or table top, provided the surface is protected. The modern A3 size plastic cutting board is perfectly adequate for work with plastic kits, but for more general modelling a portable workbench can be a boon. The one shown here is one I built some time ago. The base is a piece of 12 mm thick blockboard to which 6 mm ply sides have been securely glued and screwed. There are carefully smoothed hand holes in the sides, and 25 mm square corner blocks have also been added. In front of the power unit is a fret saw/piercing saw bench, a strip of 6 mm ply with a wide sawcut. This is held down by two 2BA countersunk screws which go into a brass plate. On the right the sole-plate of an old electric iron serves as an anvil, while the portable vice also serves as a clamp to hold the workbench secure on the desk top.

Storage

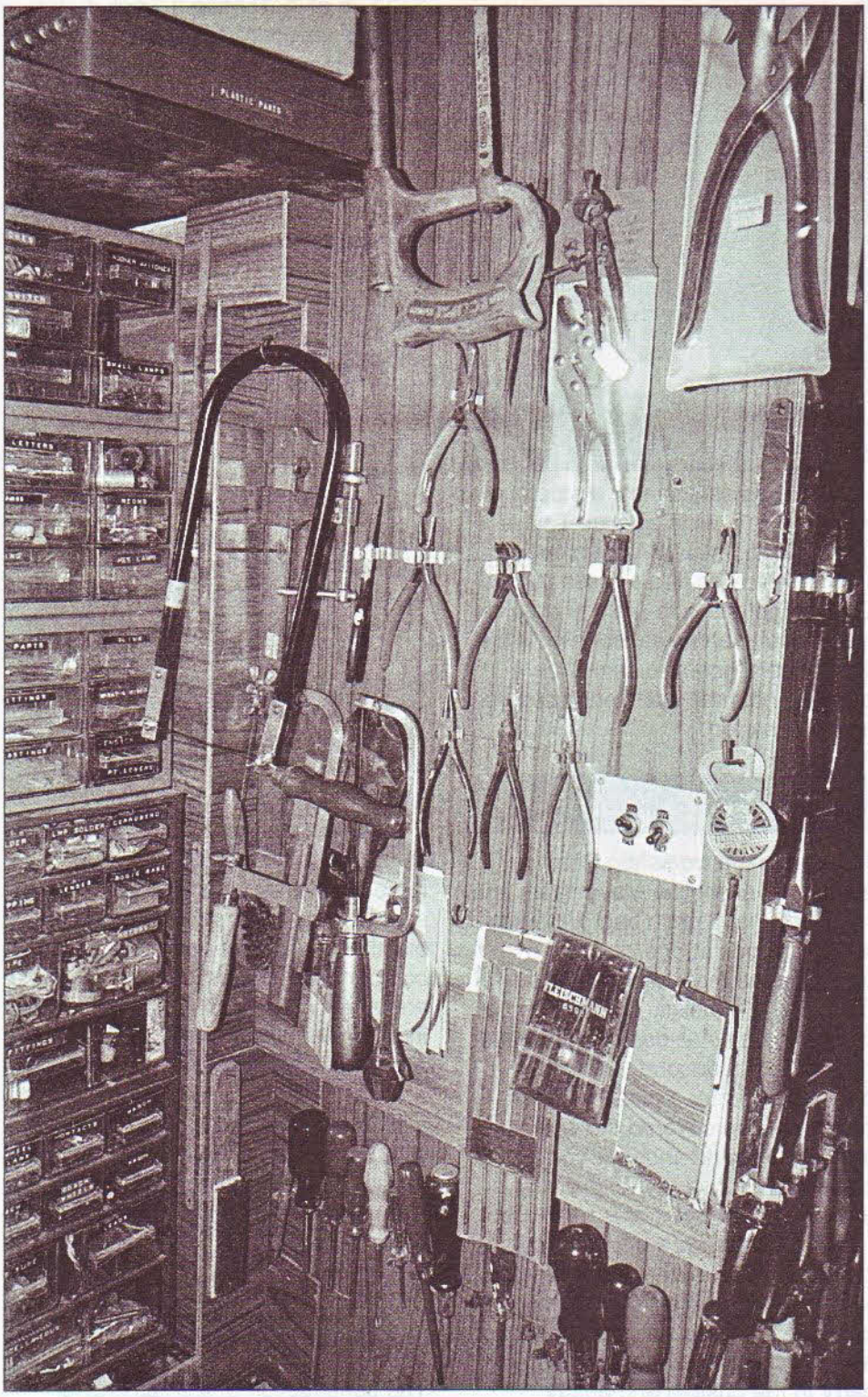
Tidiness in the workshop is advisable, if not essential. Many years ago I realised that a gash bag, a plastic bag on a hook at one end of the bench, is the most convenient way of disposing of rubbish. This is complemented by a small dustpan and brush (the latter is a decorator's dusting brush, the former a plastic kitchen scoop). I have covered the carpet in front of the workbench with clear plastic carpet overlay, sold in any respectable carpet stores by the foot.

For a temporary workshop, a large cloth should be spread over the floor to catch debris. Plastic is not suitable, because it is very difficult to fold over any dirt and even more difficult to carry to the dustbin and empty without leaving a trail of debris through the house. However, plastic sheet is the most suitable protective material when using plaster or paint.

The workbench gets a regular clean up at least once a week during working sessions. Tools are put back in their homes, and at regular intervals I reorganise part of the storage. There is no ideal arrangement. The only viable solution is to bring the tools in regular use into the most convenient places and relegate the specials to less accessible locations. The definition of regular use depends on the job in hand at the time. During electrical work, or when working in sheet metal, the soldering iron lives, in its holder, on the bench. At other times it is stowed away on a shelf.

I do tend to collect tools for their own sake and there is considerable duplication. Accordingly I have a large compartmented plastic box which holds a reasonably complete model making kit. Another similar box holds paintbrushes and some paints. In addition there is a general purpose toolbox which is suitable for household maintenance and can also function as an exhibition toolbox together with the general model making box.

An important aspect of any workshop is storage of ready-to-use materials. Small components, screws, pins, etc. are best housed in plastic drawer units and multi-compartmented plastic boxes. These are in easy supply in DIY stores and, in particular, Woolworths, where you can often find them on special offer at about half the price found elsewhere. Each drawer is labelled with Dymo tape. From time to time I revise the collection to make optimum use of the storage. Larger items are more of a problem. For many years I kept styrene sheet (Plastikard), acetate sheet and steel and brass in labelled boxes, adequate but none too convenient. The construction of a small drawer unit has made life easier. Sections of plastic pipe, screwed to a vertical unit, hold rod and bar material, while a small array of those tubes which hold flat round tablets, holds not only



A place for everything and, for once, everything in place. The right-hand wall of the workshop area is liberally provided with hooks and Terry clips to hold most of my most useful tools conveniently to hand for instant user. Most of my smaller pliers are on the main wall, the heavier ones are on the vertical edge. A rack of screwdrivers is ranged along the bottom. The arrangement is wholly empirical; the most used tools are moved nearer to hand, the less used to the back and high up. There has been a steady progression over the years. The shot also includes part of the extended array of plastic drawer units.

short sawblades, but also an array of wire, rod and metal sections. Bulk material storage is in the garage, where there is more room.

Sources of materials

While some materials are bought for the purpose, I have been recycling scrap long before there was any concern for the ecology. This was something I learned during the war, when everything was in short supply and one had to make do with what was available. Old wooden chests of drawers can be readily broken down into their basic components, and they provide enough ply and good straight grained timber for a mass of modelling projects. Apart from the implicit saving, such timber is thoroughly seasoned, so if it is flat, you know it will stay that way. Unfortunately, modern flat-pack furniture is nowhere near as useful, though it does provide a lot of 12 mm chipboard which can be used for track bases at a pinch.

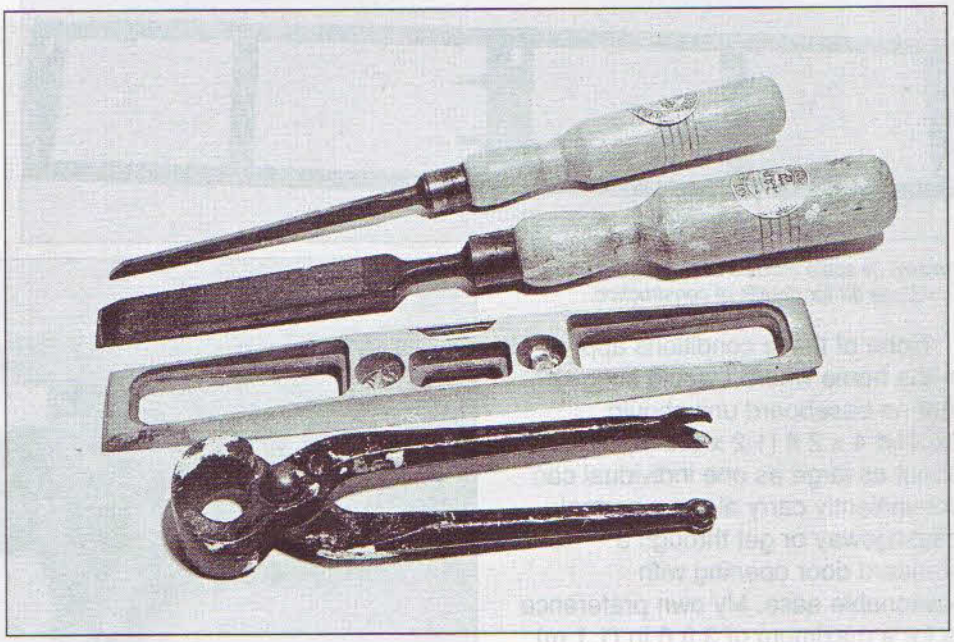
There are two excellent sources for wire; old electric cable and wire coat-hangers. The latter can supply three lengths of good straight stiff steel wire which can be threaded 8BA if you have screwing tackle. Copper wire is extremely useful, and unlike all other wires it can be straightened very easily by gripping one end in the vice, the other in a pair of pliers, and pulling hard. The straightened wire can be bent to shape and, if need be, hammered flat on an anvil.

While I don't like card as a modelling material, I know many modellers do prefer it. What many do not appreciate is that cereal manufacturers do use a very good quality card for their cartons. I'll have more to say on this later in the book. Quite apart from anything else, the less you spend on incidentals, the more you have to spend in your favourite model shop. Indeed, a good rule of thumb is that if model shops don't stock it, try to scrounge it.

Chapter 5

Basic Baseboard Construction

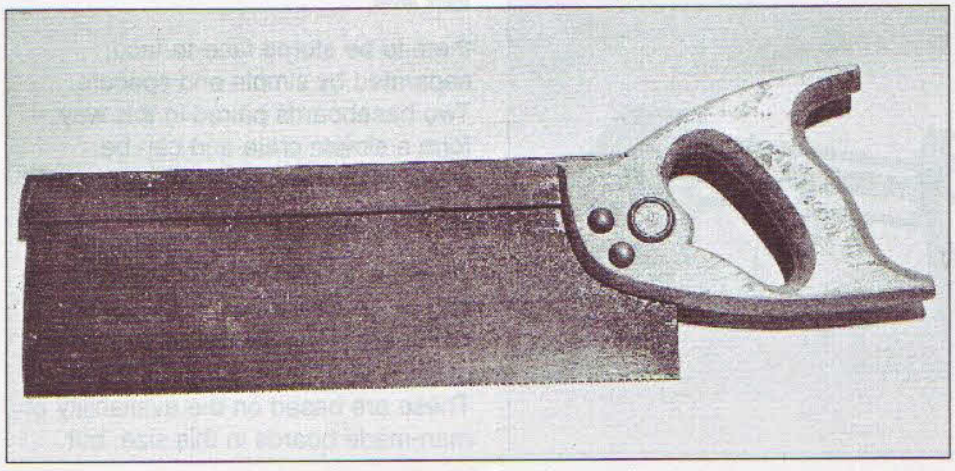
The baseboard is by far the most critical part of a model railway project. It not only determines the size of the model, it is also the substructure on which everything is built. As the model may well last for a quarter of a century, it is clear that the foundations need to be good. Fortunately this can be achieved with very simple techniques, using straightforward rectangular timber frames which can be joined together in varying formations to meet the needs of the layout design and the space available. Much of the tracklaying and modelling on the baseboard can be carried out on a workbench or other convenient site with ease and jobs such as wiring, which is most readily carried out beneath the baseboard surface, can be performed with ease by the simple process of standing the unit on its side.



While simple butt joints suffice for most purposes, a pair of chisels can be useful, a wide (1/4 in) and narrow (1/2 in) spirit level is useful for aligning the erected frames, whilst a pair of pincers will be needed should you prefer to nail or tack parts together.

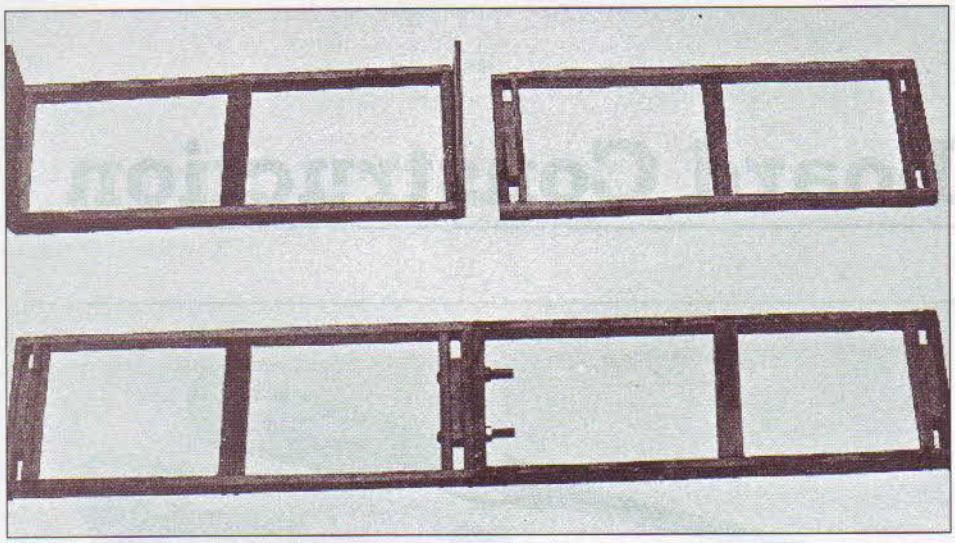
There is no single preferred size for a baseboard unit, and there are many factors which can influence the choice. First there is the size of doorways, passages and staircases, since the units will have to negotiate these obstacles. Then we must consider the length and strength of the arms of the railway modeller, who has to carry the darned things.

Baseboard construction involves a good deal of sawing of timber, and the most convenient tool for this purpose is the tenon saw. The stiff back gives rigidity to the blade, making it easier to cut squarely, even without the aid of a mitre block.



Finally, we need to pay due regard to the size of the site, together with any storage space.

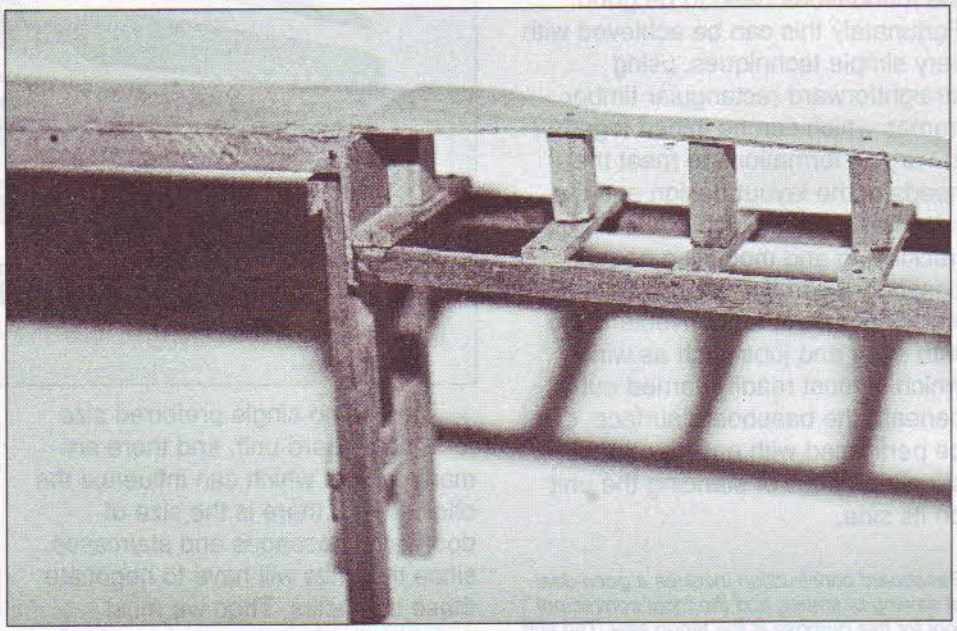
Commercial and club-based model railways are normally built on fairly large units. Here the question of weight is of secondary importance, since it can be assumed that at least two fit and strong people will always be to hand. In most clubs with large exhibition layouts, a team of six or eight is the norm. Size is also less critical, since not only are workshops, warehouses and clubrooms large and relatively uncluttered, but also door openings are wider. Exhibition halls also have wide entrances, though access to many involves at least one flight of steps.



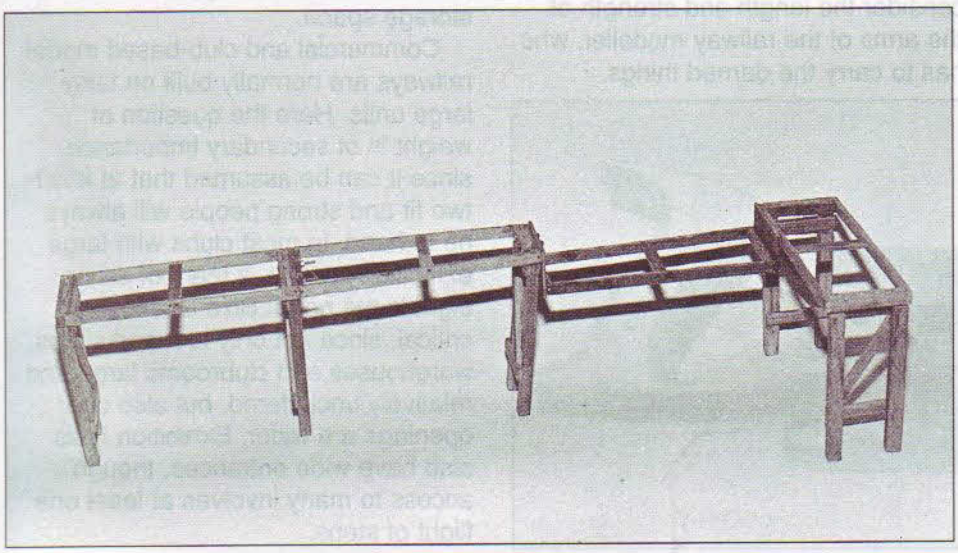
Above: *1/8 scale models of baseboard frames. See page 32 for details of construction.*

None of these conditions applies in the home where I would suggest that no baseboard unit should exceed 4 x 2 ft (1.2 x 0.6 m). This is about as large as one individual can conveniently carry along a normal passageway or get through a standard door opening with reasonable ease. My own preference is for a maximum of 3 ft 6 in (1.1 m) in length and not exceeding 1 ft 9 in (0.5 m) in width. This will fit into most family cars and will also go through most loft hatches. This is often essential when you need to store some part of the model well out of the way of normal household activities. If there is even the most remote chance that the layout might join the exhibition circuit, the question of transport to the show must be considered. It is not a good idea to load a layout on a roof rack for it is virtually impossible to keep road dust out of the model.

There is no need to have all frames exactly the same size, but it does help to arrange them in complementary pairs. This allows them to be stored face-to-face, separated by simple end spacers. Two baseboards paired in this way form a simple crate and can be safely left to removal men in case of a move.

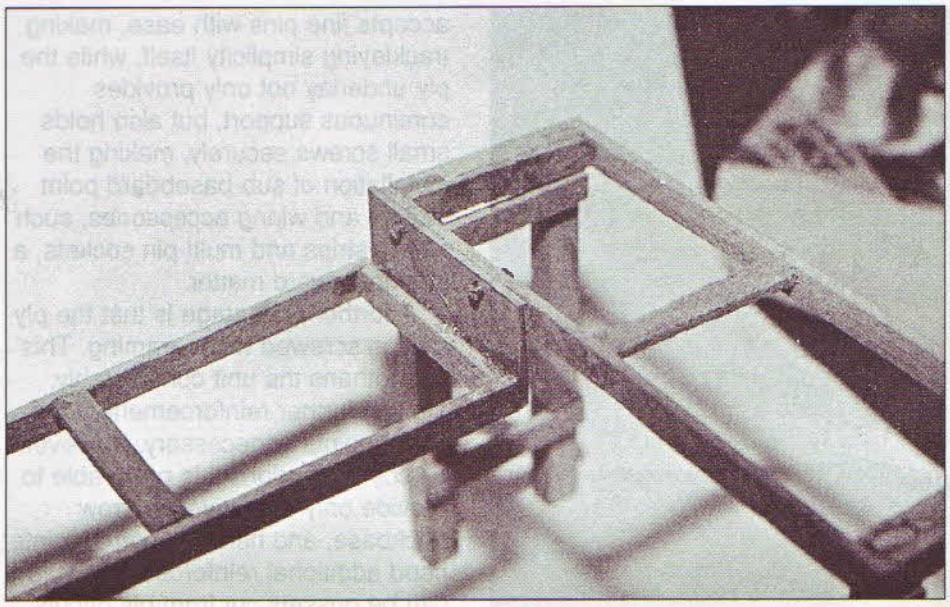


Below: *The model baseboard erected, before the addition of the track base. Note that one section of framing is dropped to allow a valley to be modelled.*



Above: *Close-up view of the dropped section. A plywood member is fixed to each end to allow the framing to be several inches below track level.*

Before we consider the actual construction, a word about the 8 x 4 ft and 6 x 4 ft baseboards which are often recommended by writers in DIY magazines and similar publications. These are based on the availability of man-made boards in this size, but



The other end of the dropped section. The fixing bolts are clearly visible. In full size the end ply section would have a pair of bracing fillets to give additional strength. In this instance, the next section is at right angles to run down the other side of the room.

overlook the fact that it is virtually impossible to manoeuvre so large a unit through a normal home without doing serious damage to the layout, the furniture, the walls and the door frames. Such baseboards are also unwieldy and difficult to store. I have seen it suggested that they can be slid under the bed, I can only assume that whoever said this hasn't looked under a bed of late, because there is no space under modern divans. In any case this isn't a good idea, because beds generate fluff, the worst enemy of the model railway operator.

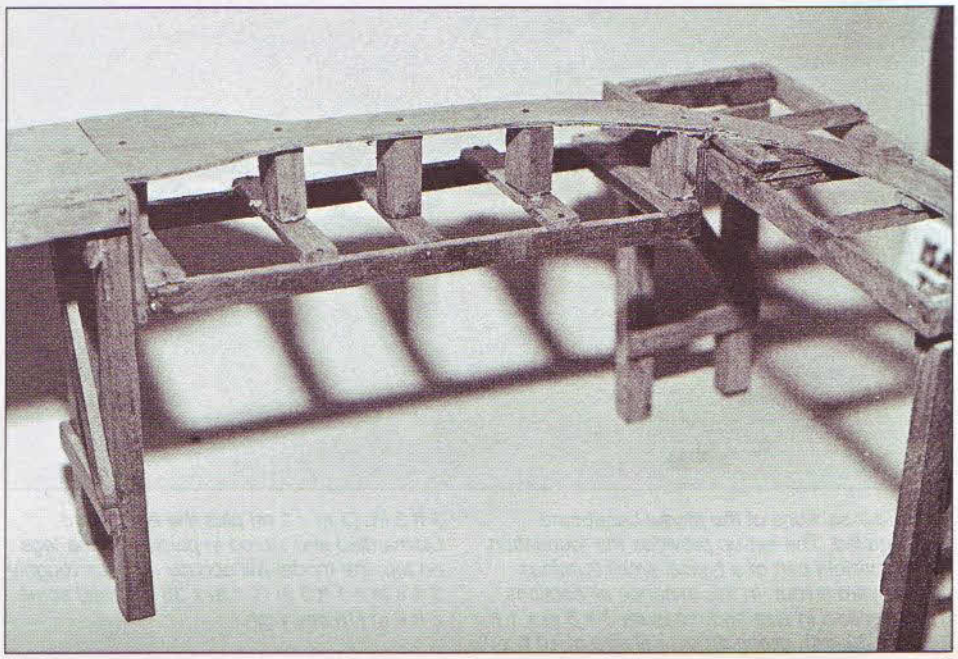
Materials

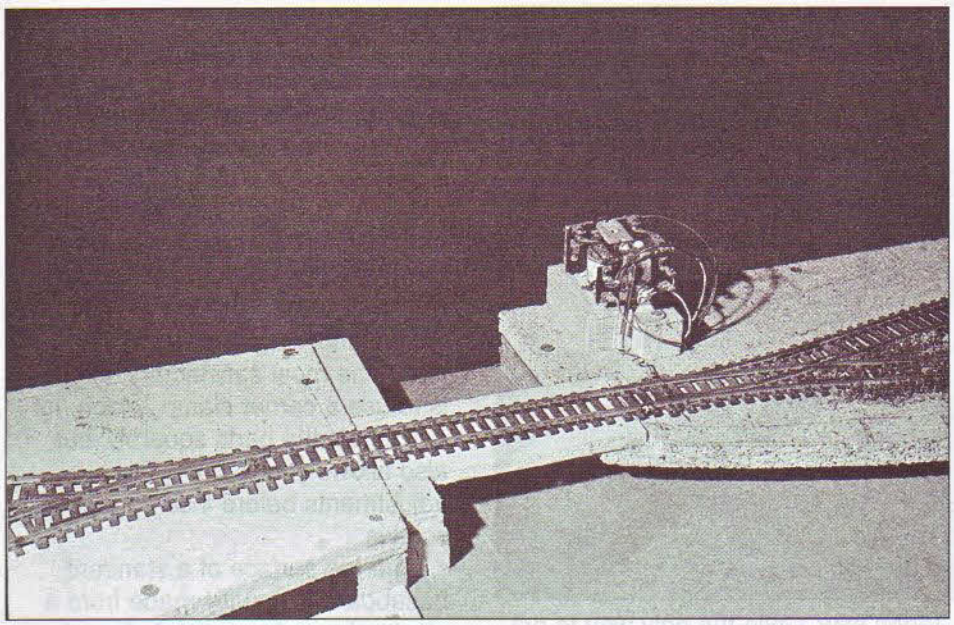
The traditional material for the frame is 2 x 1 in softwood, which metrication has turned into 45 x 20 mm timber. The size is not that critical; ready availability is the main consideration. What is important is that the parts are accurately cut to length and that the ends are square. The best way of ensuring the latter condition is to use a mitre block and tenon saw, while the only way to get all units the same length is to take care when marking out. If several units are made at once, there is a lot to be said for cutting all the timber in one session, then carefully sorting out sets of frame members for exact fit before assembly. It is not significant if, in a set of frames, the largest is 3/8 in (10 mm) larger all round than the smallest, but if there is this much difference in the lengths of the frame members of any single unit, the resulting baseboard will not be a true rectangle.

The frame units are secured by means of countersunk screws. No 6 is the preferred size. It is vital to pre-drill clearance holes in one piece and a pilot hole in the other. This not only prevents the wood splitting, but it also makes it reasonably easy to insert the screws. It is not easy to hold two pieces of wood at right angles and insert screws at the same time. The most satisfactory solution is to use a corner clamp, which not only holds the parts squarely, but also allows you to make fine adjustments before inserting the screws.

The top surface of a standard baseboard is usually made from a single piece of man-made board. This, more than anything else, is the reason why 4 ft is a popular length, it is simpler to cut the board to this size. Of the varying materials on

On the dropped section the track base is supported by timber struts carried on cross-members fixed to the framing. The gaps will later be filled with a suitable landscape. The fourth and final section of the model has the framing lowered slightly: the two legs are shorter to this effect. The track base is supported by cross-members and packing. If the line is to be on a gradient, the height of the packing is suitably adjusted.





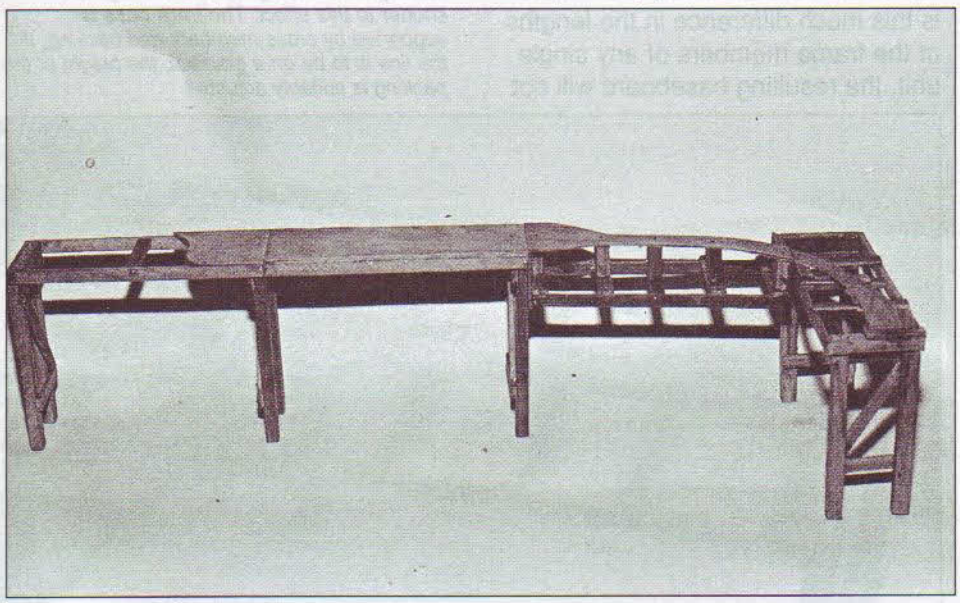
A close-up view of a dropped area, showing how the timber framing has been cut away to provide space for a small beach. The little bridge was to span a stream.

offer hardboard is worse than useless, because it buckles at the slightest provocation and will not take pins or screws with ease. Chipboard is prone to sag between supports, but is otherwise satisfactory. The relatively new particle board appears to offer considerable potential but has not been around long enough for full evaluation. Plywood is good but noisy, insulation board useful, but again tends to sag. My own preference is a composite, with 9 mm hard insulation board on top of 4 or 6 mm ply. The insulation board accepts fine pins with ease, making tracklaying simplicity itself, while the ply underlay not only provides continuous support, but also holds small screws securely, making the installation of sub-baseboard point motors and wiring accessories, such as tag strips and multi-pin sockets, a straightforward matter.

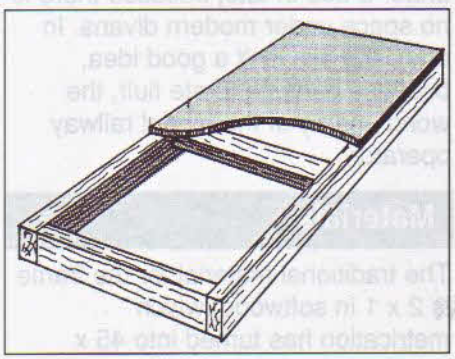
A further advantage is that the ply can be screwed to the framing. This strengthens the unit considerably, making further reinforcement of the corner joints unnecessary. However, on scenic sections it is preferable to provide only a relatively narrow trackbase, and here the corner joints need additional reinforcement. This can be gussets cut from ply offcuts or the metal brackets sold in all good DIY outlets for this specific purpose.

Joints

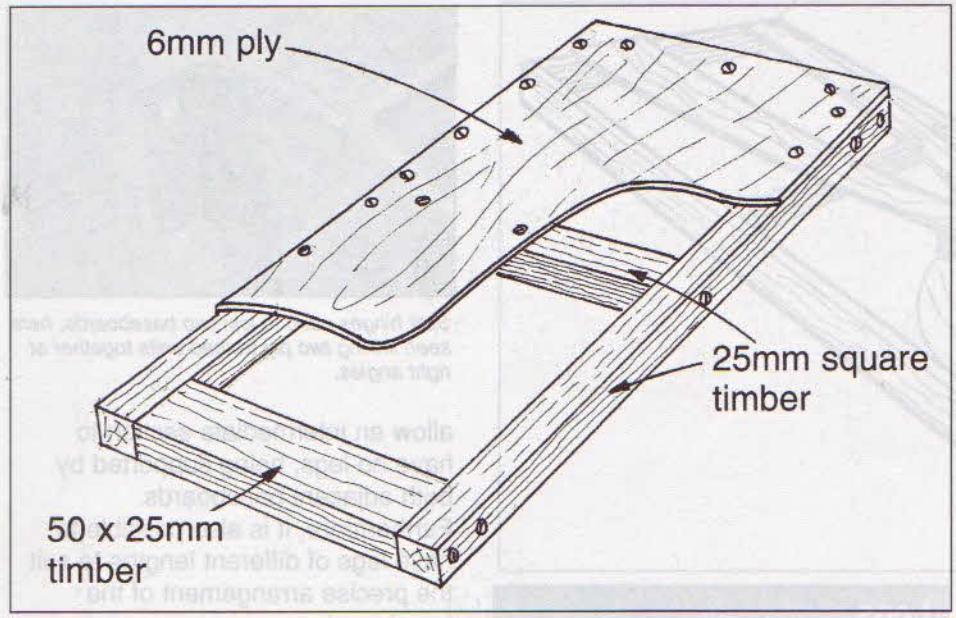
The baseboard units can be bolted together, in which case a simple jig can be employed to ensure that all holes are in uniform positions, allowing the frames to be bolted together in any desired order. This is fine for the transportable layout, where the time needed to adjust the alignment of tracks on assembly is not significant. A more precise joint



The four sections of the model baseboard assembled. The set-up provides the foundation of the visible part of a typical small terminus-fiddle yard layout. In this instance all sections are identical in size and measure 3 ft 3 in x 1 ft (1 m x 30 cm), giving an overall size of 10 ft x 3 ft 3 in, (3 m x 1 m) plus the fiddle yard. Dismantled and stored in pairs, with the legs on top, the model will occupy a space roughly 3 ft 6 in x 1 ft 3 in (1.1 m x 38 cm) and some 2 ft 6 in (76 cm) high.

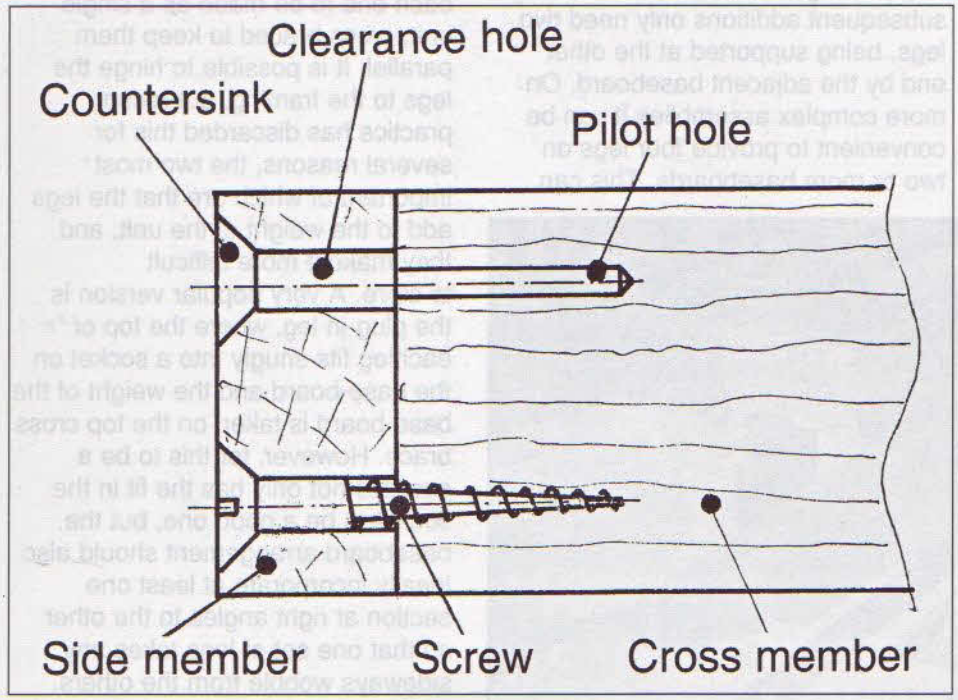


The construction of a standard baseboard frame. The framing is made from 45 x 20 mm (2 x 1 in) planed timber, the top is a piece of man-made board: plywood, chipboard or dense insulation board. Note that the longitudinal frames extend the full length of the baseboard so that the screws are not subject to undue stress since they are driven into the end grain.



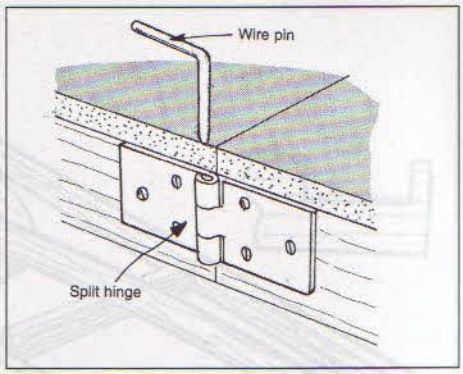
Above: *Lightweight baseboard frame. This construction is perfectly satisfactory for a unit not exceeding 3 ft (approx 1 m) in length.*

Below: *Drilling clearing and pilot holes for screws.*

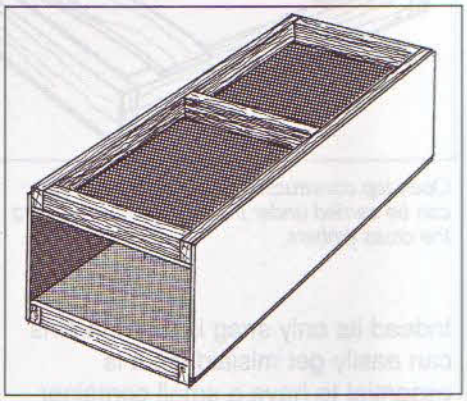


is needed for portable systems.

A popular device is the pattern maker's joint, a precision steel dowel system. It has two inherent disadvantages; it is not too easy to use, and it is very difficult to track down unless you are a member of a specialist society. Fortunately, it is not the only precision joint in existence and as two equally accurate devices can be found in any DIY store in the country, I suggest that these should be used. One such gadget is the plastic joiner sold for assembling chipboard furniture. This not only incorporates two close fitting dowels, it also has a screw to hold the two parts together.



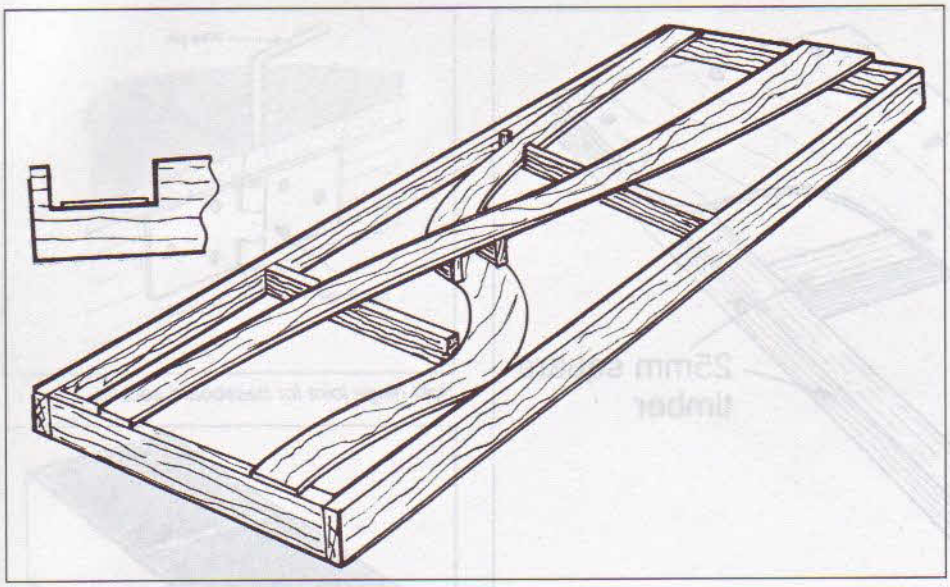
Split hinge joint for baseboard section.



Mounting two similar baseboards face to face for storage. In this instance the integral backscenes form the spacers.

The hard plastic will stand up to a good deal of use before any wear is apparent.

An even simpler device is the split hinge. Here the pin is removed from a standard hinge and replaced by a close fitting wire pin, which can be removed with comparative ease. A good quality hinge is an extremely precise device: it would not work otherwise. Heavy duty flap back steel hinges are quite satisfactory, but if you feel extreme precision is required, cast brass door hinges are the answer. They are rather long for our purpose, but while you're removing the pin you can saw them in half and drill any extra screw holes. Split hinges are very easy to install. Clamp the frames together, taking care to ensure they are properly aligned, then simply screw the hinges across the joint. As a bonus, the split hinge is very easy to dismantle and almost as easy to reassemble.

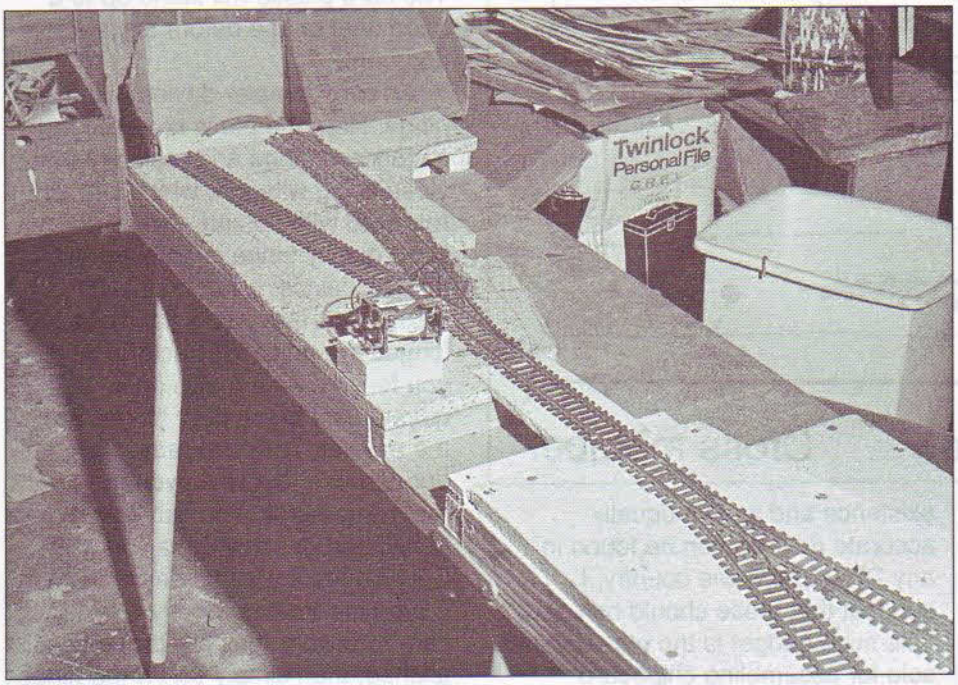


Open top construction, showing how a road can be carried under the trackbed by notching the cross timbers.

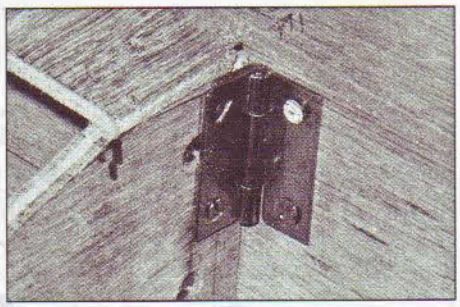
Indeed its only snag is that the pins can easily get mislaid, so it is essential to have a small container in which to keep them when the layout is dismantled. At least two spare pins should be provided.

Legs

The first baseboard in a sequence requires legs on each corner, but subsequent additions only need two legs, being supported at the other end by the adjacent baseboard. On more complex assemblies it can be convenient to provide four legs on two or more baseboards. This can allow an intermediate section to have no legs, being supported by both adjacent baseboards. Furthermore, it is also possible to have legs of different lengths to suit the precise arrangement of the baseboards.



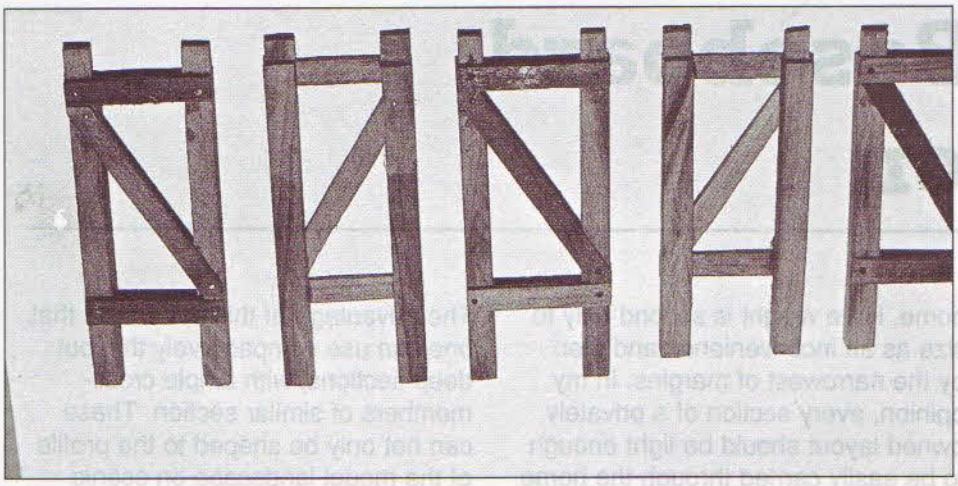
A pair of timber framed baseboards erected, with track laid on the 12 mm chipboard tops. Here the top surface has been partially cut away for scenic purposes, the depth of the side members being reduced to 25 mm for this purpose. The device alongside the point is a heavy duty surplus relay, used for point control.



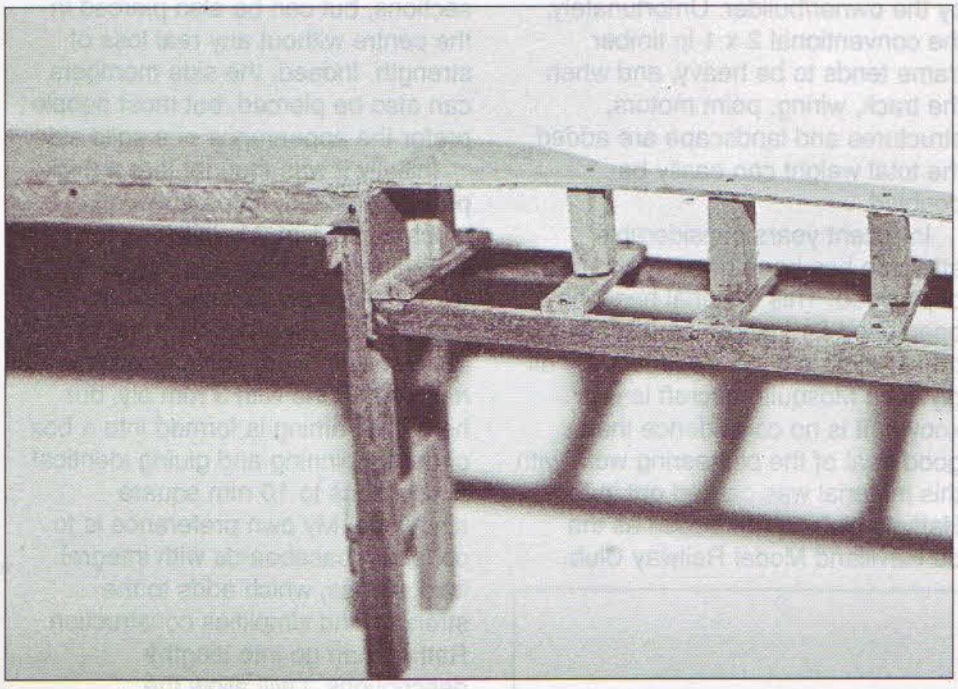
Split hinges used to join two baseboards, here seen linking two ply framed units together at right angles.

Although I speak of individual legs, it is usual for the pair of legs at each end to be made as a single unit, cross-braced to keep them parallel. It is possible to hinge the legs to the framing, but recent practice has discarded this for several reasons, the two most important of which are that the legs add to the weight of the unit, and they make it more difficult to store. A very popular version is the plug-in leg, where the top of eachleg fits snugly into a socket on the base-board and the weight of the base-board is taken on the top cross brace. However, for this to be a success not only has the fit in the socket to be a good one, but the baseboard arrangement should also ideally incorporate at least one section at right angles to the other so that one set of legs takes any sideways wobble from the others.

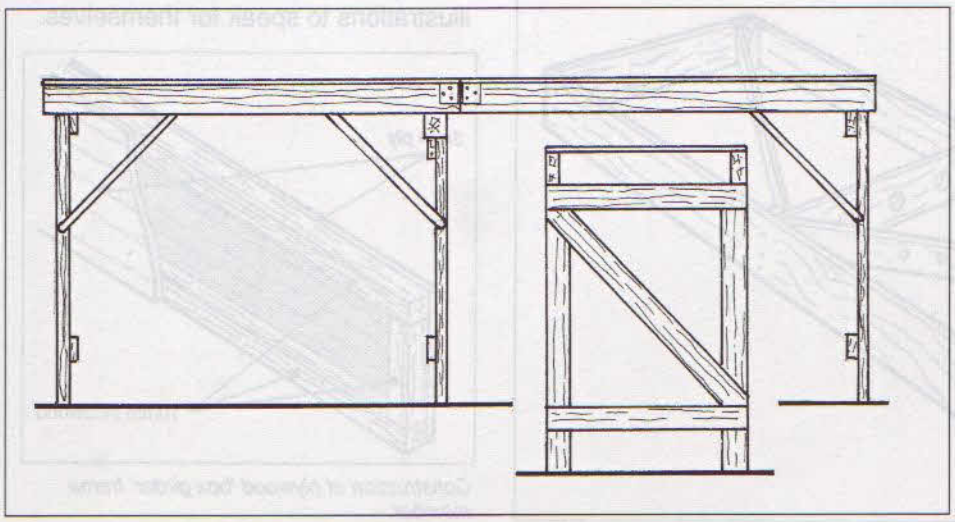
The photographs show a 1/8 scale model of an assembly of four baseboards on plug-in legs. I chose this course for several reasons, not the least of which is that it is extremely difficult to get a good photograph of a complete set of baseboards. The model was much more amenable in this respect.



Model slot-in baseboard legs. Note the simple bracing to keep each pair of legs parallel.



Close-up view of the dropped section. A plywood member is fixed to each end to allow the framing to be several inches below track level.



Legs can be hinged to the baseboards, providing they are long enough. This can be convenient, but it adds to the all-up weight of each unit and increases the depth for storage.

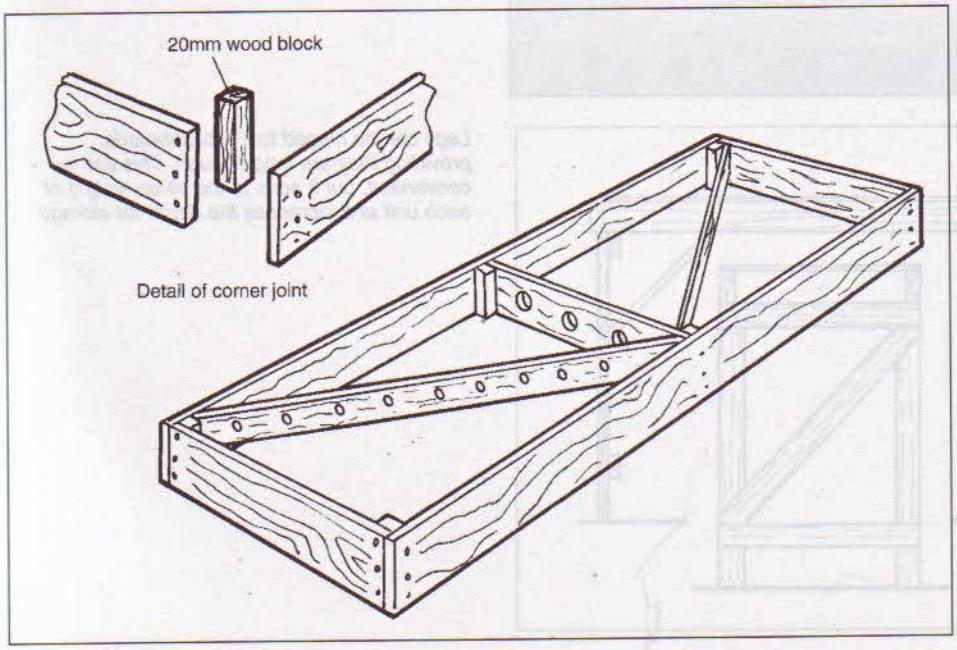
Chapter 6
Advanced Baseboard Construction

The simple timber framed baseboard sections described in the previous chapter meet most requirements in a satisfactory fashion. For those with little experience of fine carpentry and no particular desire to extend their skills in this direction they provide a perfectly adequate foundation for a layout. However, anyone who enjoys working with wood can gain a great deal of pleasure and satisfaction by adopting a more adventurous approach whilst materially reducing the all-up weight of the individual sections.

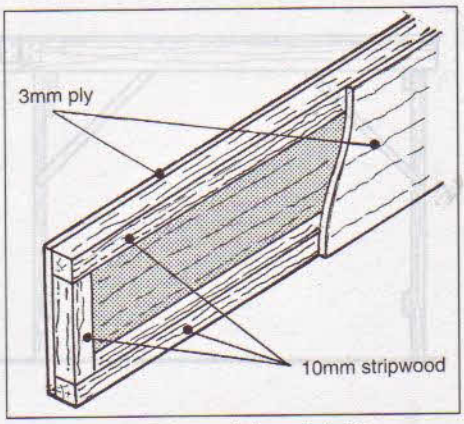
The importance of this last point should not be underestimated. It is only on permanent layouts, where in the event of a move the entire model has to be broken up, that we can ignore the tedious business of manhandling sections around the home. Here weight is second only to size as an inconvenience and then by the narrowest of margins. In my opinion, every section of a privately owned layout should be light enough to be easily carried through the home by the owner/builder. Unfortunately, the conventional 2 x 1 in timber frame tends to be heavy, and when the track, wiring, point motors, structures and landscape are added, the total weight can easily be doubled.

In recent years considerable attention has been given to the use of plywood. This material has long been used for inshore craft, whilst the strength of the now legendary all plywood Mosquito aircraft is well known. It is no coincidence that a good deal of the pioneering work with this material was carried out in the Hatfield club, which began as the de Havilland Model Railway Club. The advantage of this material is that one can use comparatively thin but deep sections, with ample cross-members of similar section. These can not only be shaped to the profile of the model landscape on scenic sections, but can be also pierced in the centre without any real loss of strength. Indeed, the side members can also be pierced, but most people prefer the appearance of a solid side.

Initially it was thought that a thick ply was needed, some advocating as much as 12 mm. My initial experiments used 9 mm ply, but for the relatively small units I suggest that 6 mm thick plywood is perfectly adequate. Indeed, some good work has been done with 3 mm ply, but here the framing is formed into a box girder by pinning and gluing identical ply sections to 10 mm square stripwood. My own preference is to construct baseboards with integral backscenes, which adds to the strength and simplifies construction. Rather than go into lengthy descriptions, I will allow the illustrations to speak for themselves.



Simple plywood baseboard frame. Note the lightening holes in the cross-members.



Construction of plywood 'box girder' frame member.

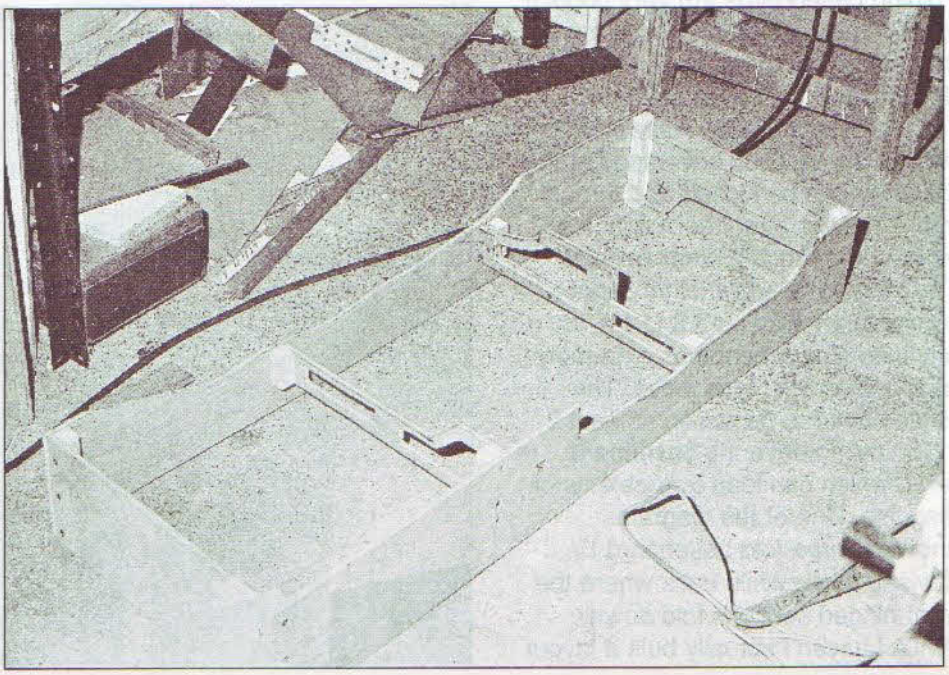
The powered jigsaw is an invaluable tool for advanced baseboard construction. Here, Leslie Bevis-Smith demonstrates how it should be used, with the workpiece held flat on a firm surface by the spare hand, well away from the line of cut. Note also that the power cable is carried clear of the cut so that it cannot get snagged as the cutting continues. In this instance only a short cut is being made, but these simple safety precautions are still being observed. Good habits need to be maintained at all times when dealing with power tools.

Cutting wood

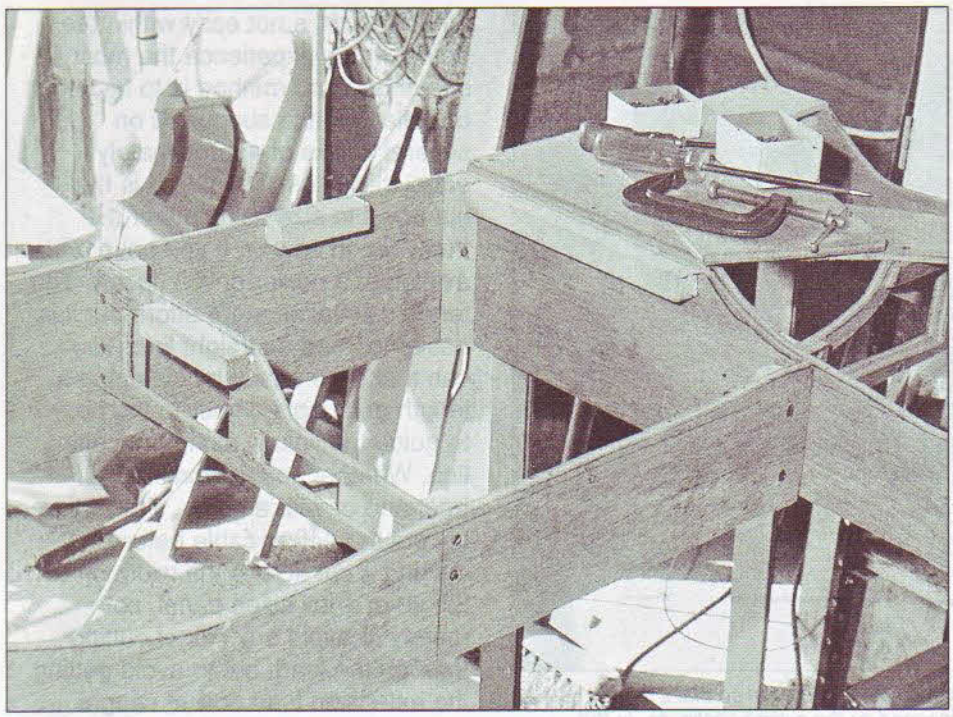
The standard plywood panel is a nominal 8 ft x 4 ft. Getting so large a sheet home from a large DIY centre or timber yard is quite a problem. It not only overlaps the roof rack, but also forms a very unpredictable aerofoil at anything above 20 mph. Of course, if someone can be at home during working hours, timber merchants will deliver the sheets for you. DIY stores supply smaller panels, down to 2 ft square, though for our purposes 4 ft x 2 ft (nominal) is the smallest practical size. This can just be loaded inside the family car.

Timber merchants can cut a panel to your requirements, providing you give proper notice and don't expect it done on a busy Saturday afternoon. Provided you can pre-plan your requirements you can simplify the problem of cutting it down to size. While the 4 ft x 2 ft sheet is fairly easy to transport, it can be wasteful to cut it down to a 3 ft 6 in length. On the other hand an 8 x 4 ft sheet can be economically cut down to provide the main framing for four 3 ft 6 in x 2 ft units, with integral backscenes.

Cutting large sheets of plywood or other boards is not easy within the home. In my experience the most straightforward method is to lay it out on a flat surface supported on several blocks of approximately equal thickness. The board is then cut down to size using either the trusty tenon saw or, if you have one available, a power-driven jigsaw. The tenon saw takes more effort, but it is easier to keep a straight line. You can make life easier by clamping a length of straight timber to the board to guide the jigsaw along the cutting line. Whether you're working freehand or with a guide, it is vital to lay out the power cable before making a cut across the width or length of a full sized panel, not merely to avoid any risk of cutting through the lead, but to avoid getting the extension lead socket caught under the edge of the board part way through the cut. The standard 2 m lead on power tools is totally inadequate for serious work. I don't advise the use of a circular saw.



Plywood framing for a scenic baseboard, where the line will run on an embankment across a shallow valley. Note the shaping of the cross bracing, which has been extensively cut away for lightness.



Two scenic sections of a ply-framed baseboard fixed together. This photo shows the 20 mm square corner blocks and cleats for securing the track base.

They are vicious beasts and can easily cause a serious accident even in experienced hands.

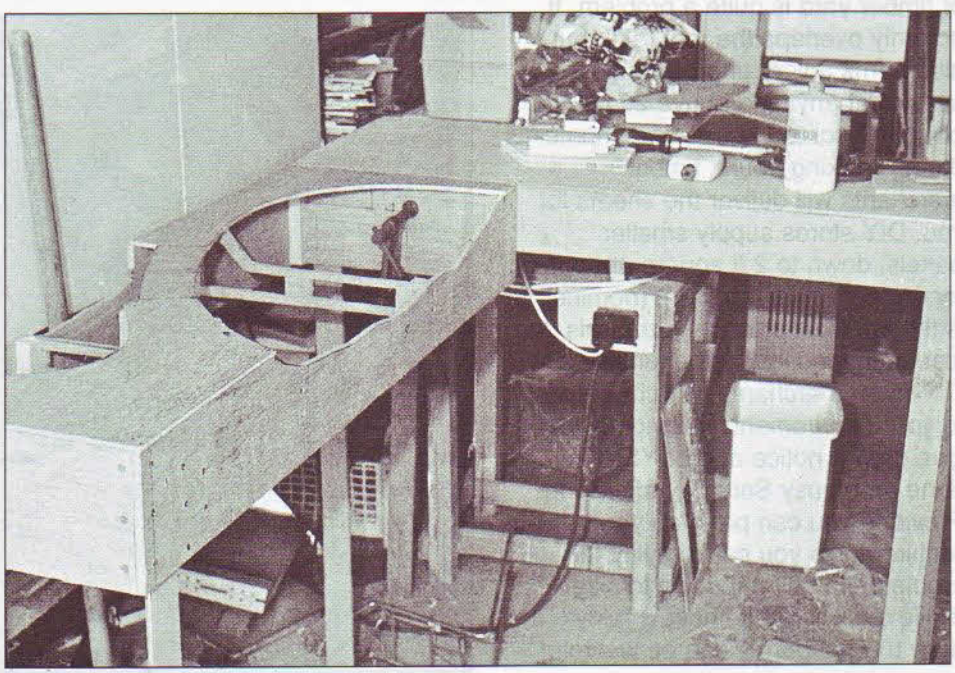
Portable layouts

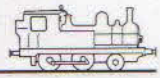
Folding baseboards are very popular for portable layouts and have an impressive pedigree; the first to be described appeared in the June 1926 edition of *Model Railway News*. The obvious advantage is that they can be closed and turned into a crate in a matter of minutes. However, there is a small penalty. The length of each section cannot conveniently exceed 3 ft (1 m), as anything longer becomes extremely awkward to open and close. The hinges need to be raised at least 2 in (50 mm) above the baseboard level, which can lead to problems of disguise. One of the diagrams shows a three-fold baseboard I devised some while back where the front hinged sections fold down. While I haven't actually built a layout on these lines, the Astolat Model Railway Club ran a competition for layouts using this basic baseboard design and half a dozen successful models were produced.

Irregularly shaped layouts

Up to now we have only considered simple rectangular baseboards. There is no reason why irregular shapes cannot be employed, either to fit into an odd corner, or just because they look more interesting. Obviously the construction is more challenging, but it is nowhere near as difficult as might be thought. A good deal of work has been done with bent plywood frames, generally of composite construction, but a more straightforward approach, which is illustrated by a series of photographs, is to locate one or two straight splines at the bottom of the frame, secured to cross timbers at each end to which the legs are fixed. Integral backscenes of 4 mm ply are fixed to this frame and plywood cross profiles fixed across the splines. The profiles were made from some scrap 9 mm ply I happened to have on hand, but 6 mm would have been perfectly adequate for this purpose. Trackbeds were cut from a single sheet of 9 mm ply and were made before the profile boards were cut to shape, while in turn the exact form

The plywood framing has now had its ply track base added and is clamped to the adjacent section to allow the split hinge joiners to be fixed in position.





Scrap	Centre	Centre	End	End	End	End
	Centre	Centre	End			
Back		Back				
Front		Front		End	End	End
Front		Front				
Back		Back				

Cutting 8 x 4 ft plywood sheet for three 3 ft 6 in x 1 ft 6 in ply bases.

This sketch is based on the folding baseboard described as long ago as June 1926. Two identical units were joined in the centre, the hinges being lifted some 3 in above the base level, on a line with a low backscene. A lift-off girder bridge hid the join.

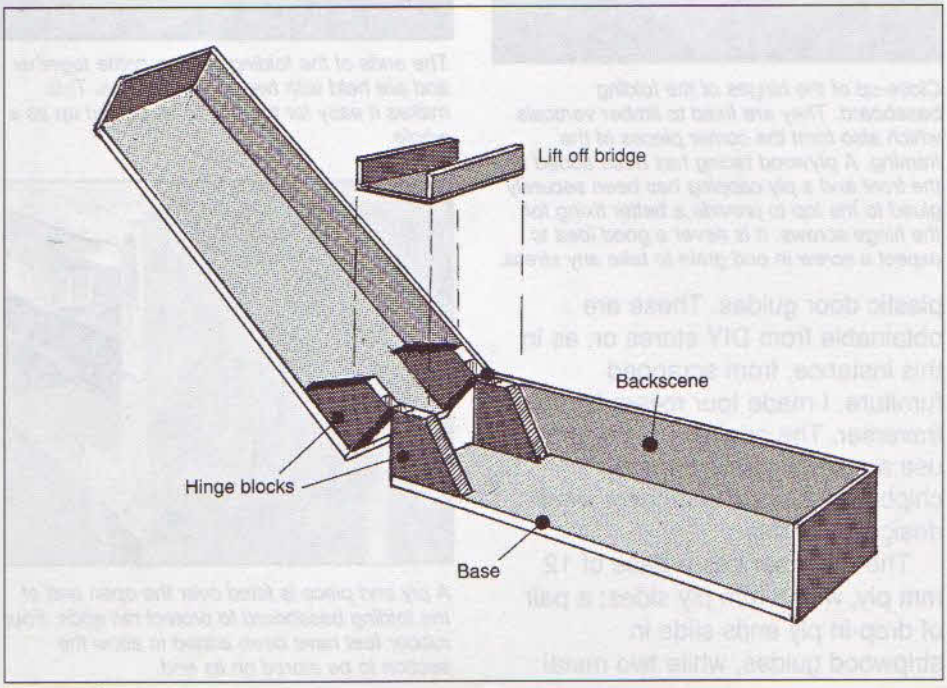
of the boards was set by the two points used for the project.

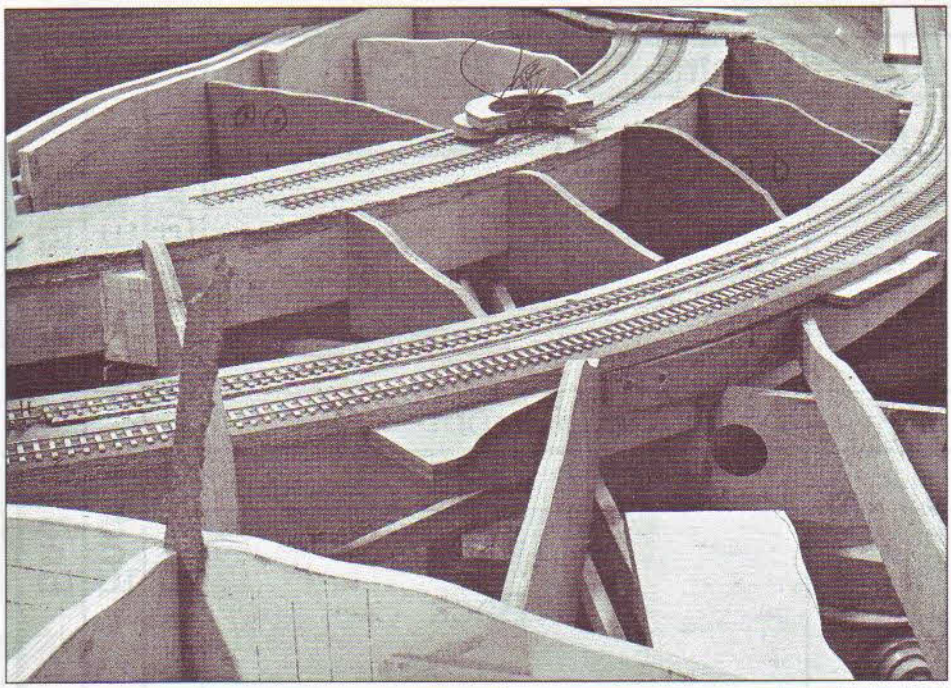
Backscenes

The integral backscenes are made from 4 mm ply. Sub-bases for the scenic developments were ply offcuts of varying thicknesses, the road foundations are thin ply, whilst the backings for retaining walls and the front curved fascia were cut from 3 mm ply. The latter was the last part to go into place.

Joints to the adjacent baseboard sections are made with flat-pack furniture joiners, as it proved convenient to have the threaded ends on this section. They have a secondary use in providing a fixing for the end protectors which screw over the openings to prevent accidental damage to the track ends. A pair of drawer handles are screwed to these panels to provide a convenient way of lifting the complete unit.

This particular exercise also shows the use of screw-on legs. These are extremely good supports for small portable layouts, particularly as the steel leg plates can double as frame joints. There is one snag, though, namely that they appear to have disappeared from the shelves of some DIY superstores.



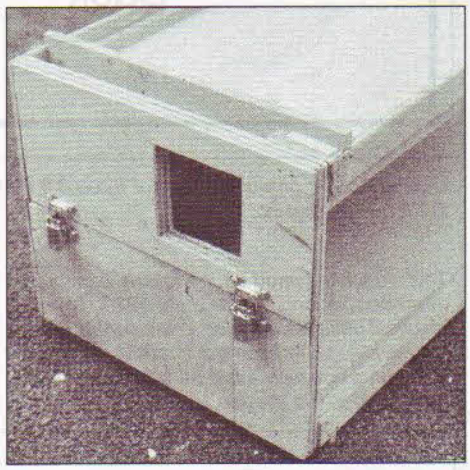


Complex plywood framing on the Model Railway Club's New Annington *OO gauge layout. Here the landscape profiles have been set in around the track bases.*

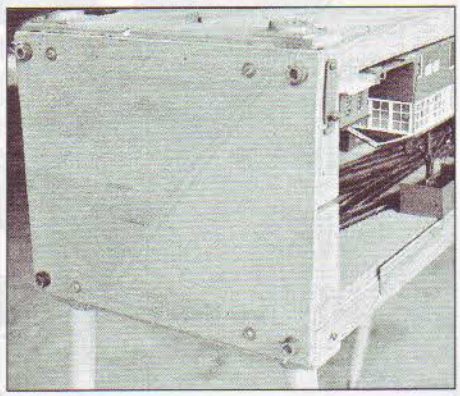
The folding baseboard unit for Brill terminus in the closed position. The backscenes form an integral part of the ply framing.

Close-up of the hinges of the folding baseboard. They are fixed to timber verticals which also form the corner pieces of the framing. A plywood facing has been added to the front and a ply capping has been securely glued to the top to provide a better fixing for the hinge screws. It is never a good idea to expect a screw in end grain to take any stress.

One end of the hinged baseboard showing the exit hole for the main line track. A piece of 9 mm thick ply is let into the insulation board base to provide a firm fixing for the track at this crucial position.



The ends of the folding section come together and are held with two toggle catches. This makes it easy for the unit to be picked up as a whole.



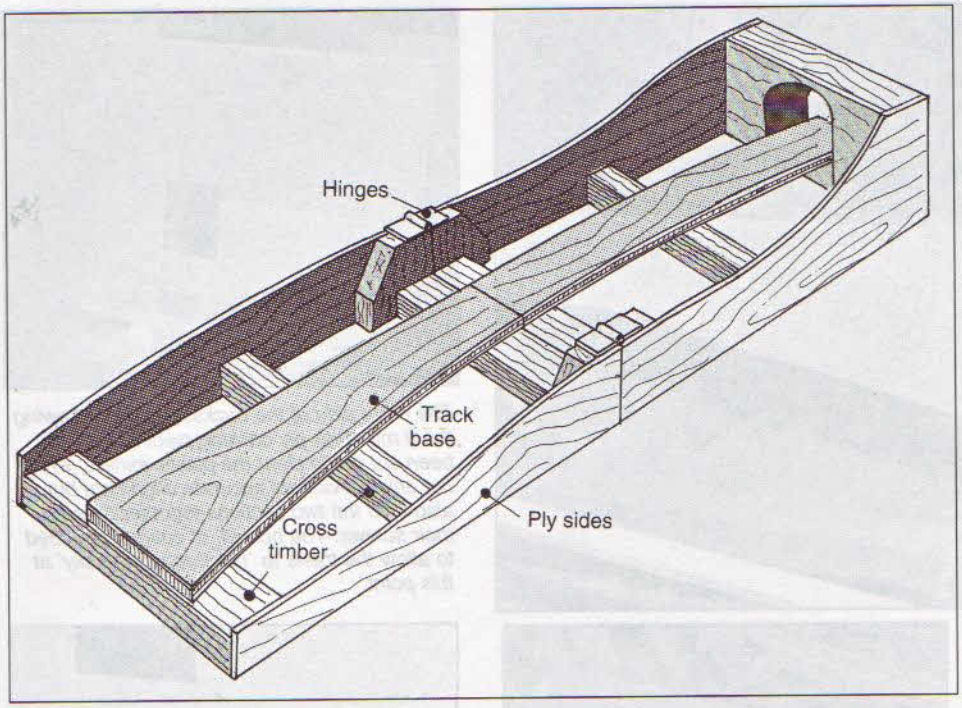
A ply end piece is fitted over the open end of the folding baseboard to protect rail ends. Four rubber feet have been added to allow the section to be stored on its end.

Folding baseboards

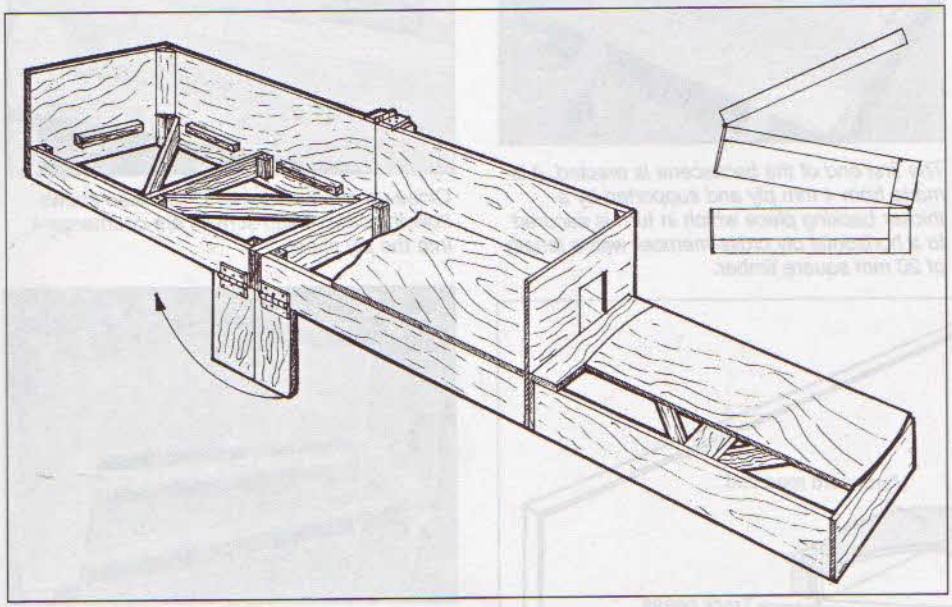
Further illustrations show the basic framing for a fairly elaborate traverser five-track fiddle yard. The framing is hinged in the centre to reduce the overall length, not merely for storage, but also so that it will, if required, fit into the back of a small car, or on to a roof rack. While it is not essential to ensure your layout fits into the family car, it does mean that it will be much more convenient for exhibition poses.

The traverser moves sideways on plastic door guides. These are obtainable from DIY stores or, as in this instance, from scrapped furniture. I made four rollers for the traverser. The original plan was to use a strip of plastic coated chipboard, since the runners were designed for this.

The traverser has a base of 12 mm ply, with 6 mm ply sides; a pair of drop-in ply ends slide in stripwood guides, while two metal

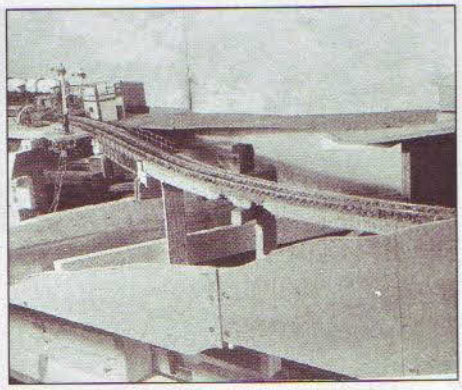


Framework for a folding section of main line. Here the curving sides slope up gently to the tunnel (or overbridge), allowing the hinges to be flush with the landscape. The four ply sides need to be cut so that when closed they do not touch. The open spaces will be covered by the landscaping.

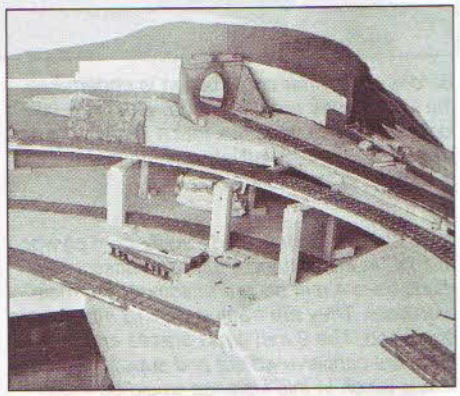


An elaborate design for a three-fold layout, built entirely from plywood. To avoid having the front hinge impede the view, its supports are arranged to fold down when the layout is erected. The section on the extreme right carries a train turntable, while the inset diagram shows how the layout folds into a single unit. The suggested size for each section is 1 x 0.5 m (3 ft 3 in x 1 ft 8 in). This will just accommodate a small OO branch terminus, but gives very considerable scope in N gauge.

drawer handles are screwed to cross-timbers. These elaborations enable the traverser to function as a stock box. The addition of a foam plastic topping sheet and screw-on lids will increase the security over the original arrangement used as long ago as 1950 by Peter Denny on the portable *Buckingham*. This is not merely a case of a double function. It also simplifies the breakdown and assembly, as very little stock needs to be individually packed.

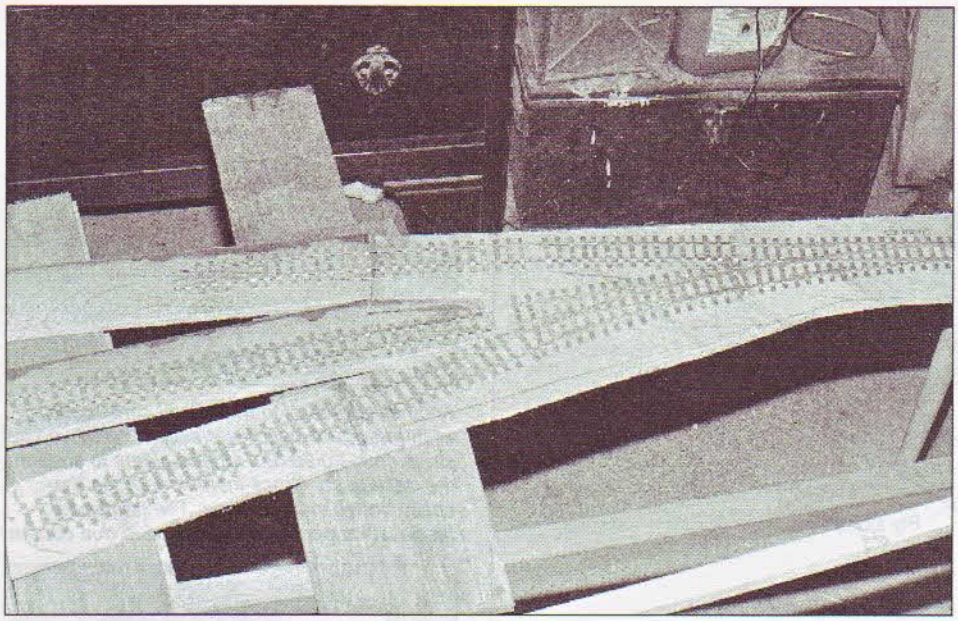


Another approach to multi-level construction, where the track bases are supported by vertical struts carrying 20 mm square cleats to support the track base. Cross-members bridge the space between the frames. The hardboard fascia will support the landscape in due course.



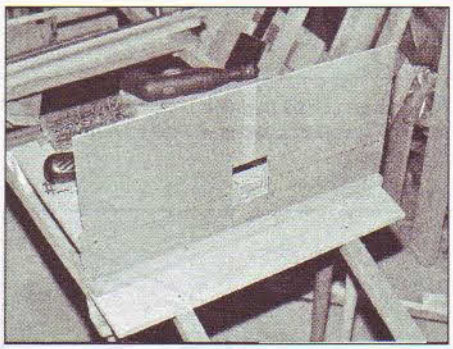
Multi-level construction arranged by supporting the high-level section on struts. Note how wooden portal frames are used where the high-level track is almost directly above the low level.

While the sector plate appears a simpler proposition, tracklaying is a more complex task, because the unit cannot be so readily taken off the framing. In addition, the fact that all ends of a traverser are straight and are set out with a standard square simplifies construction, while the plastic slides solve the major difficulty. The fact that there is one redundant slide is of no consequence. You put the fixing screws through this part, neatly out of the way.

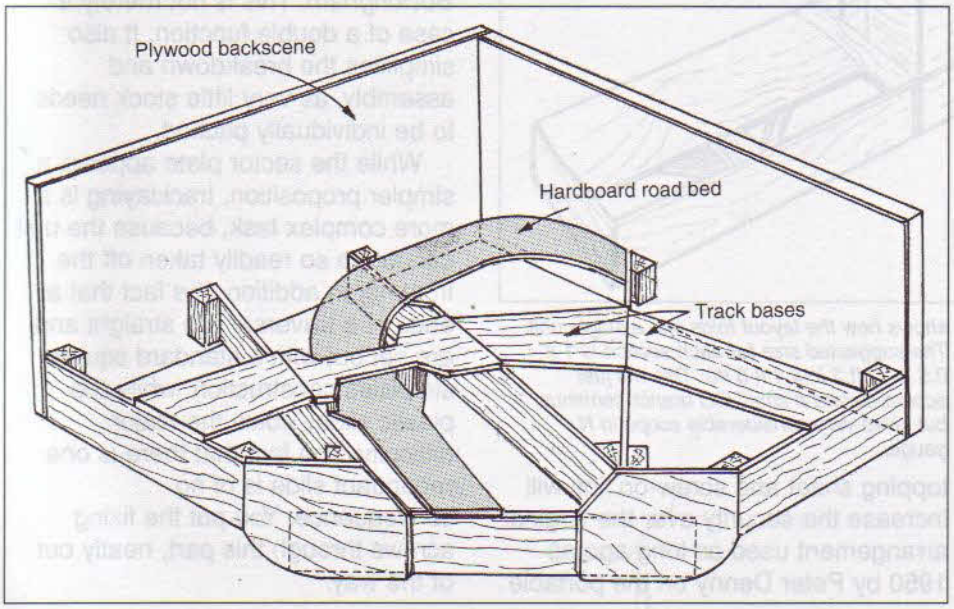


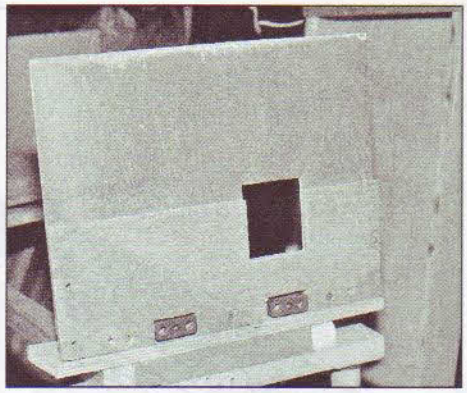
Before any further construction is undertaken, the track bases are offered up, with track laid loosely in place, to check that it is all going as planned. It is still relatively easy to make modifications at this stage.

A corner unit, constructed largely from plywood offcuts. In this instance, the two backscenes made from 4 mm ply are effectively the main members. They are framed with 13 mm square stripwood. The 9 mm cross braces and end units are cantilevered out and support the front fascia which in this instance would be made from 6 mm ply rather than the more usual 3 mm. The wood joint blocks, made from 25 mm square timber, will need to be carefully shaped to suit the intricate angles of the structure. It would be a good idea to mark out the framing on a large sheet of paper.

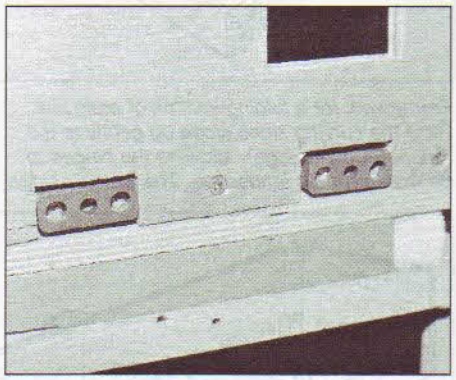


The first end of the backscene is erected. It is made from 4 mm ply and supported by a thicker backing piece which in turn is secured to a horizontal ply cross-member with a length of 20 mm square timber.

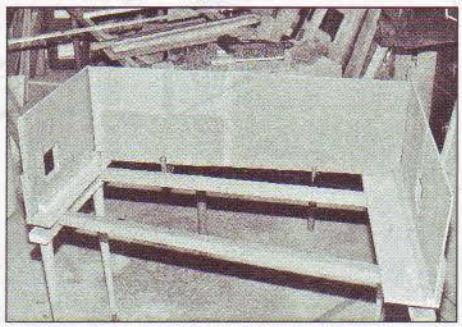




The other side of the backscene end, showing the 9 mm thick ply backing piece. This has been cut out to clear the plastic joiners, which not only provide an accurate alignment but also hold the two sections together through their screws. The hole is, of course, provided to allow the trains to `run through the sky' at this point.

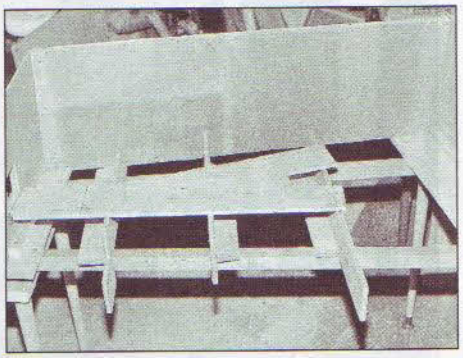


Close-up of plastic joiners. This also shows how the cross-head screws are countersunk into the ply sheet.

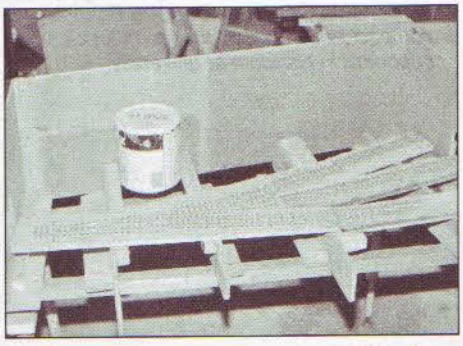


Once the two end backscenes are secured, the rear section can be fixed in place. Unlike the end pieces, this section of ply has a 12 mm square wood edging; it can hardly be called a frame since it was put in place after the ply was cut to size.

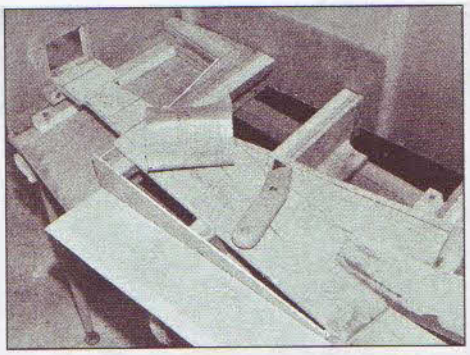
The framing is pinned to the ply backscene, small holes having been drilled in the ply beforehand. Note how the vertical frame has been screwed to the end backscene beforehand. It is virtually impossible to drive a pin into an unsupported piece of wood, so a 'dolly' is brought into play. This is just a solid mass of steel, in this instance a 2 lb ball peen hammer, held firmly against the other side.



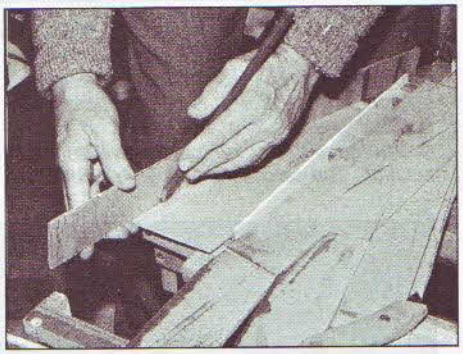
The integral backscenes are now in place and the cross-members offered up. These have their base supports fitted, but the top cleats for the track bases have not yet been located.



The cross-members are now secured in place and the track bases are in position. At this stage there is no front to the unit. The paint tin is a mock-up for the proposed gasholder, which not only shows that there is ample room for this, but also gives a very rough idea of the ultimate appearance. Once more the track is laid down loosely to check all is well.

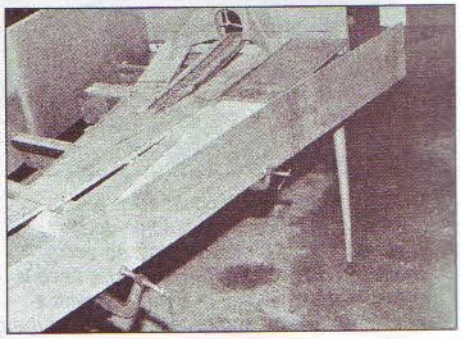


Construction is progressing apace. One of the track bases has been notched for the girder bridge that will span the low-level road, though the 9 mm ply does all the work. The low-level road base is in position, ply backing for the retaining walls has been fitted, and the slope up to the coalyard has been begun. At present it is just a piece of 3 mm ply laid in position. The knife has been used to trim the various bits of thin ply to fit, while the sandpaper block is there for smoothing down rough edges. It's very easy to get splinters into your fingers if this isn't done.

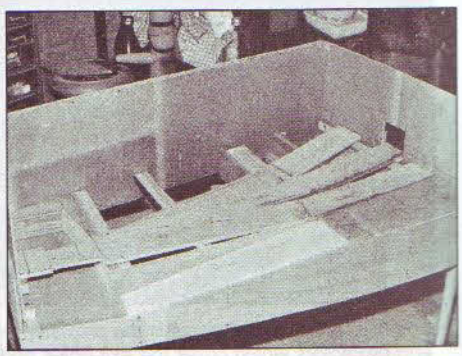


The sloping road is to have a curved edge, This is marked out by using a scrap length of ply, which is temporarily fixed at one end with a panel pin and then gently bent to the desired curve. I'm marking out, left-handed as usual, with a carpenter's pencil. This is the best tool for marking out timber, because the lead is thick enough to be reasonably robust and the shape allows a neat edge to be made with a chisel or heavy knife.

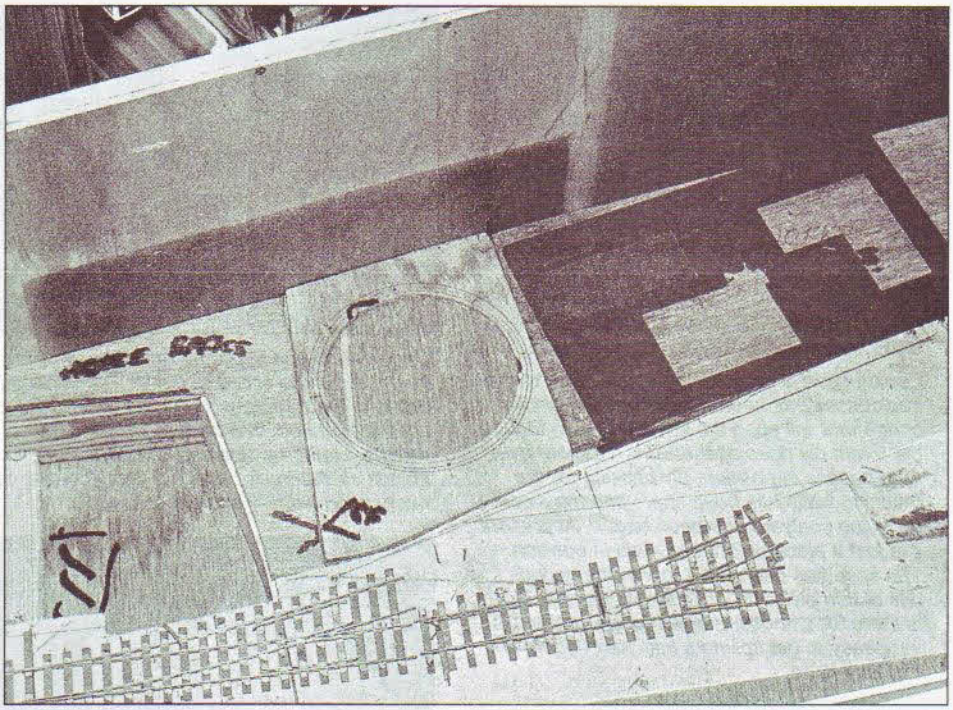
Once the road is in place, the ply base of the coalyard can be screwed down. The cordless drill is in the foreground and has been used to put the pilot hole in a cleat. A box of small screws, sorted by size into compartments, stands on the track base. I am just locating the ratchet screwdriver into the screw slot.



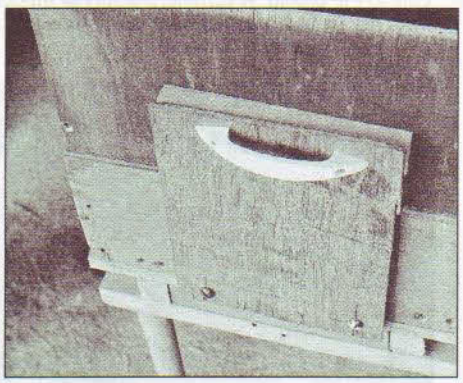
The fascia board – more 3 mm ply – is partly secured with clamps prior to marking out for cutting the profile. A commercial tunnel mouth from the Pola range has been put in position to see how it looks.



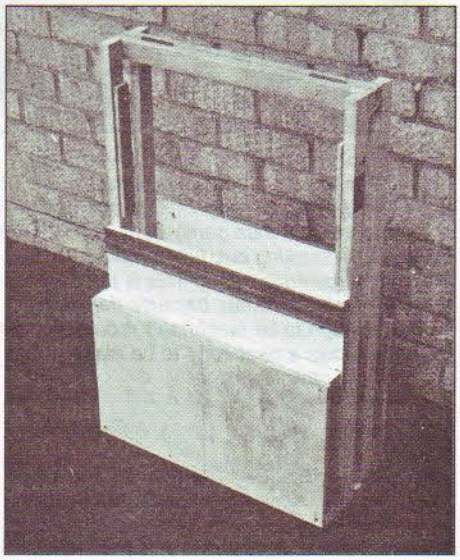
The track bases are laid and screwed down, the roads are in place, and the fascia board screwed to the cross-members. The substructure of this section is almost complete but there are still holes along the back.



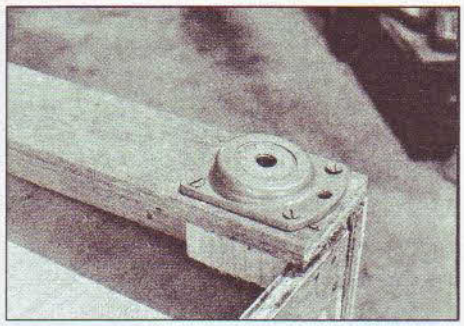
The holes at the back could have been covered with landscape, but this doesn't generate 'traffic' for the railway, so we're erecting a gasworks. The gasholder base is made from two pieces of 6 mm ply, with a circular hole in the top slice to represent the pit for the gas tanks. In reality they would be anything up to 20 ft deep, but it will look no different if the scale depth is only 1 ft 6 in! The base moulding of a Vau-pe plastic industrial building has been placed over the other section. Another filler has been optimistically labelled 'house backs', but there's no guarantee at this stage that this will be the final solution. The carcass is now all but complete.



The final construction detail is the provision of end protectors which cover the exit holes and so protect the vulnerable ends of the track. These are made from plywood offcuts with timber spacers, and are secured to the plastic joiners with the joiner's own screws: a good way of ensuring that these are not mislaid. Plastic drawer handles are provided to give an easy way of lifting the complete unit.

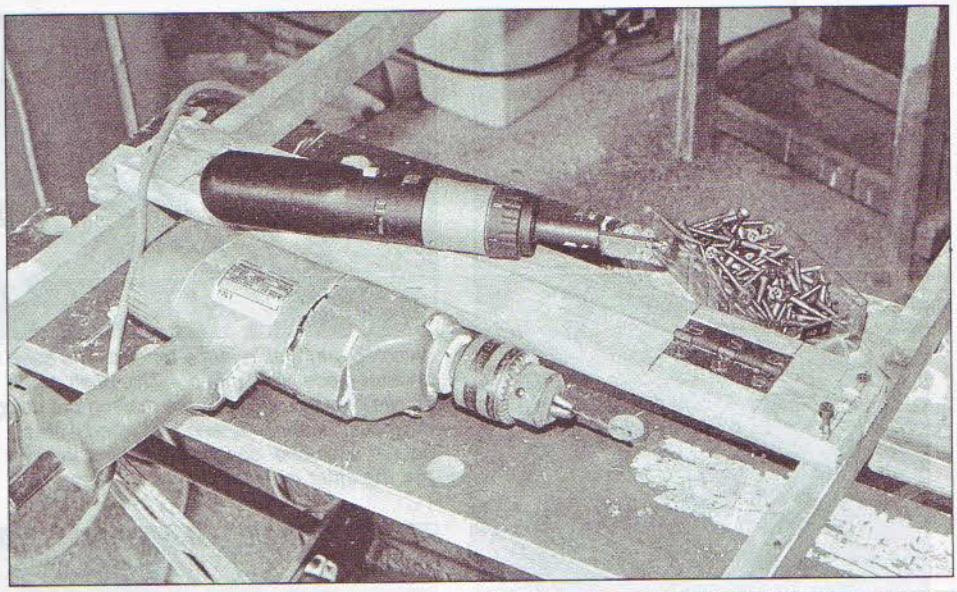


The framing for the fiddle yard folds in the centre for ease of storage and transit. It was made as a single unit and cut into two after the initial timbers had been secured. The main members are two lengths of identical section timber.

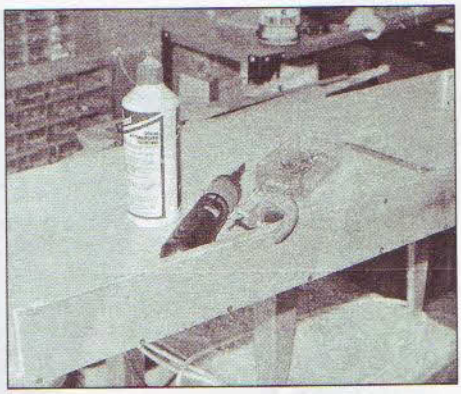


Foot plates are fitted underneath the framing to take screw-in legs.

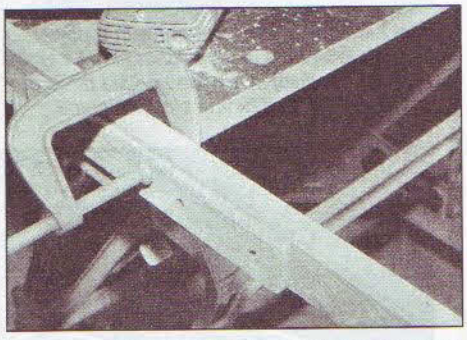
Screw-in legs are very easily fitted to a portable baseboard unit. This 1976 photo shows Nick Freezer screwing the legs on to his portable OO gauge Dugdale Road, *a compact terminus designed to fit into a small cupboard in his room at university.*



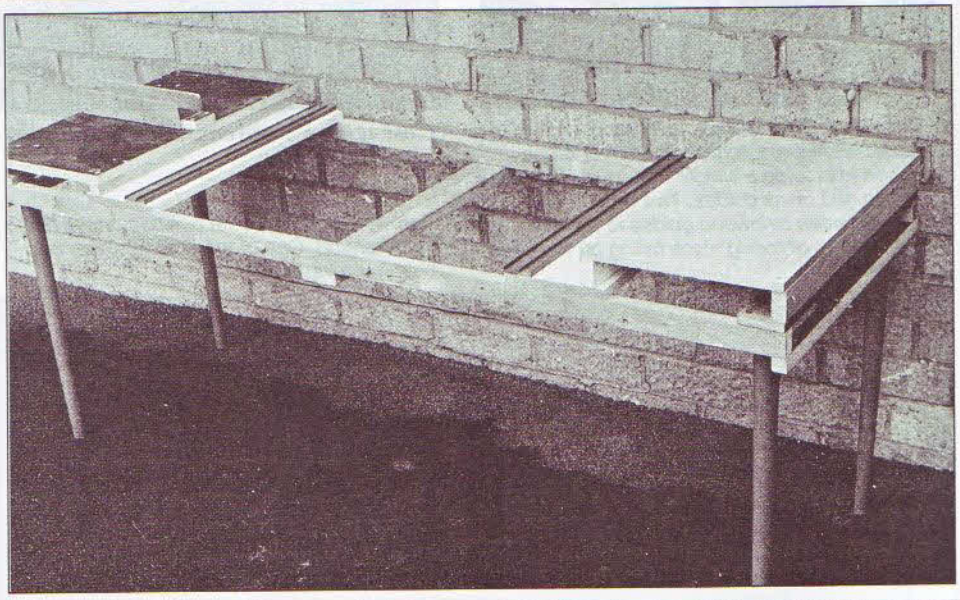
The centre cross timbers were joined by a pair of hinges before they were screwed to the framing. The main timbers were then carefully cut through with a tenon saw. The power drill is being used to make the pilot holes for the screws, while the cordless screwdriver is on hand to drive the screws home. Cross-head screws are being used. They are much easier to drive home with a powered tool as the bit stays in the right place.



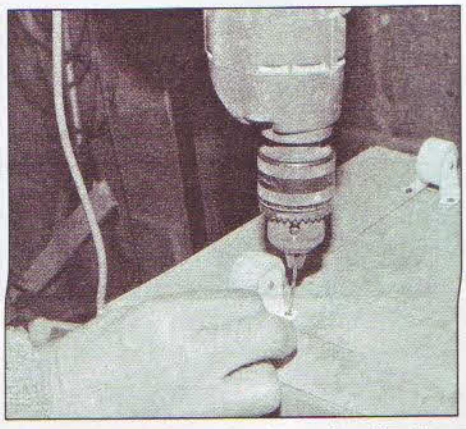
The traverser itself is simply ply box, the base is 12 mm thick, the sides 6 mm. This photograph shows how the top stiffening member made from 10 mm square stripwood is clamped and screwed to the top edge. A good measure of PVA glue ensures the joint will stay put.



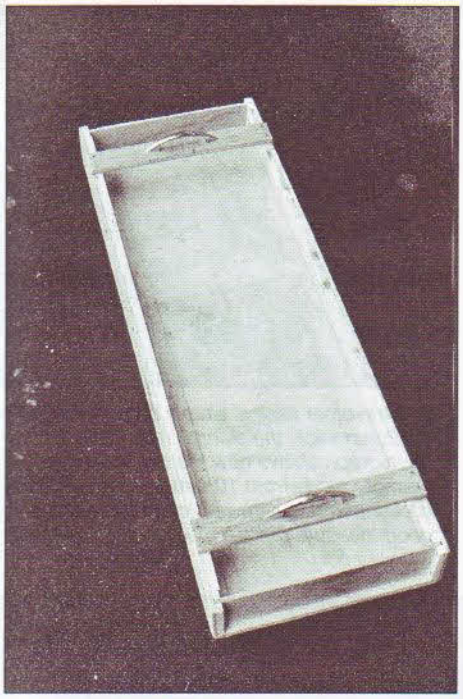
In order to keep the framing level, two plywood fishplates are provided. This photograph shows one clamped in place prior to drilling the holes.



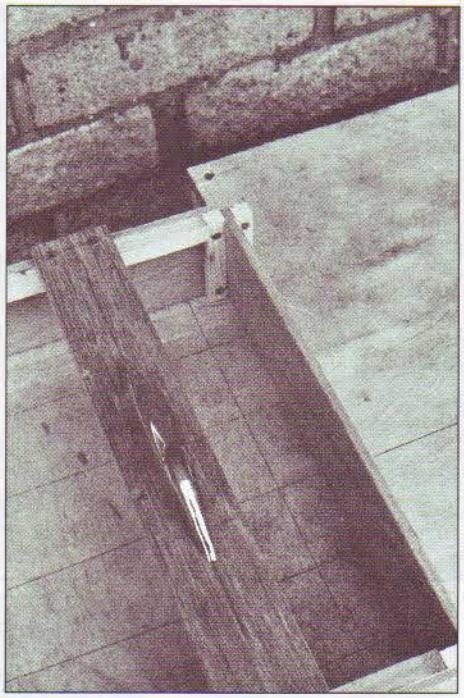
The complete fiddle yard frame erected. A substantial framework supports the bases for the end tracks. The two plastic slides for the traverser are carried on 12 mm chipboard since they are most definitely not self supporting. Any flat material will do – the chipboard just happened to be around at the time.



The rollers are screwed to the underside of the traverser. The first brackets are aligned to a line drawn at right angles across the base, and the second pair are then fitted to match.

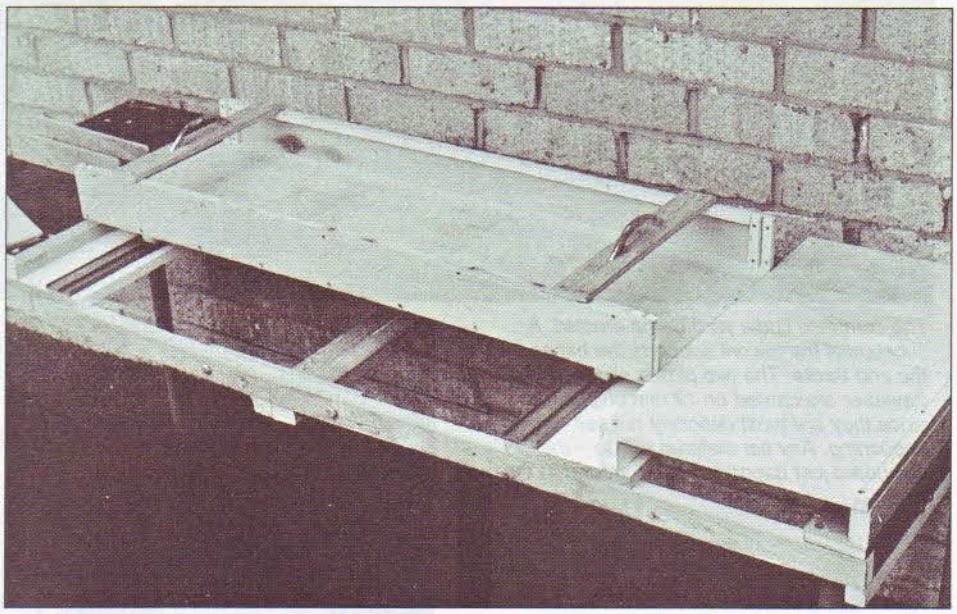


The completed traverser, less tracks. A pair of metal handles are screwed to timber cross-braces to provide a simple means of lifting the unit on and off its guides. Two drop-in ends slide between stripwood guides to prevent locomotives or rolling stock falling off the ends in transit.

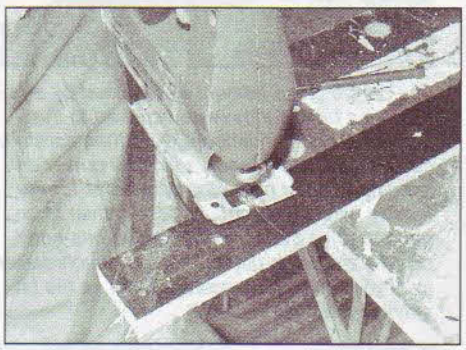


Close-up view of the drop-in slides and lifting handle.

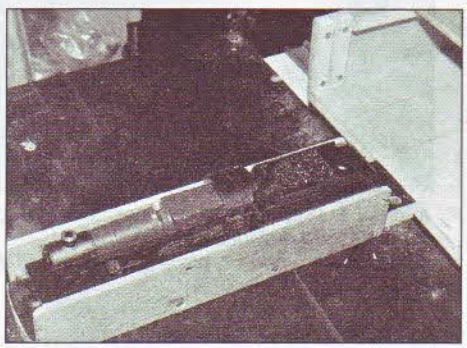
***Below:** The traverser in position on the fiddle yard framing. One of the drop-in slides has been removed.*



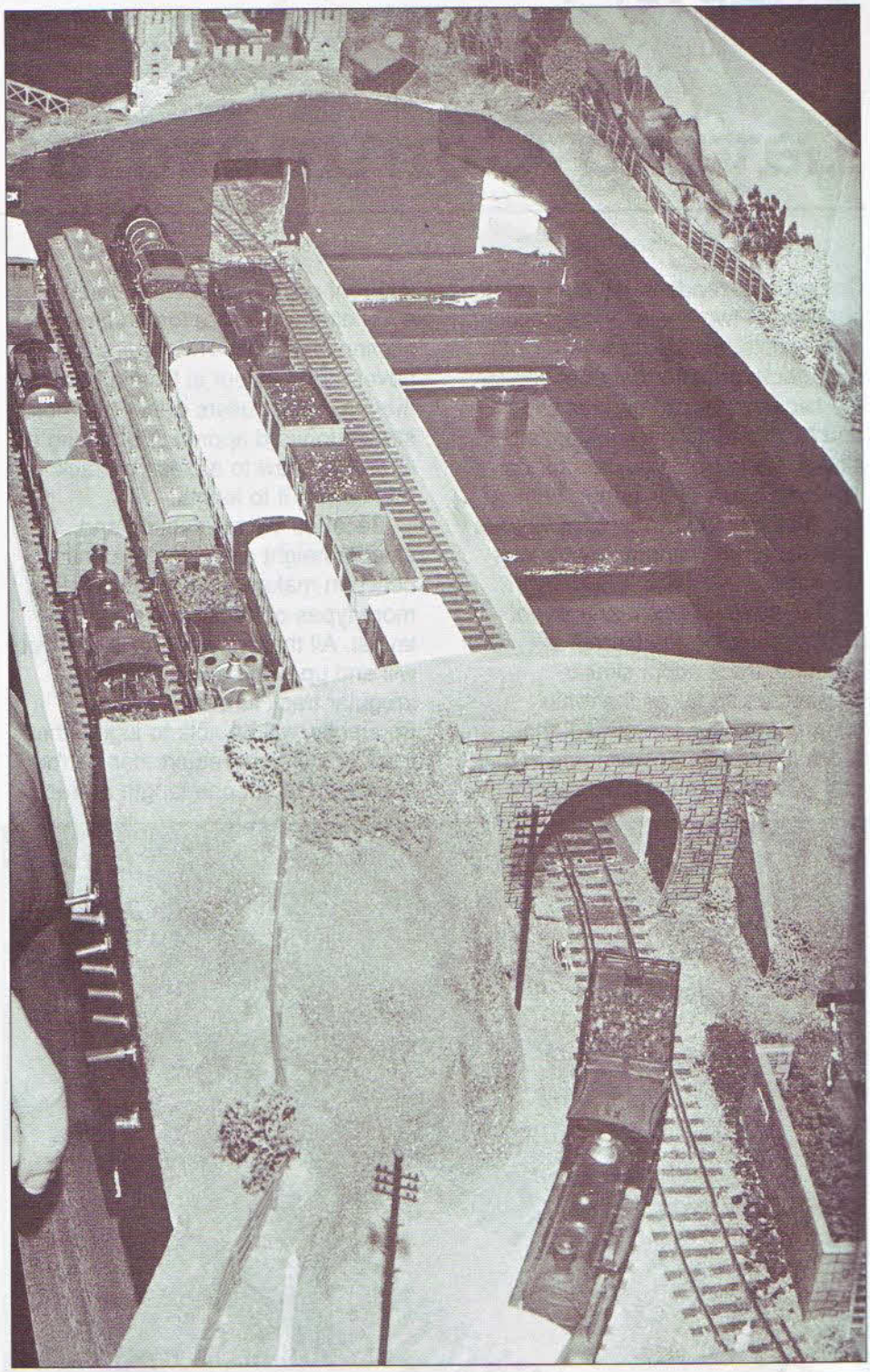
I wanted a turntable at the far end. The base is another piece of 12 mm ply. This photograph shows how the end radii are marked out using a simple trammel – a length of wood with a hole at each end, one for the temporary pivot pin, the other for a scriber.



The turntable base is cut out with a power jigsaw whilst held in the Workmate. A central hole for the pivot screw was drilled through using the hole left by the pin as a guide.

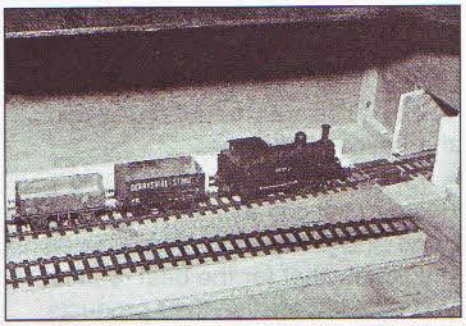


The completed turntable in place. Sides are from plywood, rounded and smoothed since the motive power is the simple and utterly reliable hand. The locomotive was put in as a final check to ensure that I'd got all my measurements right. Mistakes can happen.



The traverser fiddle yard on Allan Wright's Cheviotdale. *This five-track table provided storage for trains on a simple, compact, continuous circuit recreating a former North Eastern country branch scene in LNER days.*

A simple no-frills, two-track fiddle yard for a small layout. The tracks are laid on to a piece of blockboard which pivots on a screw at the far end. A thin edging strip is provided on either side of the blockboard and the ends of the track are soldered to slices of gapped printed circuit board (PCB).



Chapter 7

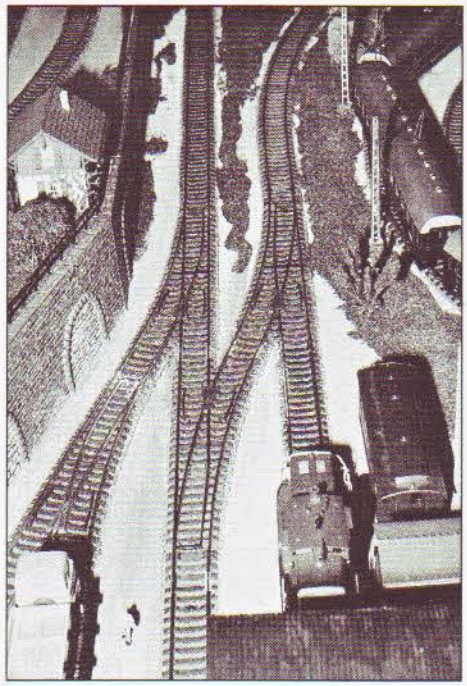
Laying Commercial Track

Commercial ready-to-lay track is supplied in two basic forms, sectional and flexible. As the major manufacturers offer both options for the two commercial gauges OO/HO and N, and all follow substantially similar standards, you can not only mix both types on a layout, but you can also mix the products of various manufacturers without any serious difficulties.

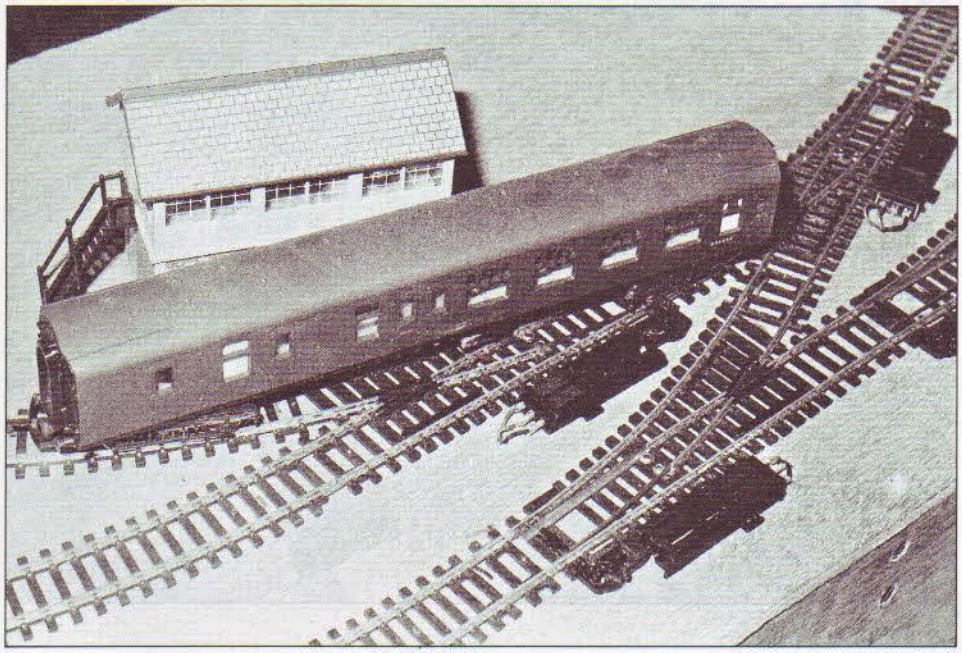
This needs a little clarification. Whilst many manufacturers of sectional track adopt similar geometries so far as the main components are concerned, there are at least two different systems in use, and in addition most offer slightly different packing pieces. A couple even offer a variable length straight section as a filler. This device has never found favour in Britain because the majority of users prefer the more straightforward approach of taking a small hacksaw to a piece of track and cutting it to length.

Because the rail section and sleeper height are virtually identical between makes, you can use two or more types of track on the same layout. All that will happen is that you will end up with some delightfully irregular track formations and, frequently, will be able to juggle the track to suit your requirements. You may need to cut one length of track to complete the circuit, but this will only happen if the layout is fairly small. There is a tiny tolerance in the joints which allows you to slew the tracks sufficiently to get round minor theoretical differences.

Of course, no manufacturer is going to tell you this, and indeed, for good and proper commercial reasons they imply that for the best results you should only use their products. One exception to this rule is Peco, who, before they introduced their own double slip directed their customers to the Fleischmann variety. For personal and patriotic reasons I both use and recommend Peco track. It is widely available throughout the world,

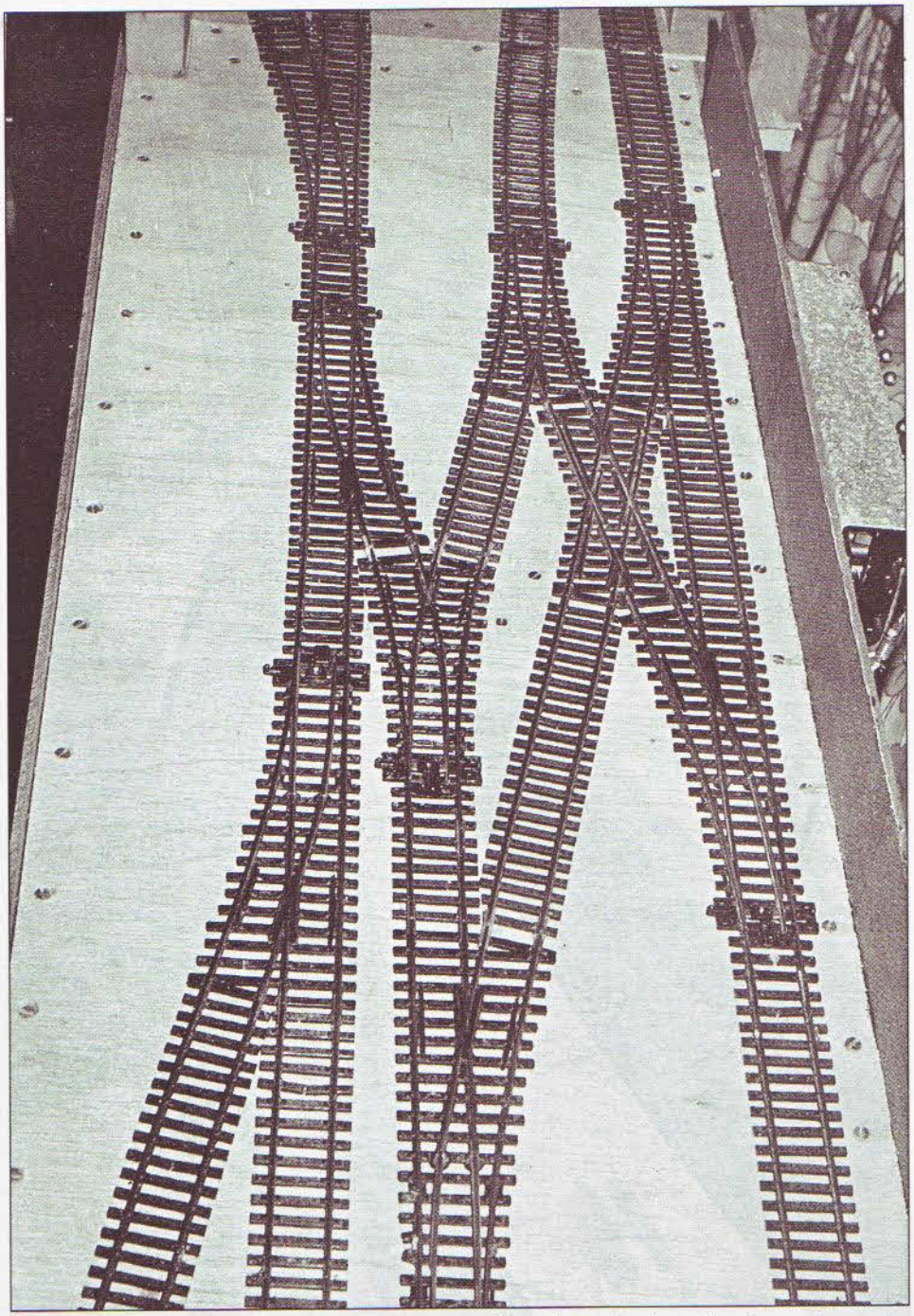


Still with sectional track, we have here the Fleischmann combined track and ballast system. There is a considerable improvement in appearance, but the wider spacing imposed by the sectional track is all too obvious.



A simple track formation laid with Hornby sectional track. This is a simple, effective, low cost approach which gives quick results and, at least with continuous circuits, saves space. The snags are obvious from this photograph; overscale track spacing and, worse still, excessive overhang on curves, as shown graphically by the Mk I coach which not only looks wrong, but also forces adjacent structures – in this instance, the signal cabin – well away from the tracks. Note the point motors mounted alongside the track. The wiring is carried beneath the baseboard through holes drilled in the plywood top surface.

it has a very extensive range of pointwork on offer (and is obtainable for most gauges), and has always been robust without sacrificing detail appearance. More to the point, I happen to know just how exacting Peco's Sydney Pritchard can be. He has the idea that a commercial ready-assembled track should be capable of withstanding unreasonable wear and tear, with the result that given no more than sensible usage, Peco track can be lifted and re-laid a good half-dozen times without damage.



Flexible track combined with larger radius turnouts allows tracks to be laid with closer track centres and all round improvement in overall appearance. This compact station throat has been assembled from standard Peco turnouts. The use of Y points and a short diamond crossing has not only saved a good deal of space – the section is only 30 in (76 cm) long – but has also created the impression of a complex station approach, in keeping with the ambience of the model, a small inner city terminus.

Points and turnouts

Although we are considering track, our first consideration must be the turnouts, crossings and more complicated formations such as single and double slips and three-way points. These are fixed size units, and you tamper with them at your own risk. Points are available in differing nominal radii, and Peco turnouts are offered as large, medium and small, plus the even smaller radius Setrack pattern. An important feature of Peco track is that the crossing angle of all points is uniform. This means that you can make up a crossover with one large and one small point just for a laugh. There is no logical reason for doing this and the formation does look a little odd, but what this does mean is that you can keep to the larger points on the main line and other running roads, where speeds will be high, and use smaller points in goods yards where space can be at a premium.

On a properly designed model railway, most of the points will be concentrated in a few areas of the layout. There may be just two, forming a crossover, but somewhere on the line there will be a gaggle of anything from four to 12 points in close formation forming the station throat. These arrangements should first be assembled on a trial basis and studied carefully to ensure that they are correctly aligned. This is done by squinting along the top of the track. In this way a dog leg which is virtually invisible when viewed from above jumps out alarmingly. On all but the simplest of formations two or more short filler sections will be needed. These should be cut from a

length of flexible track and linked in place using standard or insulated rail joiners as dictated by electrification considerations.

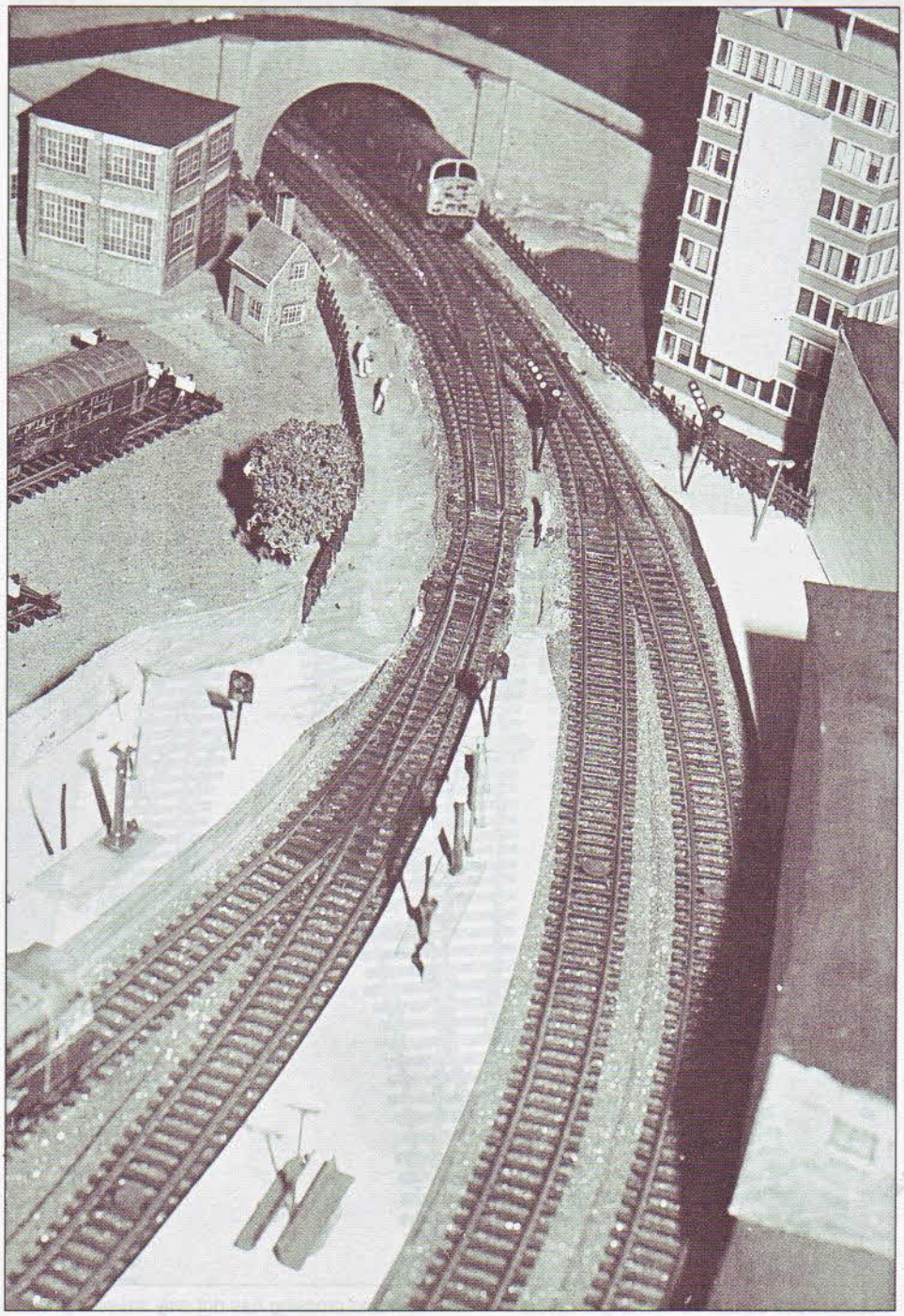
Once the formation is correctly aligned, it can be placed on to the baseboard. Whilst the alignment of the individual parts of the formation should not be altered, the entire assembly can be slewed or moved bodily sideways to get the best arrangement of the tracks. In some cases slight adjustment of the linking tracks is possible, but it is advisable initially to treat the assembly as a whole. Although typically the adjustments will be minor, they can, for example, permit longer platforms to be fitted in, or provide a better alignment of the goods sidings. This fine tuning is a routine matter on finescale models laid with custom-built track, but it is equally useful and probably more profitable where commercial track systems are involved, since one benefit is the reduction of the mechanical appearance of track formations assembled from standard units.

When you are satisfied that no further adjustments to the main point formation will produce a worthwhile return, the units should be lightly pinned down using one or at the most two pins per point. These should not be driven fully home, so that they can be pulled out without any risk of damage to the trackwork. The intervening track can now be cut to fit or, in the case of a wholly sectional layout, placed in position. Further point formations are introduced at the appropriate places. At every stage of the proceedings it is advisable to check the alignment of both track and points.

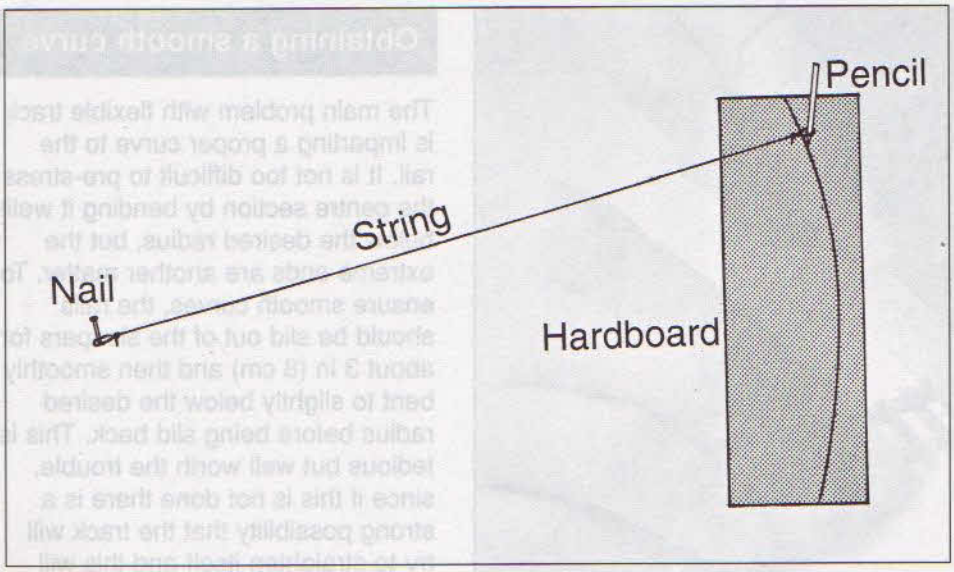
Curved track

So far we have by implication only considered the relatively straight tracks found in a station. On the main line we encounter curves, which bring in a new dimension to tracklaying.

Most newcomers think in terms of fixed radii, a natural carry-over from the sectional tracks familiar to every train set owner. With flexible track a less rigid approach is possible, and larger, more sweeping and correspondingly more realistic curves are possible. Therefore, providing



Still with standard Peco turnouts, we see here the effect of large radius curved points, used to create the impression given by the sweeping curves found at the entrance of so many prototype stations. That this arrangement also saves a good deal of space by moving the pointwork around the curved tracks, leaving more space for longer platforms, is an added bonus.



Striking a large curve with string and pencil.

that the nominal radius of a curve is at least 50 per cent above the recommended minimum for the stock in use, one does not have to be absolutely precise. So let us look at what is meant by minimum curves.

Most manufacturers of ready-to-run equipment indicate their recommended minimum radius. Usually these are very conservative figures and the stock will go round smaller corners, though it will look very silly in the process and, moreover, a train of any length is apt to fall over on the inside of the curve. What is more reassuring is that commercial ready-to-run stock will get round a short piece of tight curve, as happens when two lengths of sectional track are very badly aligned.

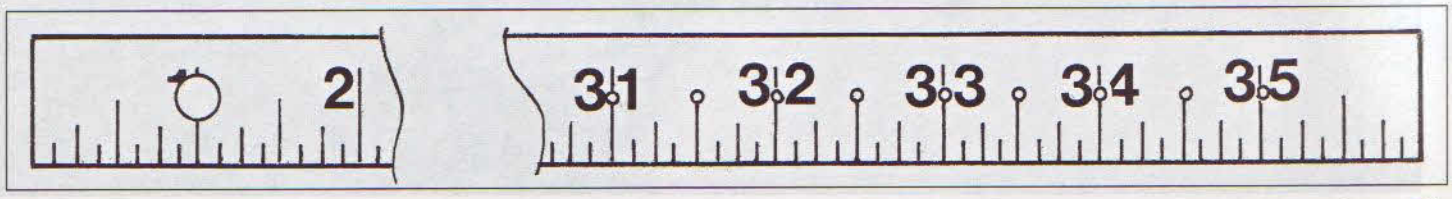
However, if you want to combine a good appearance with reliable running, then your minimum visible curves should be well in excess of the recommended minimum. In addition it helps if the tighter curves are entered through a form of transition curve. I am being very careful here: a true transition curve is a complex arrangement requiring a good deal of calculation and a lot of careful plotting. The difference on a model between this and a spline curve produced naturally by flexing one end of a length of track around a curved template and aligning the other against a straight edge some 20 mm away from the tangent of the curve is negligible, except for the effort involved.

Templates for curves

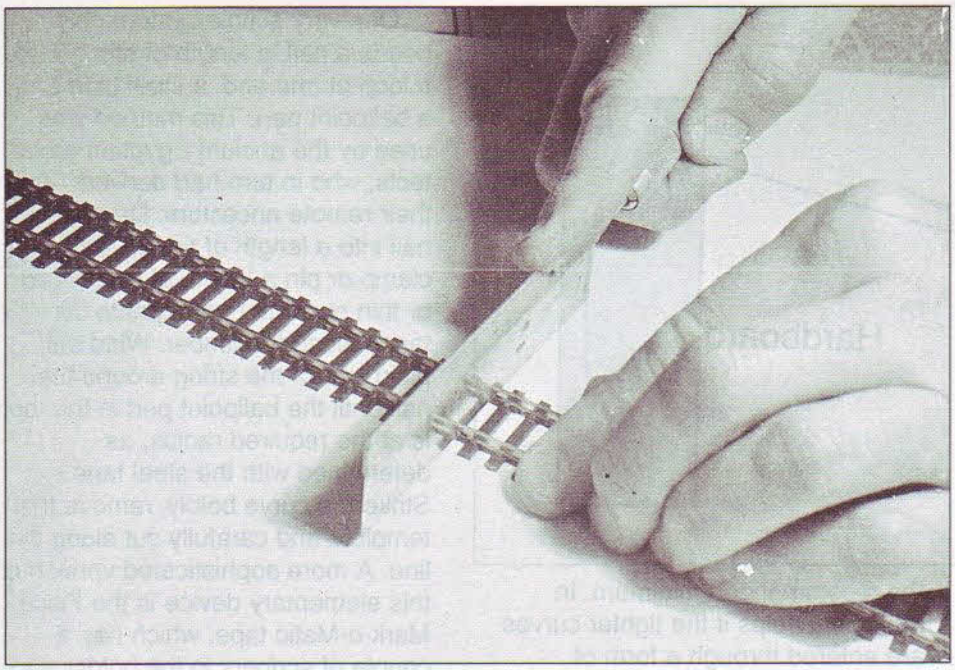
Curved templates are available commercially under the name Tracksetta. They are made from aluminium to 16.5 and 9 mm gauges, and are fairly short. They have their uses but it is a relatively simple matter to make your own templates. All you have to do is to set out a fairly accurate curve of large radius.

One very simple system only needs a nail, a length of string with a loop at one end, a steel tape and a ballpoint pen. This method was used by the ancient Egyptian architects, who in turn had derived it from their remote ancestors. Drive the nail into a length of timber, and clamp or pin a length of hardboard or thin ply at the appropriate distance along the timber. Wind the plain end of the string around the nail until the ballpoint pen in the loop is at the required radius, as determined with the steel tape. Strike the curve boldly, remove the template and carefully cut along the line. A more sophisticated version of this elementary device is the Fisco Mark-o-Matic tape, which has a couple of scribers in the holder and a hole at the other end of the tape. My version has a 5 m tape (roughly 16 ft), and is clearly long enough for all practical purposes. The only snag is that this British-made tool is not widely available; I knew of its existence a good two years before I came across one in a DIY store.

For many years I have used a simple trammel for setting out curves. It consists of a wooden yardstick which has a large hole drilled 1 in from one end. This either takes a ballpoint pen or serves to hang up the rule. At the other end a series of 3/32 in diameter holes are drilled at 1/2 in intervals. These fit a panel pin, and provide reasonably accurate curves from 20 to 34 in radius, without in any way impairing the value of the yardstick as a low class straight edge and measure. Although yardsticks are obsolete, metre long rules are readily available and will take the same treatment.



Drilling a yardstick to produce a simple trammel.

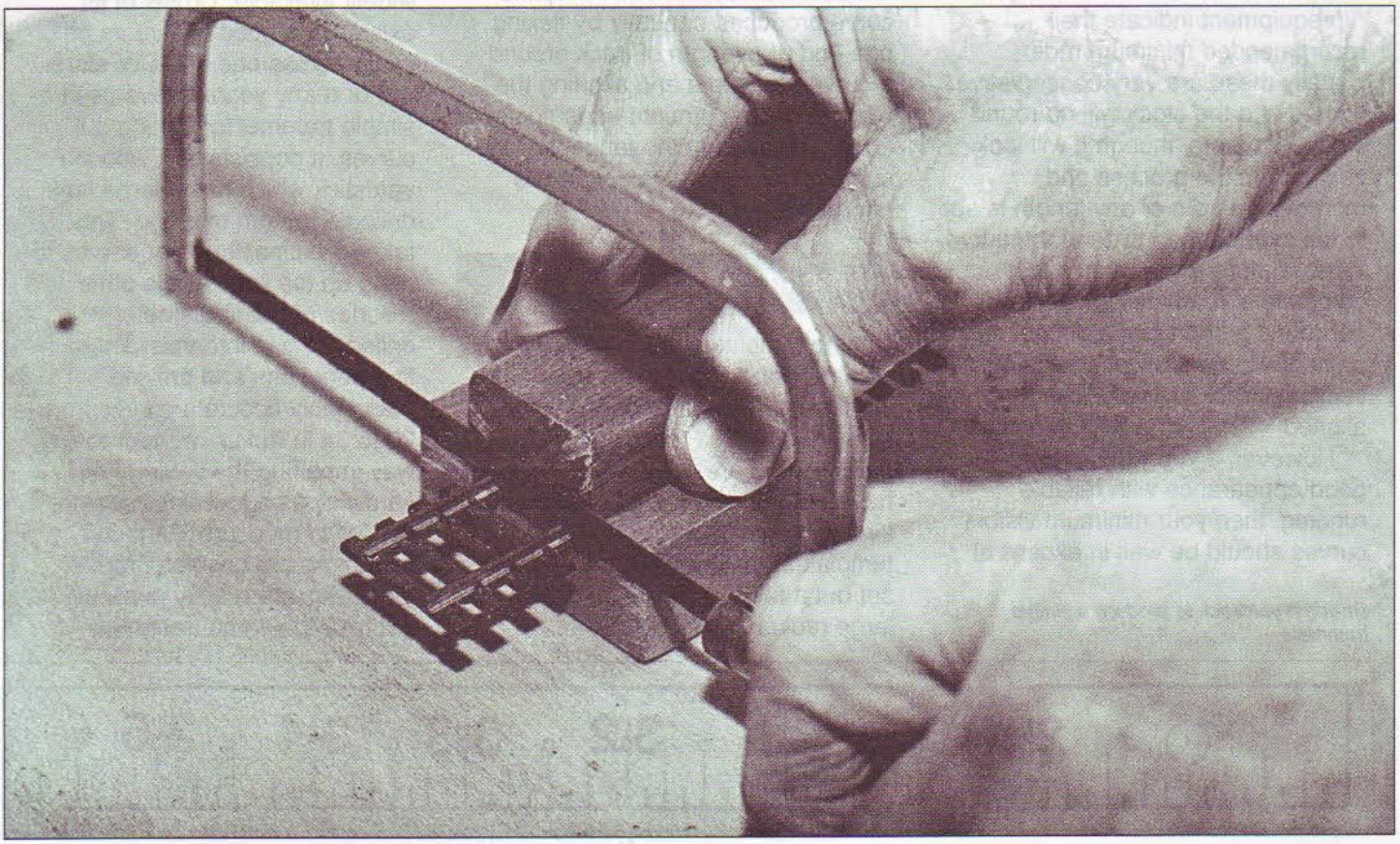


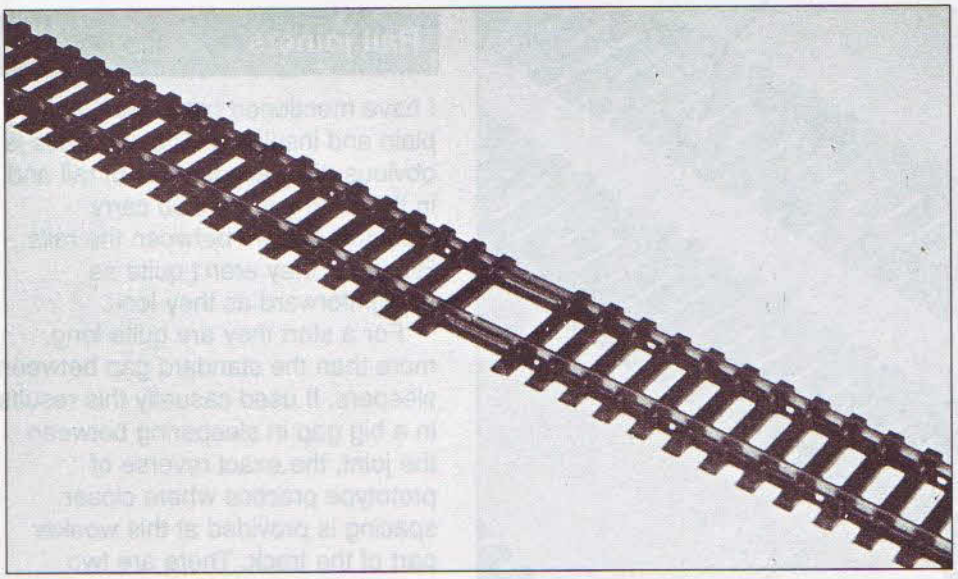
Above: *All modern track systems can be readily cut to size. This is the simple way, in which the track is held down with one hand and a razor saw used in the other. The saw should be used gently and not forced, since should the teeth catch in the thin web the rails can be forced out of their fastenings.*

Below: *Alternatively, the track can be held in a simple jig which enables one to hold each rail individually. With this system the coarser 6 in pin-ended hacksaw can be used, and the cutting is quicker. The jig shown has seen some 20 years' use, and I'm not even sure if it is still obtainable.*

Obtaining a smooth curve

The main problem with flexible track is imparting a proper curve to the rail. It is not too difficult to pre-stress the centre section by bending it well below the desired radius, but the extreme ends are another matter. To ensure smooth curves, the rails should be slid out of the sleepers for about 3 in (8 cm) and then smoothly bent to slightly below the desired radius before being slid back. This is tedious but well worth the trouble, since if this is not done there is a strong possibility that the track will try to straighten itself and this will lead to derailments. This is more marked the sharper the curve, so I strongly recommend that when it is necessary to get close to the radii used for sectional tracks you use these curves instead. The rails are accurately pre-curved in the factory and the costly tools used for the





Rail joiners are long and if used without due thought produce unsightly sleeper gaps, as shown here. Although it is possible to slide in spare sleepers this is a job that is all too often left incomplete.

track bases are made to precise dimensions. When new the radius is accurate to within 0.1 mm of the quoted dimension on the centre line of the track and even with casual handling is not going to alter appreciably. This is a great deal more accurate than can be achieved with flexible track under ideal conditions. When you're getting down to the limit, accuracy is vital.

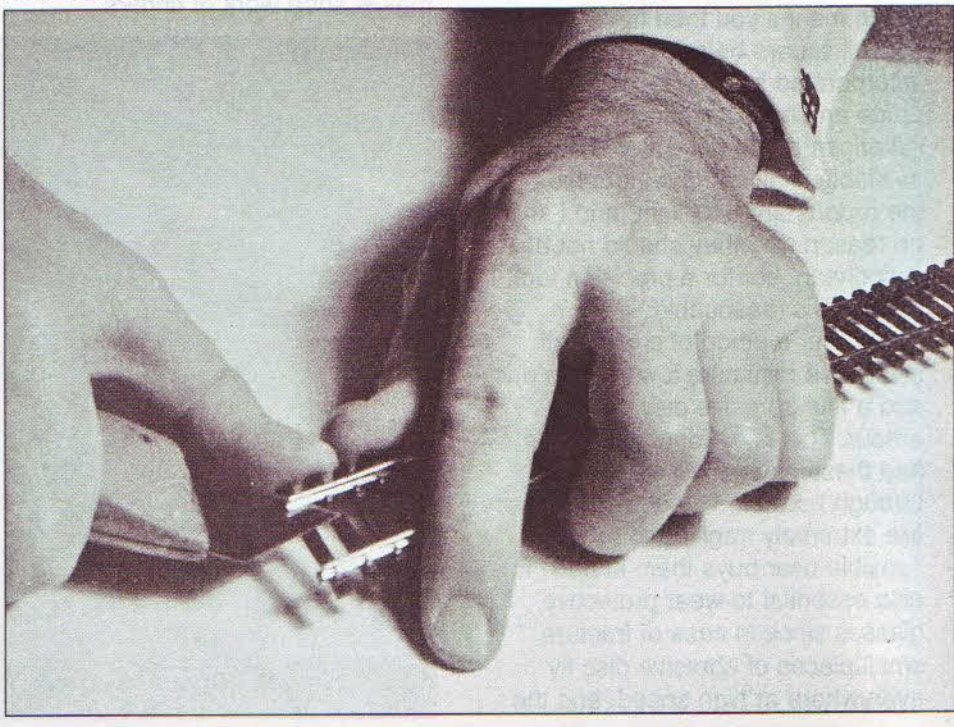
Cutting track

Once the whole of a baseboard section is laid, you can think about pinning the track firmly in position but before we get to this stage, it is as well to look more closely at a couple of processes which, to keep up the flow of instructions, I passed over in a couple of words. The first is the very important business of cutting the track.

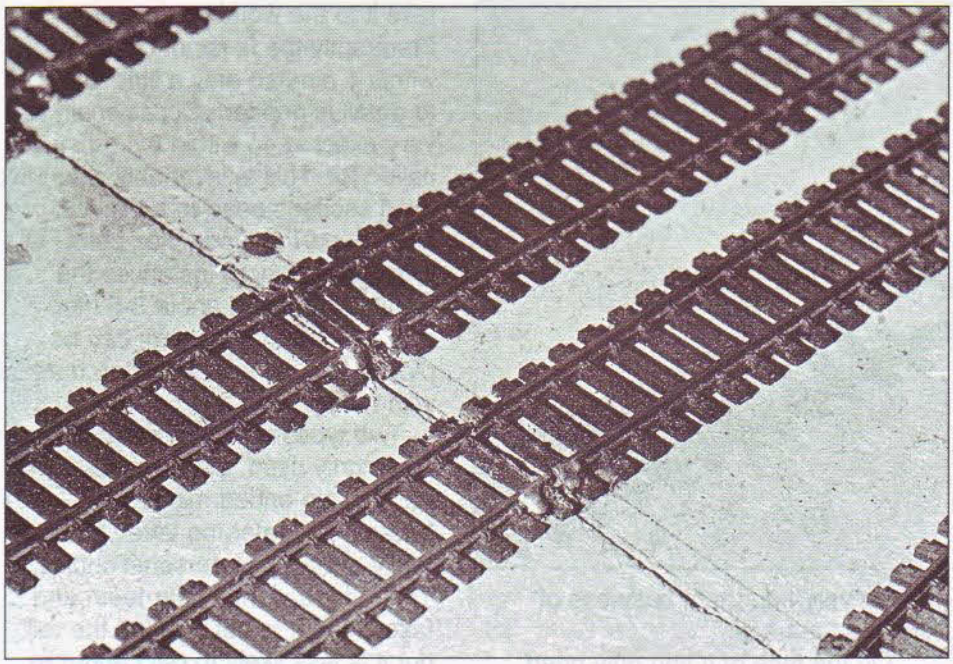
On the face of it you only need take a fine toothed metal cutting saw and get to work. It isn't quite as simple as this. If you want the track to fit a specific space then clearly it is a good idea to mark it beforehand. My method is to fit one end to the fixed adjacent track or point with rail joiners, offer it up to the other position and mark the cutting places with a small triangular file, and then take it to the workbench to cut. Frequently the fit is not critical to within 1 mm, so only a little attention to detail is needed. Occasionally a very exact fit, to within 0.5 mm is called for. This is invariably when two fixed sections need to be linked, often in part of a complex point formation. In such instances the initial cut is made about 3-5 mm oversize, so that the rails can be placed side by side and then marked with the file.

Two types of metal cutting saw are commonly used, the razor saw and the 6 in pin-ended miniature hacksaw. I prefer the latter, but it is really a matter of personal choice. The razor saw has finer teeth and takes longer to cut through the rail, but it is less likely to get caught by the relatively narrow web of the rail. It is possible to saw through the track whilst holding it down with your spare hand, but the process is less fraught if the track is held more firmly in a vice or in a simple wooden fixture.

Rail can be cut with a pair of heavy-duty wire cutters, hardly surprising since solid drawn model rail is actually a very specialised,



If the rail fastenings on the last sleeper are cut away, the rail joiners will overlap the sleepers. This is done with sectional tracks where the end sleepers have no fastenings. Cutting is readily done with a sharp *knife, since using undue force can end disastrously. Although this illustration appears to put the user at risk, it will be seen that when the knife has cut through the plastic, it will be stopped by the next fastening. This will only happen when the blade is* gently *pulled into the relatively soft plastic.*



In order to ensure alignment across a baseboard joint, the tracks can be laid across the gap and then soldered to small screws driven into the baseboard. In this instance 12 mm chipboard has been used for the top, and this will hold the screws firmly. The rails are then cut through with a razor saw. Alternatively, PCB sleepers can be used in place of the screws, which produces a somewhat neater joint.

high quality wire. However, normal wirecutters crush the cross-section, which means you then have to file the rail square before it can be incorporated into the layout which is crude and not very effective. An American-made rail cutter is now available, which I have not tried but the reports are excellent, and I see no reason why they should not be. It isn't cheap, but for a precision tool the price is reasonable.

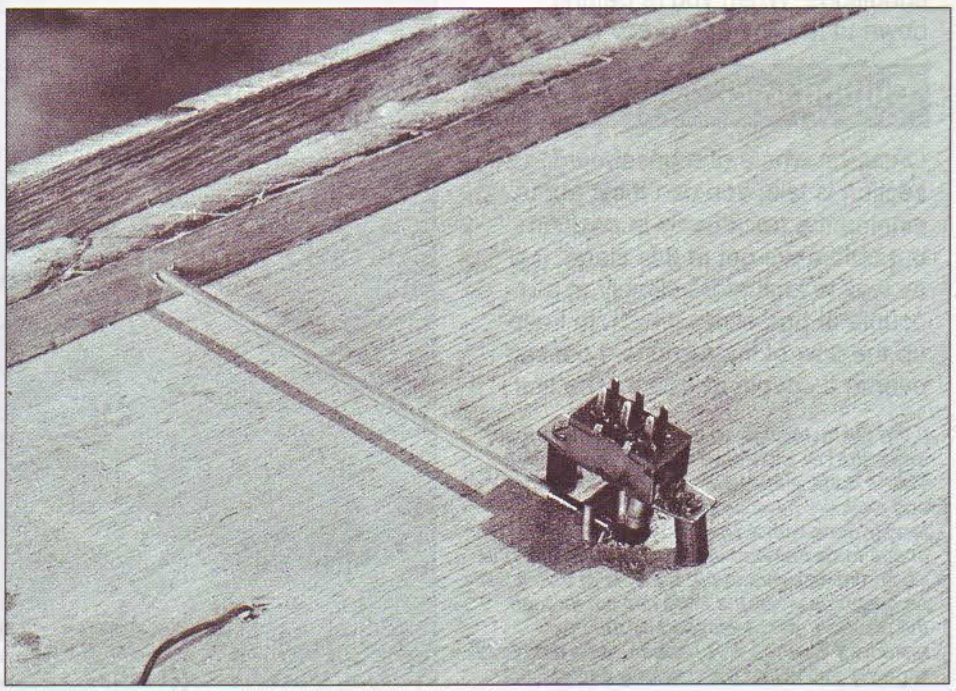
Another method of cutting rail involves a miniature low voltage drill and a fine abrasive disc on an arbour. This is extremely effective, and these cutters will even slice through hardened steel, but the discs are extremely fragile and so the sensible user buys them in bulk. It is also essential to wear protective glasses since in case of fracture, small pieces of abrasive disc fly everywhere at high speed, and the chances of one fragment ending in an eye are too high for comfort. The advantage of this system is that the rail can be easily cut through in situ with the minimum of fuss and disturbance. It is an excellent way of introducing an electrical break in track that has already been laid, but it is also a hazardous process. Anything that cuts hardened steel makes short work of fingers.

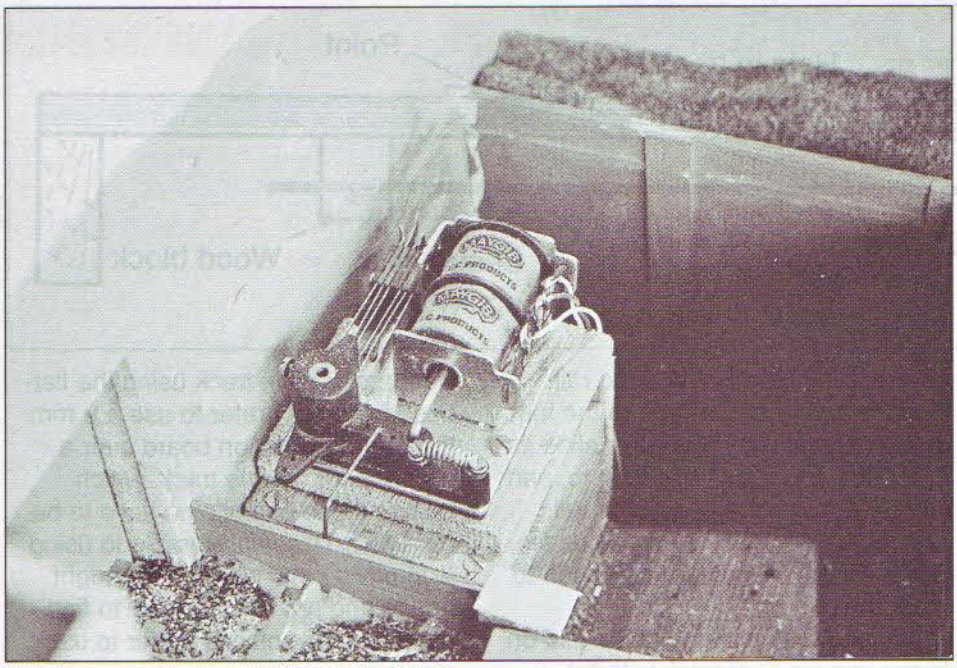
Rail joiners

I have mentioned rail joiners, both plain and insulated. Their purpose is obvious: they join lengths of rail and, in the plain pattern also carry electrical current between the rails. However, they aren't quite as straightforward as they look.

For a start they are quite long, more than the standard gap between sleepers. If used casually this results in a big gap in sleepering between the joint, the exact reverse of prototype practice where closer spacing is provided at this weaker part of the track. There are two schools of thought. The lazy way is to leave the gap and, later on, insert a spare sleeper or two taken from a

A slider switch adapted for pushrod point control. A brass sleeve is folded around the dolly and a spring steel (piano) wire is forced into a small hole drilled in the top of the dolly. These can be secured in place with epoxy resin, but with moderately careful work the fit will be tight enough to keep the parts together. The slider switch is supported on two tubular spacers and held down by woodscrews. The pushrod itself began life as the bottom section of a wire coathanger. One end was threaded 8BA and screws into a tapped hole in the sleeve. A locknut holds all parts secure.

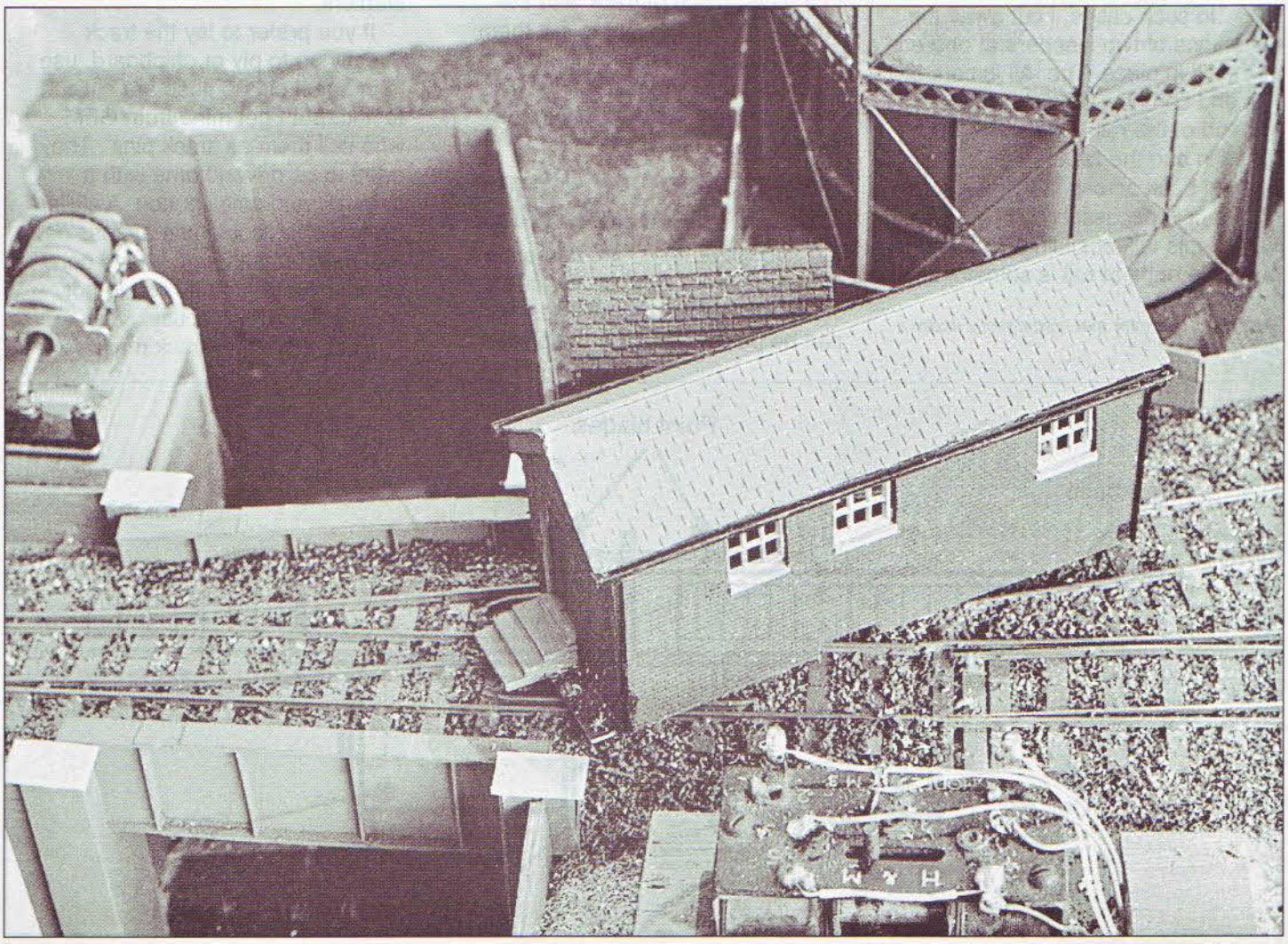


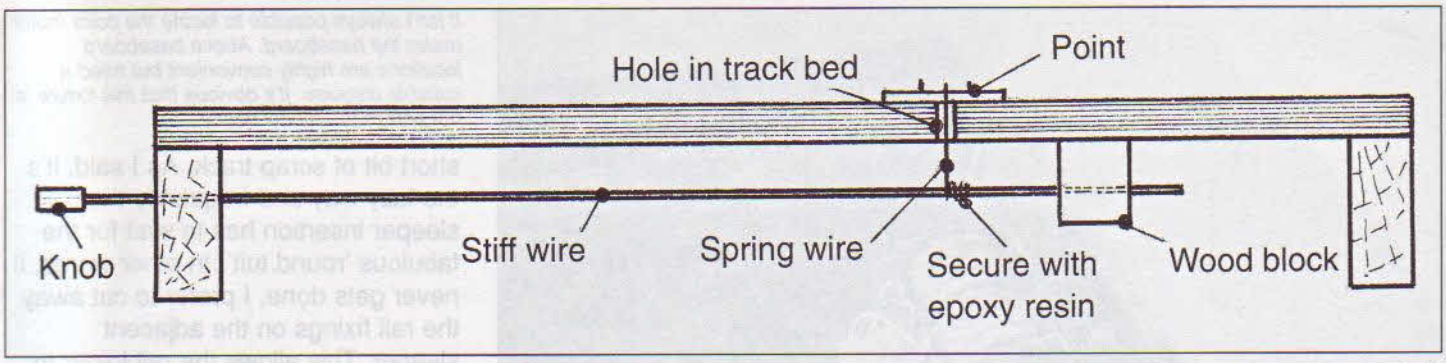


It isn't always possible to locate the point motor under the baseboard. Above baseboard locations are highly convenient but need a suitable disguise. It's obvious that this fixture is not part of the model scene.

short bit of scrap track. As I said, it's the lazy way and frequently the sleeper insertion has to wait for the fabulous 'round tuit'. In other words, it never gets done. I prefer to cut away the rail fixings on the adjacent sleeper. This allows the rail joiner to slide over the sleeper and there is no need to go round later sliding a loose sleeper under the track. Occasionally

The simplest disguise is a small building. Here we have a simple scratchbuilt structure which is probably a storeroom, made to fit directly over an old Hammant & Morgan point motor. This was a last-minute substitute for a more modern device that wasn't suitable for the restricted location.





Above: *Simple pushrod point operation.*

around pointwork a gap seems inevitable, and in such cases the sleeper must be put in before the pointwork is fully fastened down.

There are instances, particularly with fill-in pieces in point formations, where a very short length of track has to be fitted between two fixed parts of track. In such cases, I cut away the fastenings of two sleepers at one end of the fill-in piece. The rail joiners at this end can now be slid back past the end of the rail, the section then drops in and the rail joiners are pushed back across the joint.

It is now necessary to point out that all this talk of sliding rail joiners on to the ends of rail is something of an over simplification. A good rail joiner is a very close fit on to the foot of the rail and will not always slide on at the first try. I don't expect it to, and usually smooth the end of the rail and radius off the foot with a fine file, generally the triangular one I used to mark the rail.

Although rail joiners can be slid on to the first piece of track with the fingers, it's a lot easier to get them on to the other section with the aid of a pair of fine flat-nosed pliers. These pliers are essential for sliding the joiners along a rail.

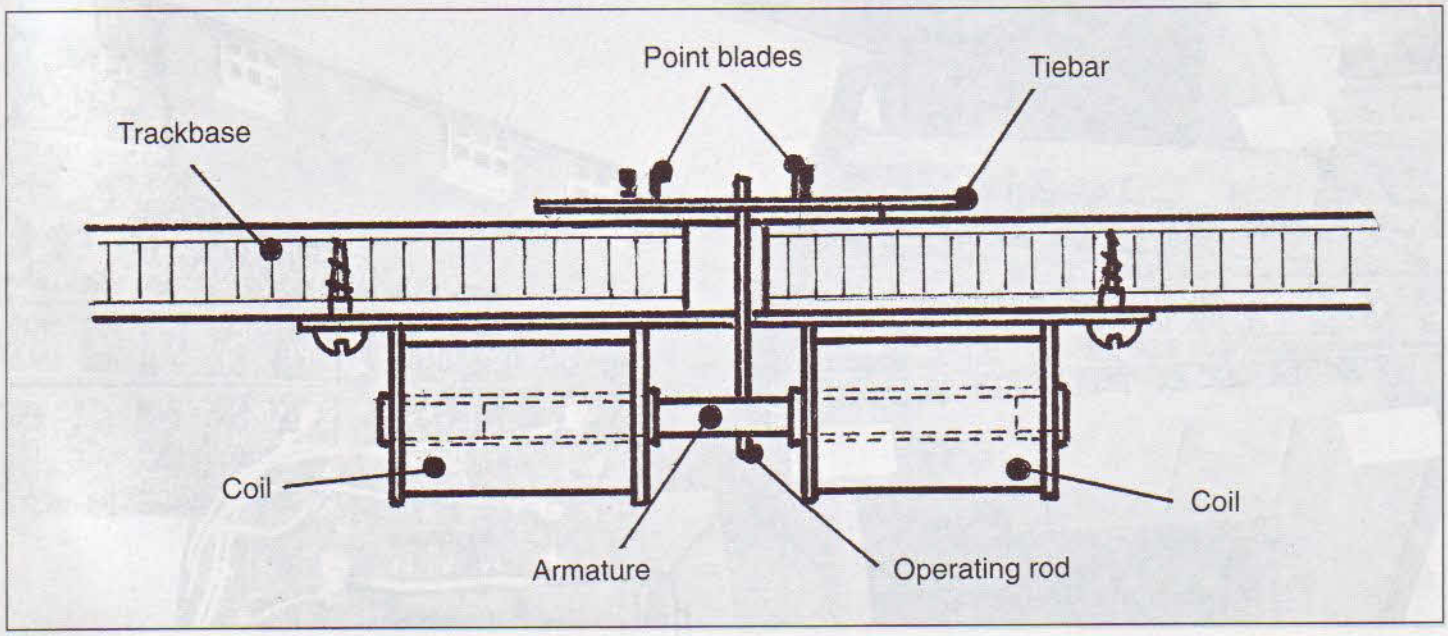
Fixing track in place

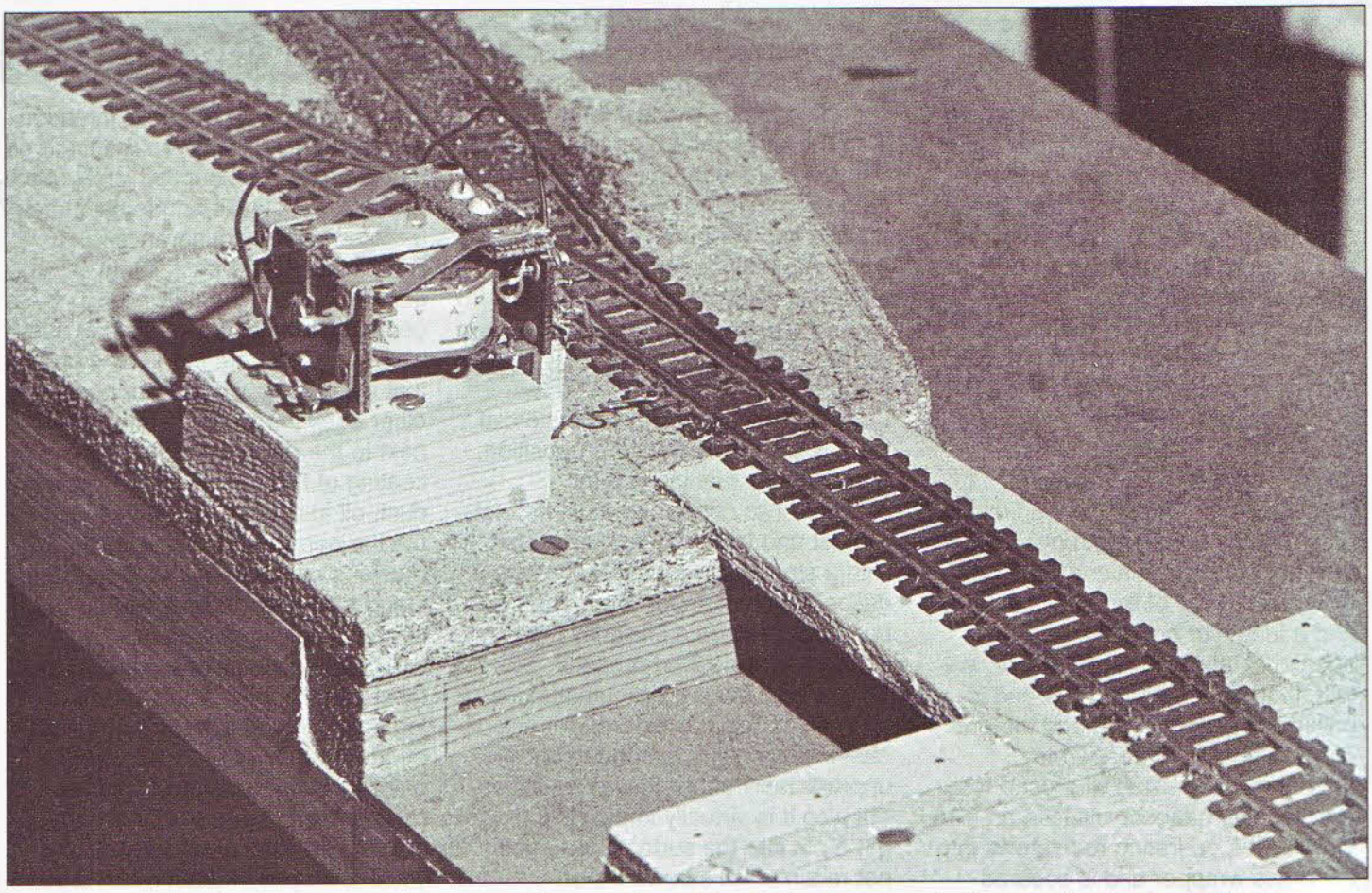
For this stage, Peco recommends a long, fine, blackened pin for use with 12 mm insulation board. These pins can be pushed through the plastic sleepers of plain track using the flat-nosed pliers. I prefer to use a 9 mm thick hard insulation board over a ply base for flexible track, which means these useful pins have to be cut short. This is preferable to using ½ in office pins, which have bright heads and are not too easy to find these days as offices prefer to use staplers.

If you prefer to lay the track directly on to ply or chipboard, use ⅜ in panel pins. These are difficult to find, but I get mine from GEM who sell them as 'track pins'. They need to be driven home with a hammer and small punch. A skilled hammerman could use a cross peen hammer, but although I have done so as an experiment I would not recommend the practice.

Peco and other track manu-

Below: *Point motor mounted directly under a point.*





Another means of electric point control is an ex-equipment relay with a gain stroke arm added to the armature. This pattern relay (ex-US Navy) is ideally suited for sub baseboard use, but when employed on top needs a good (1 in) 25 mm packing to get the required stroke. All this will be hidden, very appropriately, by the signal cabin.

facturers, provide a foam underlay which is supposed to act as ballast and provide sound deadening. I have to admit that I cannot get on with this material since, apart from anything else, you cannot pin track down. The result of doing this is to produce a minor roller-coaster effect and initiate derailments in unexpected places. Peco advises gluing the ballast to the track and then gluing the assembly to the baseboard. Again, I don't like this, because although it works there is no opportunity for minor adjustment during tracklaying. The effect is not as realistic as loose ballast, which will be dealt with in the next chapter. Sound deadening can be achieved with a cork underlay but personally I like to hear the trains rolling.

Point operation

Peco provide an excellent point motor for use with their turnouts, that is reasonably priced and extremely versatile in its application. Full fitting instructions are provided. It can be mounted under the baseboard or, in a special adaptor, alongside the point on the surface. Indeed, every make of point motor I have examined is provided with fitting instructions, though to most people I imagine the process is a matter of common sense. However, there is just one small point to bear in mind. If you intend to have under-baseboard fitting you will almost certainly need to drill the hole for the operating rod before you lay the track. For the moment we'll leave the business of wiring, which is more logically dealt with when we consider electrification.

Electric point motors, no matter how reasonably priced, soon add up when used in any quantity. Anyone on a tight budget should consider simple mechanical operation, at least for those points close to the operating position. You can't get much simpler than the elementary pushrod system.

In essence this consists of a stiff steel rod under the baseboard with a length of spring steel wire fixed so that it passes through a 1/4 in (6 mm) hole in the track base into a hole in the point tiebar. One end projects though the front of the baseboard and usually has some sort of knob fixed to it. It is very cheap to make. The pushrod is cut from a wire coat hanger, the spring wire is a length of

piano wire wound round the rod and secured with epoxy resin (Araldite). The knob is a slice cut from a discarded ballpoint pen and stuck in place with more epoxy. A small block of wood provides the rear support. Apart from a couple of screws to hold this block in place, the piano wire and epoxy resin, everything is made from recycled material.

I am using a slightly more sophisticated system which puts the cost up by between 30 and 50p. This is the cost of a two-pole changeover slider switch, which is mounted upside down on two small tube spacers, 3/8 in (10 mm) long, directly under the tiebar. A length of piano wire is inserted into a small hole drilled in the top of the switch dolly and a length of brass sheet, approximately 1/4 in (6 mm) wide, is folded around the dolly. The end is drilled and tapped 8BA, and the end of the wire rod is threaded to fit. Providently, the usual wire used for dry-cleaning hangers will take an 8BA thread. The operating rod screws into the brass wrapper and is secured with a lock nut. I imagine that anyone without the necessary screwing tackle could solder the rod in place, or use more of that invaluable material, epoxy resin. This pushrod system not only provides a locking mechanism for those points not provided with a toggle spring, but also gives two changeover contacts.

Although this does not provide centralised control, on the usual size of layout the distance between point operating knobs is considerably less than the length of a prototype ground frame, let alone the manual lever frame in a signal cabin. It is simple, reliable and very easy to understand, since you pull the knob nearest the point you want to operate.

Achieving reliable running

Laying ready-assembled commercial track is a straightforward proposition, but if reliable running is to be achieved two conditions must be met.

First and foremost you must start with a smooth track base with only deliberate changes of level. The track base needs to be sufficiently rigid not to sag and it must be properly supported. Under no circumstances should you use hardboard for track bases. Not only is it prone to buckle unpredictably under these conditions, but also it is virtually impossible to get a pin into the surface and it will not retain small screws either.

Second, the track must be accurately aligned and should not be under any stress. I have mentioned this on several occasions but it doesn't hurt to repeat it because any failure to observe these fundamental requirements will inevitably lead to infuriating derailments which are next door to impossible to eradicate.

Colouring track

Among any range of paints intended for railway modellers you will find one marked 'Track Colour', which is used widely to paint rails and to give track a more realistic appearance. However, full size track is not a uniform colour. The rails are generally a rusty brown, with overlay of dark brown from the oil and grease that falls off the wheel bearings. On older track the sleepers and ballast next to the rail will also have a coating of flakes of rust, brake block dust, oil and grime. The hues vary, but the general effect is a drab brown, shading to black when locos stand around a siding for any appreciable length of time.

The classic way of arriving at a mucky brown is to mix a lot of paints together. The ideal base is the last quarter of a tin of brown household paint, to which you add whatever comes to hand in the way of surplus. Mix in a little thinners, stir well and you'll end up with around half a pint of track colour. Store in a screw-top jar, dilute to taste and slap it along the rail with an old brush since rail fixings play havoc with brush hairs. Before the paint is dry, wipe the top surface with a piece of rag wrapped around your forefinger, then when dry, burnish the rail head.

Chapter 8

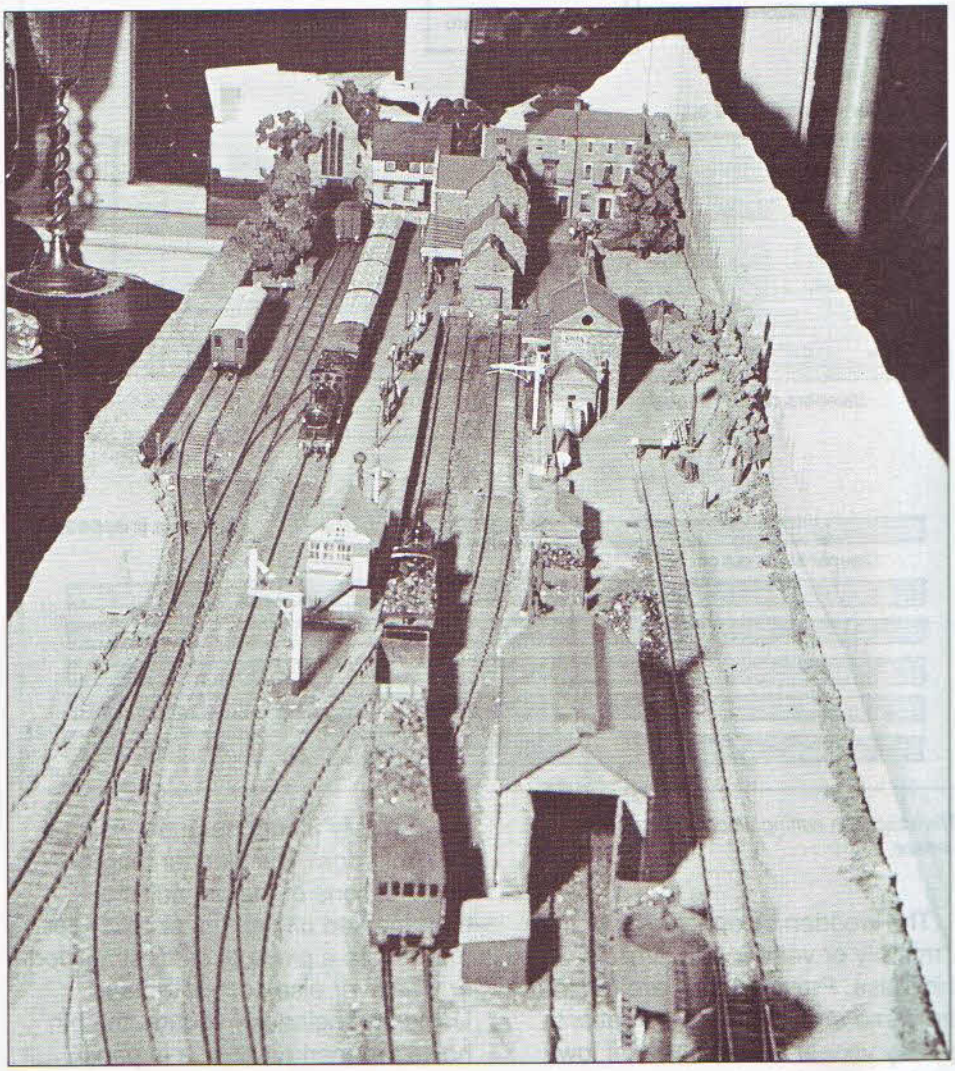
DIY Track Construction

With such a range of excellent ready assembled track on the market, why should anyone bother to make their own? On the face of it, it is at best a tedious, at worst a difficult task, compounded by the fact that so far as plain track is concerned the cost of the individual components exceeds the price of ready-made flexible track.

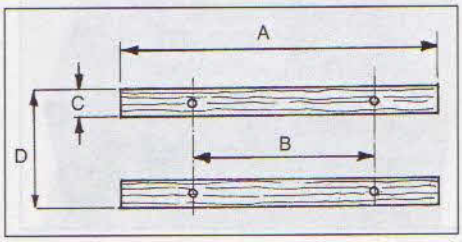
The first answer is that pointwork is not only cheaper, it can also be tailored precisely to your specific requirements. The second is that commercial 16.5 mm gauge track is made to HO standards, with the result that the sleepers are too closely spaced so for the best appearance, you must make it yourself. The third is that if you want to work in EM or P4 gauges with 4 mm scale, you have little option but to do it yourself. Finally, to someone with the right temperament, it's good fun.

Making sleepers

Way back in the late 1940s and early 1950s, before commercial ready-made flexible track was available, and sectional tracks were crude and unrealistic, scratchbuilding was the norm among serious modellers. During this time I followed the principles laid down by Peter Denny and related in his excellent book, *The Buckingham Branch Lines* (Wild Swan, 1993). This in turn was based on a system introduced by the long defunct firm ERG of Bournemouth. The main difference I introduced was the method of manufacturing wooden sleepers, and the use of ply as the sub-base rather than hardboard. As this type of track can be made largely from recycled material, only the rail and track pins have to be purchased, making it is a very inexpensive system.



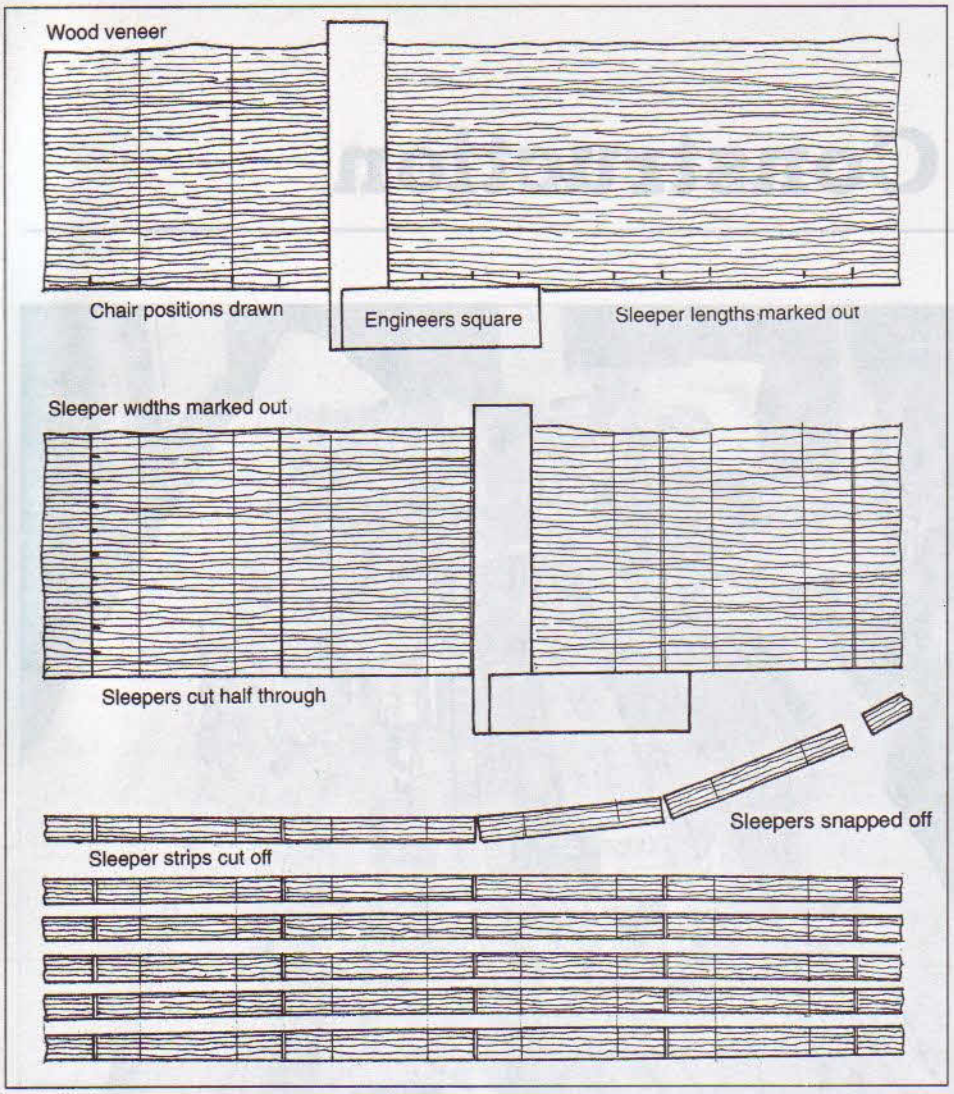
Peter Denny's Buckingham Mk II, *showing the effect one can get with track laid on wood sleepers and soldered to pins.*



Sleeper size and spacing for British track.

Gauge	A	B	C	D
OO	34 (36)	19	3	13
EM/P4	34 (36)	20	3	13
N/2 mm	17 (18)	11	1.5	6.5

Sleeper length for modern 8 ft 6 in sleeper, older 9 ft version in brackets. Dimensions in mm.



The stages in cutting wood sleepers from veneer.

The wooden sleepers are cut from 1 mm ply or veneer of a similar thickness. Provided they are cut from the same sheet this is automatic. I get my veneer from a sheet of low-grade 3-ply which has been stored for a little while in a damp place. This effectively destroys the bond and the three layers of wood will separate. Usually, the centre ply is of poor quality, but the outer layers are usable.

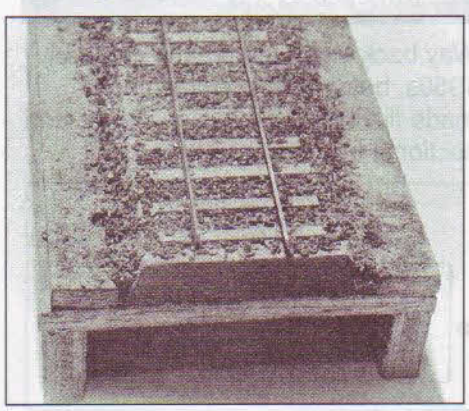
My method of cutting out is to take a section of veneer with reasonably straight grain about 12 in (30 cm) long and up to 4 in (10 cm) wide and cut carefully along the grain, using a straight edge. The sleeper lengths and locations of the pin holes are then marked off using a simple ruler made from a piece of card, stripwood or whatever else comes to hand. Using an engineer's square, the pin holes are marked across in pencil, then the sleeper lengths are *half cut through* with a craft knife. After this, the sheet is cut into strips one sleeper wide. Originally I set this out with a pair of engineer's dividers, but today I set an inexpensive calliper gauge to sleeper width and use the depth gauge to align the straight edge. A Stanley pattern knife with a new blade will cut straight through the grain with a single stroke. The sleepers are then snapped off individually.

The pin holes can either be drilled or pierced with a sharp pointed instrument. A scriber is excellent for this purpose. The latter method will occasionally split a sleeper, and my outlook is that this finds the flawed sleepers.

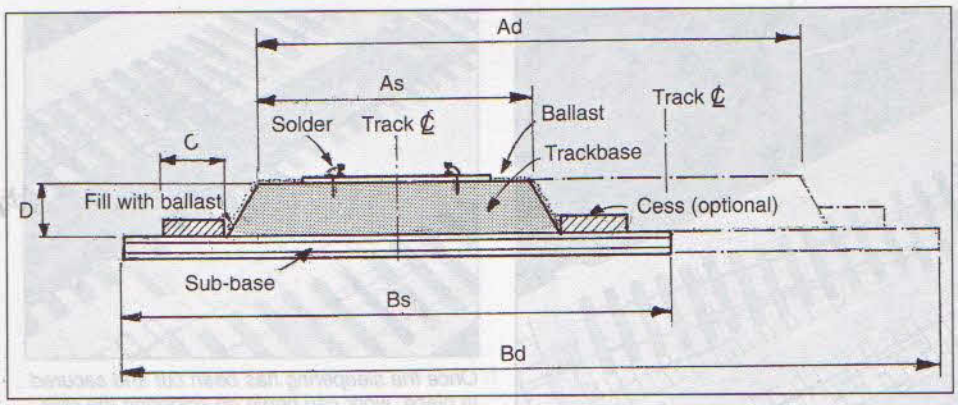
Fixing sleepers

The sleepers are glued to a plywood trackbase, cut to the width of the ballast bed. Sleeper spacing is arranged either by using dividers or a comb jig. After this the base is covered with loose ballast. Press this down firmly, using a sheet of newspaper to keep the glue off your hands. The base is then set aside to dry overnight, after which surplus ballast is tipped off and put back into the container. Alternatively, the sleepers can be pinned down first, and the glue and ballast applied afterwards.

I use ¼ in brass gimp pins, bought in bulk in 1948. I've only got through half my supply so I've not checked on current availability. I have found ½ in black steel gimp pins in a local DIY store, but the heads would need cleaning with a fine file and the



A short experimental length of track laid with wooden sleepers with the rail soldered to gimp pins. Here the sub-base is 9 mm Sundeala insulation board laid on a 4 mm ply base, carried on 20 mm deep 9 mm ply runners. Ply 'cess' side fillers were added. The idea was to produce a self-supporting track base for open top construction.



Dimensions of track base and sub-base.

Scale	A		B		C	D
	Single	Double	Single	Double		
4 mm	50	100	90	140	10	9
2 mm	25	50	45	70	5	6

Dimensions in mm.

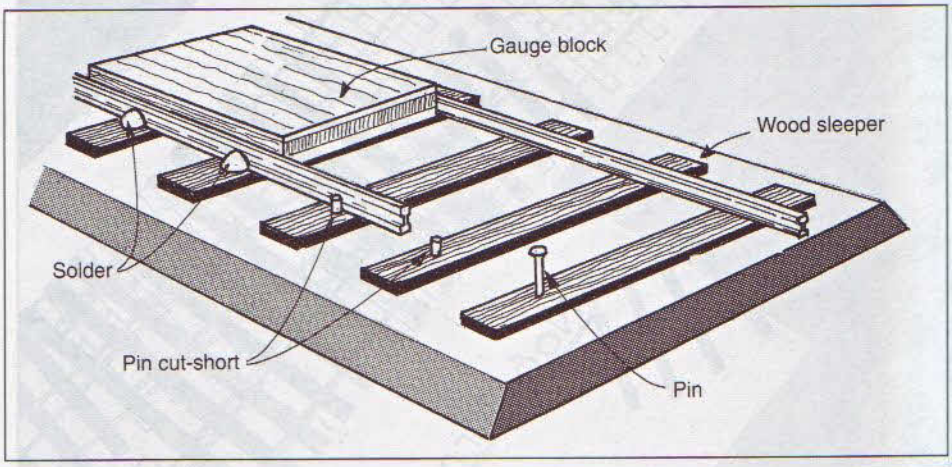
surplus length would have to be cut off and riveted over on a small anvil - the discarded sole of an electric iron is ideal. As gimp pins are mainly used by upholsterers it would be well worth enquiring here.

The rail is then soldered to the gimp pins. Gauge is set by any available track gauge, I use a piece of 3 mm ply about 1½ in (30 mm) long and exactly 16.5 mm wide. This has the great advantage of heat insulation, whereas metal gauges are apt to get too hot to handle. One important advantage of soldered track construction, is that small errors can be readily corrected with a hot soldering iron and a pair of pliers. In addition, it is not too difficult to repair track in situ, though as always, where serious trouble arises, relaying with new or bench-reconditioned track is usually the quickest way of resolving the problem.

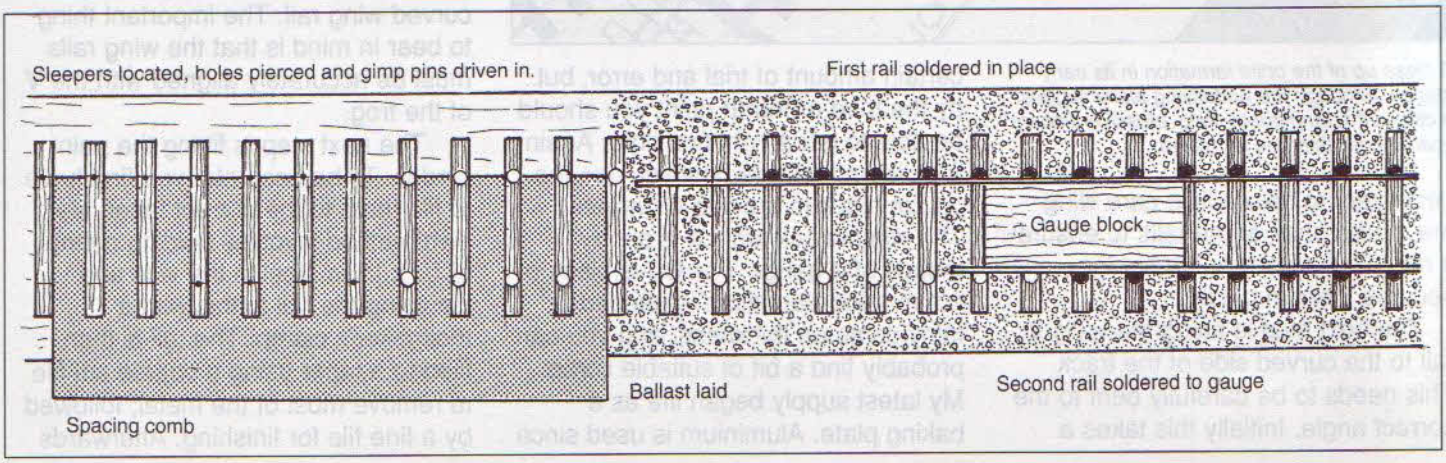
In the 1940s, it was necessary to set out each point individually on the track base. Today it is a relatively simple matter to draw a right and left-hand point on a sheet of A4 paper and get several photocopies run off. This cuts out the most tedious part of the job. The sleepers are cut from plain strip and marked out for pin holes. For point construction, I consider it preferable to pin the sleepers down before ballasting because of the need to mark each one individually.

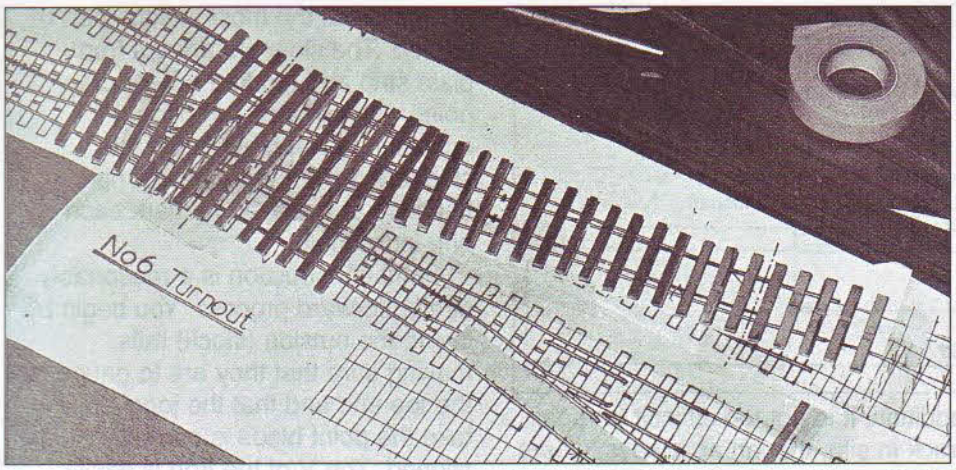
Point construction is a reasonably straightforward process. You begin by laying the outside (stock) rails, making sure that they are to gauge at the toe end and that the joggle to take the point blade is correctly aligned. The V of the frog is easily located by using two gauge blocks pushed against each other; the diagram is self explanatory. It is only

An alternative form of wood sleeper track, using ½ in plated pins. This is a shade more tedious than with flat-headed pins, since not only are the thinner pins more difficult to drive into the track base, but they also have to be subsequently cut off. On the plus side it is easier to get the overall effect of a prototype chair.

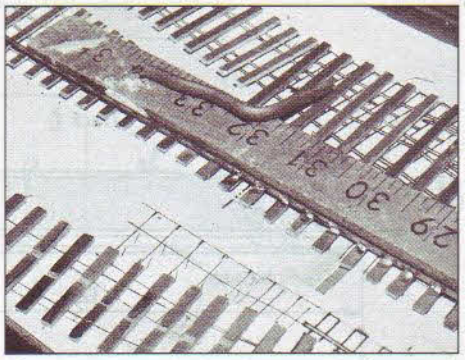


Constructing soldered track using wooden sleepers.

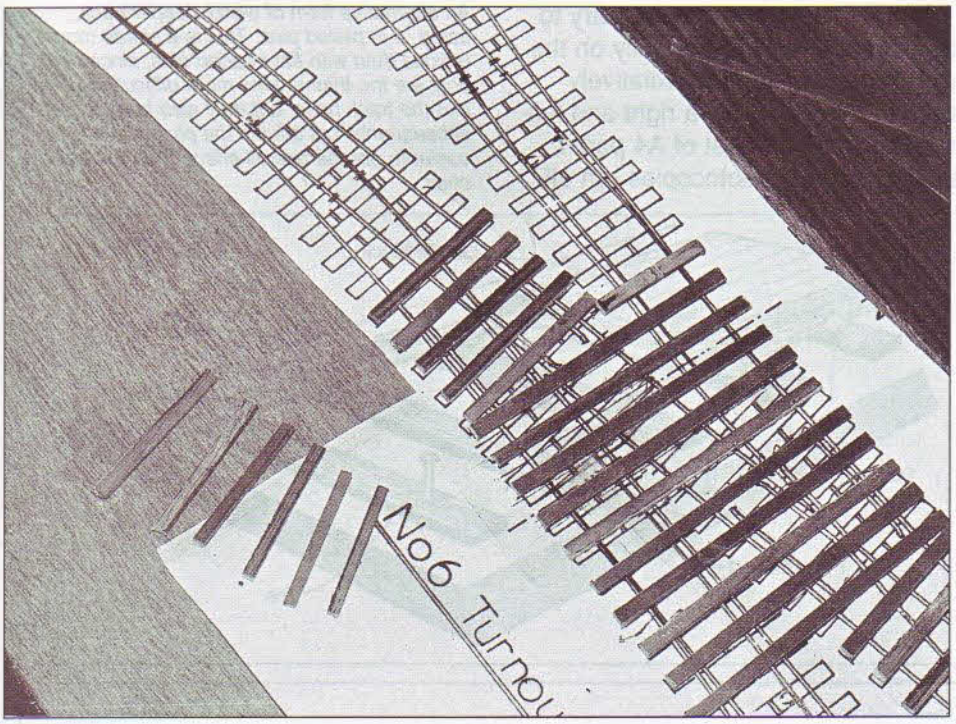




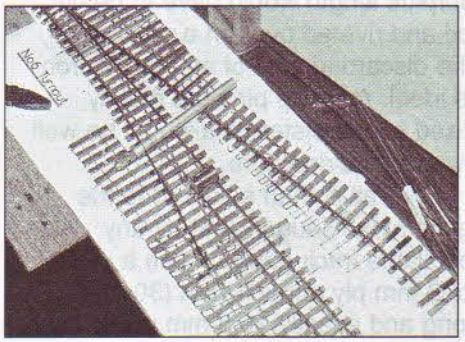
The first stage in the construction of a PCB sleepered point formation. Several photocopied point plans have been taped to a piece of plywood. On the extreme right some roughly drawn infill tracks can be seen, which suffice to locate the sleepers. Lengths of PCB sleeper strip are cut to size and lightly attached to the diagram with double-sided sticky tape.



Once the sleepering has been cut and secured in place, work can begin on soldering the rails in place. The first to go in is a straight stockrail, which is soldered in place along a straight edge. In this instance I am using my trusty old yardstick. It is just possible to see the pivot holes mentioned in Chapter 7 by the way they break into the inch division line between the digits.



A close up of the point formation in its early stages. Although the underlying plans suggest a different arrangement, long 'crossing timbers' span the width of the formation.



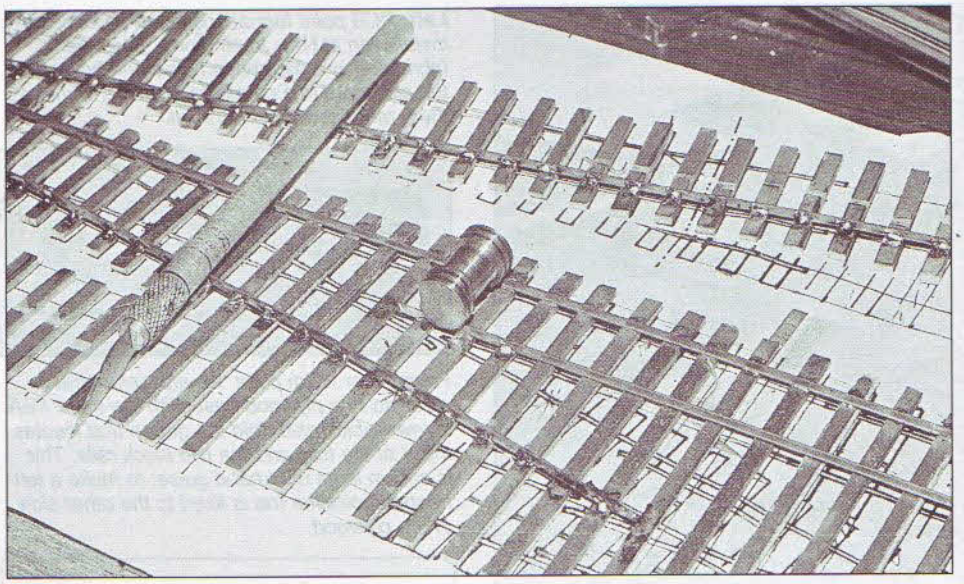
Several stockrails are now in place and the formation is beginning to take shape. The stockrails are extended to the maximum distance possible to reduce the number of joints in the assembly.

necessary to take a little care filing the mitred ends of the rails to ensure a neat fit. A good fillet of solder secures them in place.

The next step is fitting the wing V rail to the curved side of the track. This needs to be carefully bent to the correct angle. Initially this takes a certain amount of trial and error, but by the third or fourth point you should be able to get it right first time. Again the diagram shows how you use the gauge block to provide alignment. The wing rail clearance is set by means of a gauge. For OO a piece of 1 mm thick aluminium is needed, a fairly common thickness, and you can probably find a bit of suitable scrap. My latest supply began life as a baking plate. Aluminium is used since this does not take normal solder.

The straight wing rail is a shade more tricky to fit unless you can locate a piece of 1 mm thick steel which is pushed into the gap on the curved wing rail. The important thing to bear in mind is that the wing rails must be accurately aligned with the V of the frog.

The next step is fitting the point blades. To be accurate, you first have to file them to the correct taper. My own method involves holding a strip of 1/2 x 1/4 in steel in the vice and clamping the rail to this with a toolmaker's clamp. The rail is then filed to a taper using a coarse cut file to remove most of the metal, followed by a fine file for finishing. Afterwards



Close-up view of pointwork under construction, using a Peco Rollagauge to check the track gauge. This is an acceptable alternative to the wooden gauge block.

the blade is turned over and tapered for about 10-15 mm on the other side to bring the tip down to the thickness of the web, around 0.2 mm. Point blades are made in pairs and preferably in a batch. Pairs of blades are held with a twist of copper wire until required.

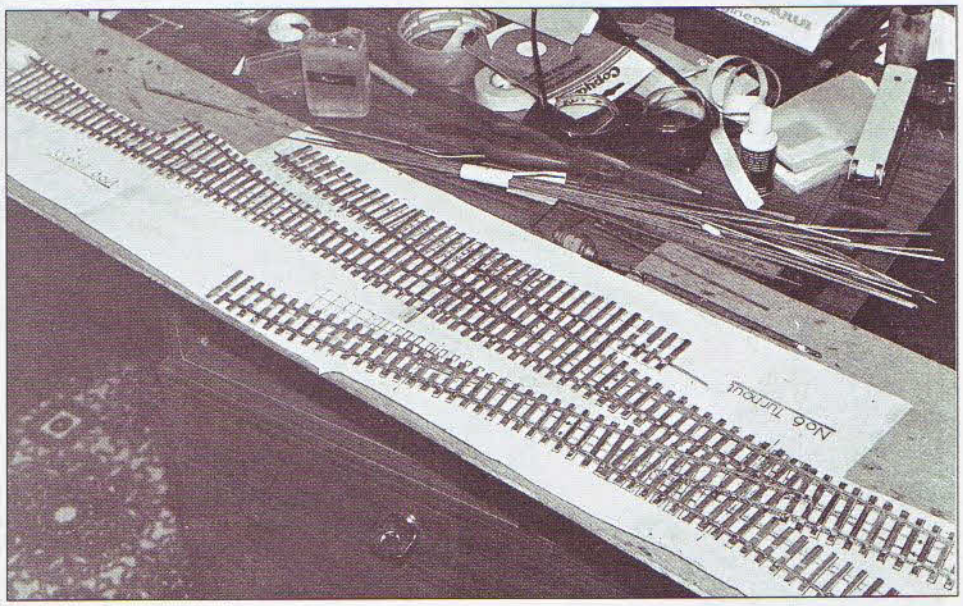
They are cut to length and secured to the wing rails with rail joiners. The tiebar is now made from a short piece of printed circuit board (PCB) with most of the copper surface filed away, leaving two short pieces to which the ends of the blades are soldered. When this has been done it only remains to fit the checkrails, again using the 1 mm thick aluminium spacer.

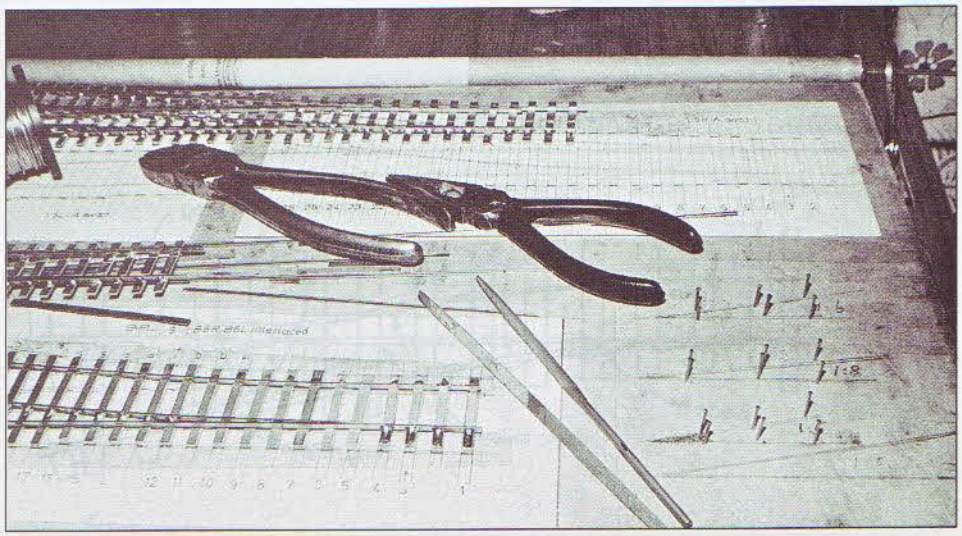
Soldering is nowadays normally carried out with an active flux, but the difficulty of washing pre-ballasted track means that this type of track is best assembled using paste flux (Fluxite). This flux can be wiped away before painting, and when used together with cored solder, the type most readily available, is perfectly satisfactory.

PCB sleepers

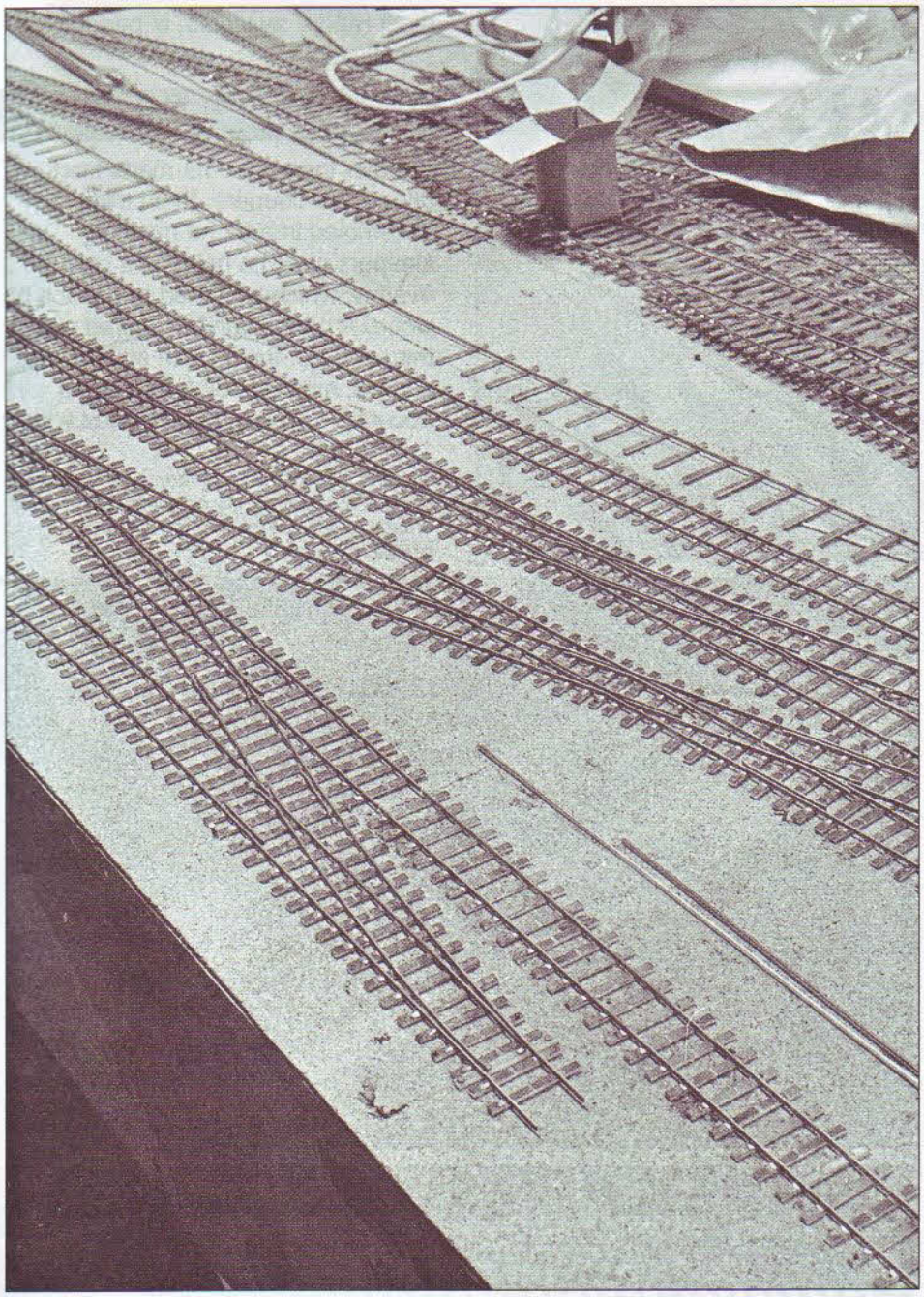
Another form of home-made track uses PCB sleepers. Plain track is assembled in a home made jig. The sleepers slot into holes in a card overlay, which is pinned to a piece of wood. A gauge lath is secured along the centre of the jig with small metal screws; mine are 6BA and use a decorative type of nut that was widely

General view of the point formation. This piece of track was built on my desk since it provided a larger working area than my adjacent workbench.

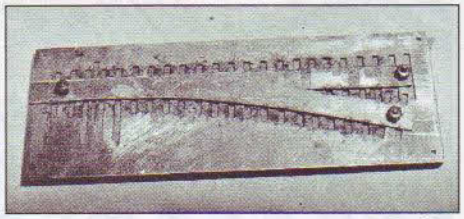




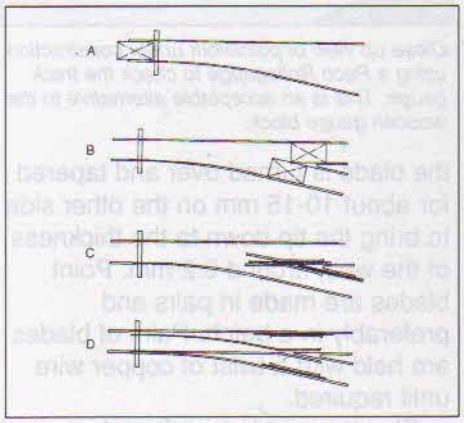
A slightly different approach to point construction is shown here since the frogs are assembled in the pin jigs, shown on the right. These are marked with the crossing angles, and provide three alternatives.



Left: *PCB point formations in the process of installation at* New Annington. *These were fabricated in a member's home and brought to the clubroom in a couple of sections to make them more suitable for transit.*



Point jig for HOm point. An aluminium fret is screwed to a plywood base with the three 6BA screws which also hold the gauge that locates the V of the frog and the two stock rails. This is shown in its right-hand guise; to make a left-handed point the fret is fixed to the other side of the plywood.



Stages in constructing a point.

A Stock rails laid, with joggles correctly aligned. Note that the tiebar is already in place.

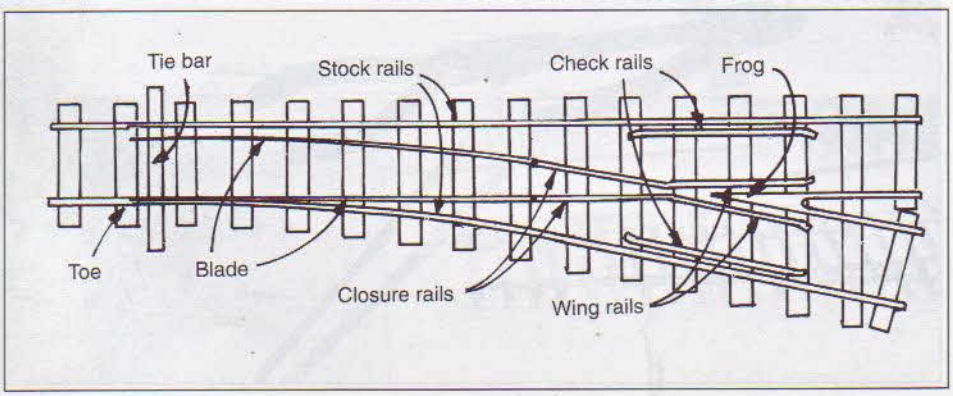
B Gauge blocks used to determine the correct position and angle of the V of the frog.

C Aligning wing rails and closure rails.

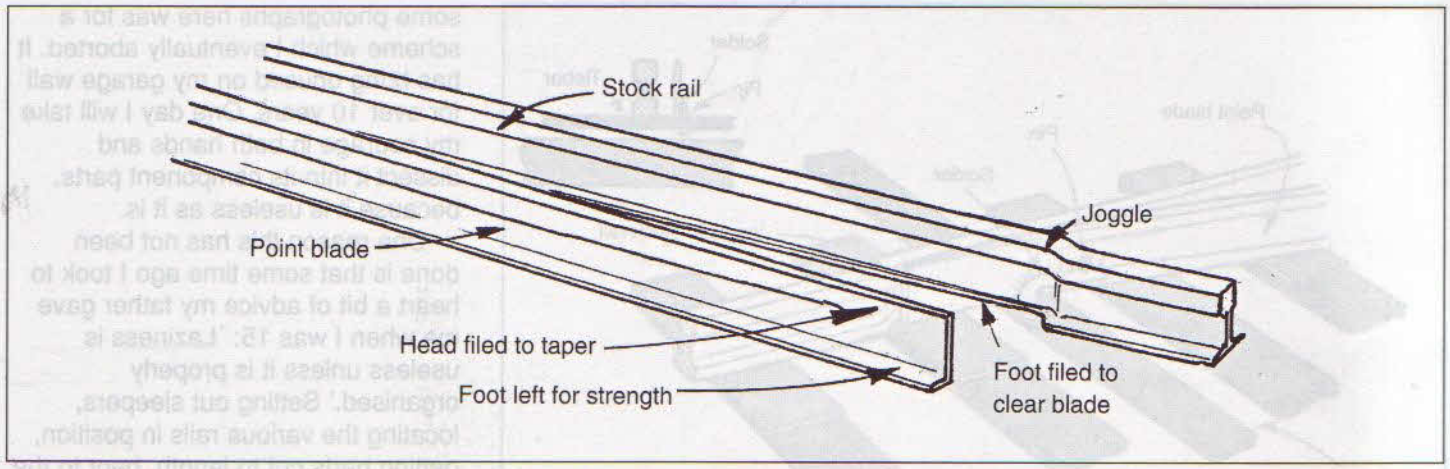
D Point blades and checkrails installed.

used on wireless component terminals 50 years ago. As with so many once useful items, they are, to the best of my knowledge, no longer available. It's a pity because unlike normal nuts they can be tightened with the fingers.

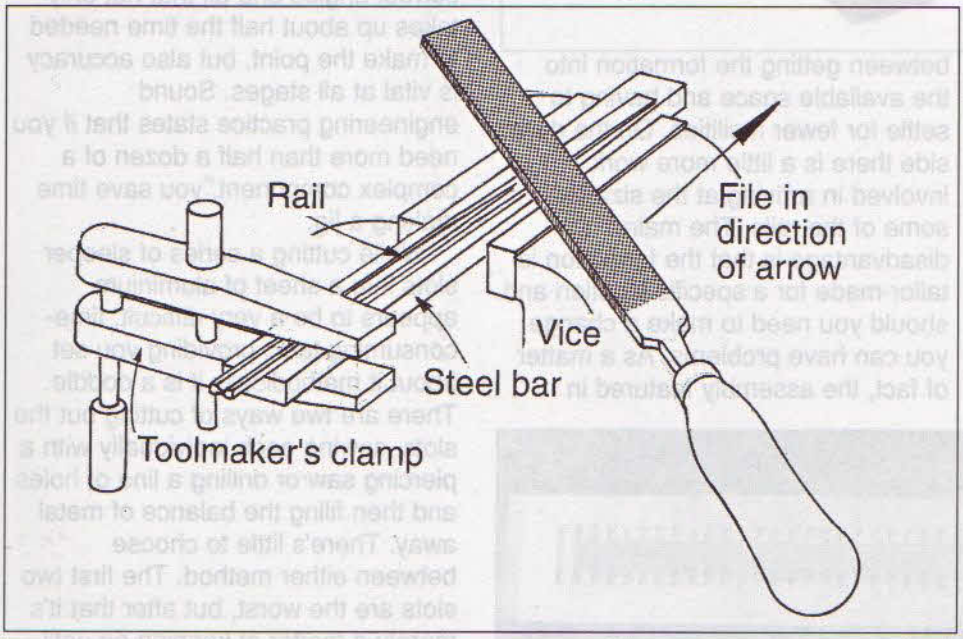
The jig is simple to use. PCB sleepers are placed in each of the slots. As with the tiebars mentioned above, the copper cladding is removed from the centre by the manufacturer. The gauge lath is screwed down and a length of rail

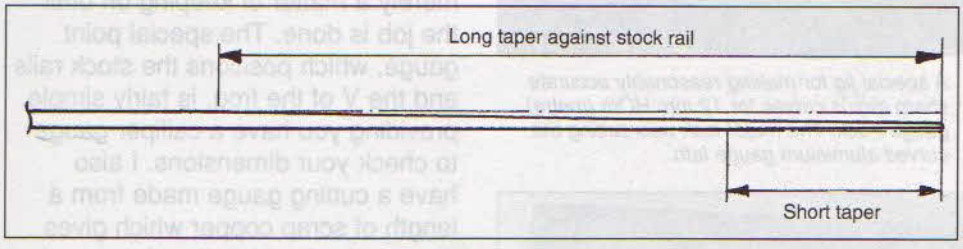


Left: *The parts of a standard point.*

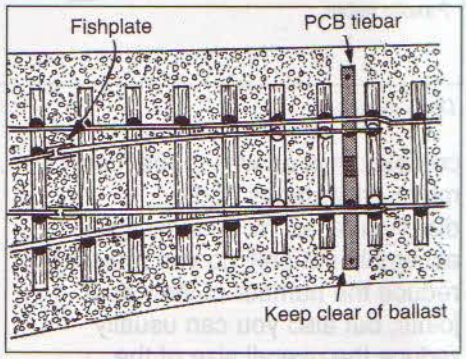


Above: *Detail of point blade and stock rail joggle.* ***Below:*** *Filing point blades.*





Taper on point blade.



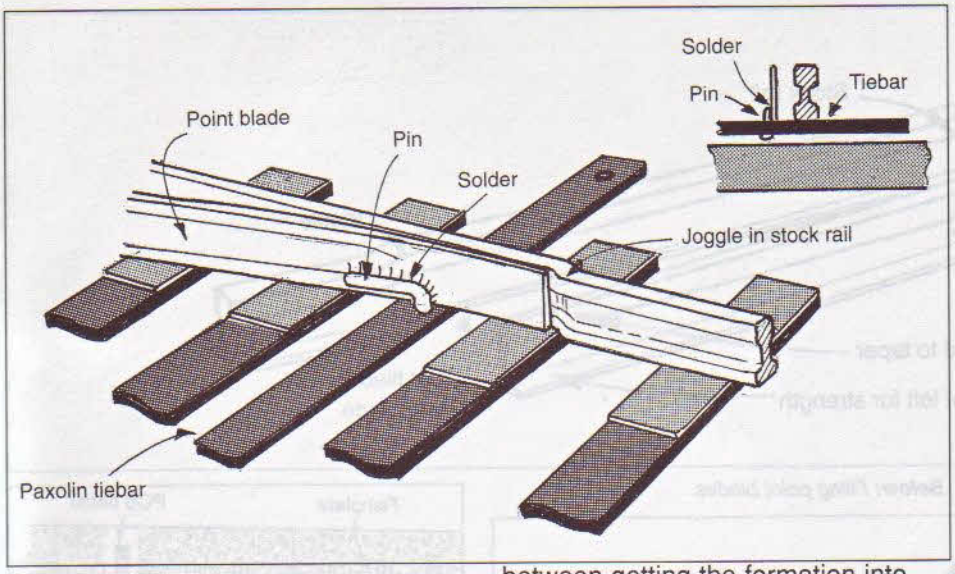
Detail of toe of point showing the pivoting of the point blades.

soldered to the sleepers. For straight track a further length is soldered to the other side. For curves the "half track" is removed from the jig and then shaped around a template.

The normal method of point assembly is to build up the unit on top of an accurate drawing of the point. These drawings are available commercially from various sources, including the specialised societies. The easy accessibility of photocopiers does, however, mean that anyone with a drawing board and some slight draughting skill can produce a master drawing of a pair of points, right and left-hand, and run off as many copies as are needed. If you have a computer with a respectable CAD program, the task is considerably simplified since not only can the plan for the RH point be flipped to produce the LH version, but you can also draw your rails and sleepers with absolute precision. Plans for complex point assemblies are created on a board by straightforward cut and paste techniques, using a quantity of individual point plans.

After this has been done, the sleepers are cut from strip PCB and secured in place over the plan with double-sided adhesive tape. It is a matter of choice whether the insulating gaps in the copper cladding are cut at this stage or later, for while it is easier to file the gaps on each sleeper before assembly, it takes appreciably longer to mark the positions.

Once the sleepers are in place, the procedure is the same as with wooden sleeper points. However, as I've brought up the idea of a multi-point

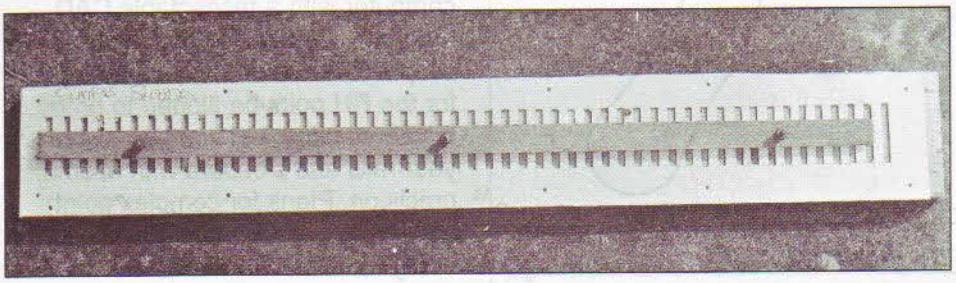


Detail of tiebar.

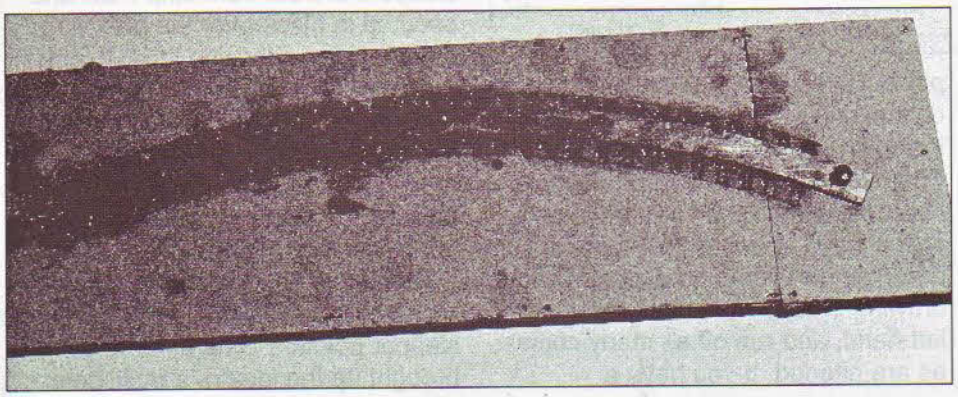
complex, it is as well to mention its major advantages and disadvantages. With an integral assembly not only do you materially reduce the number of individual joints, but also you can usually reduce the overall size of the formation by as much as 10 per cent. This can often mean the difference between getting the formation into the available space and having to settle for fewer facilities. On the down side there is a little more work involved in arriving at the size for some of the rails. The main disadvantage is that the formation is tailor-made for a specific location and should you need to make a change you can have problems. As a matter of fact, the assembly featured in some photographs here was for a scheme which I eventually aborted. It has hung unused on my garage wall for over 10 years. One day I will take my courage in both hands and dissect it into its component parts, because it is useless as it is.

One reason this has not been done is that some time ago I took to heart a bit of advice my father gave me when I was 15: `Laziness is useless unless it is properly organised.' Setting out sleepers, locating the various rails in position, getting parts cut to length, bent to the correct angles and all that not only takes up about half the time needed to make the point, but also accuracy is vital at all stages. Sound engineering practice states that if you need more than half a dozen of a complex component, you save time making a jig.

While cutting a series of sleeper slots into a sheet of aluminium appears to be a very difficult, time-consuming task, providing you set about it methodically it is a doddle. There are two ways of cutting out the slots, sawing each individually with a piercing saw or drilling a line of holes and then filing the balance of metal away. There's little to choose between either method. The first two slots are the worst, but after that it's merely a matter of keeping on until the job is done. The special point gauge, which positions the stock rails and the V of the frog, is fairly simple, providing you have a calliper gauge to check your dimensions. I also have a cutting gauge made from a length of scrap copper which gives the length of each rail and the angle to bend the wing rails, together with a couple of further gauges to locate the wing rails, but these are not absolutely essential.



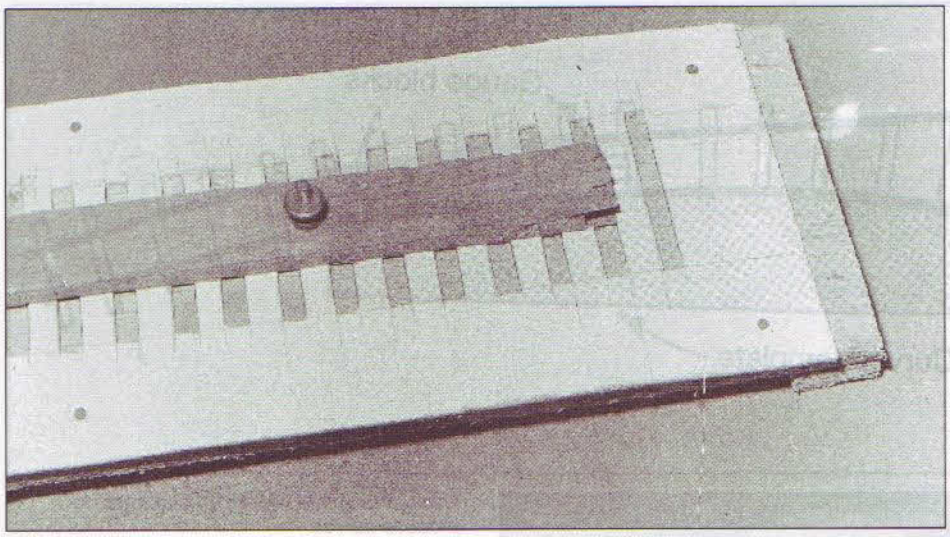
Jig for making soldered track using PCB sleepers. This is for 16.5 mm gauge and is long enough to make an 18 in (0.5 m) length of track.



A special jig for making reasonably accurate sharp radius curves for 12 mm HOm (metre) gauge track. The major task was cutting the curved aluminium gauge lath.

Ballast

An advantage of the Denny system is that the track is ready ballasted,



Close-up of one end of the straight track jig. The sleepers slot into holes cut into a sheet of cardboard pinned to a ply base. The gauge lath is cut from 3 mm ply and held in place with 6BA screws. The special nut, designed for a terminal screw, can be clearly seen.

while with PCB sleepers track has to be ballasted after laying. Ballast can be obtained commercially, but various common materials have been used. Fine grit or sand is an obvious choice, usually sieved to remove the larger lumps. Cork dust and dried coffee granules have also been used with considerable success.

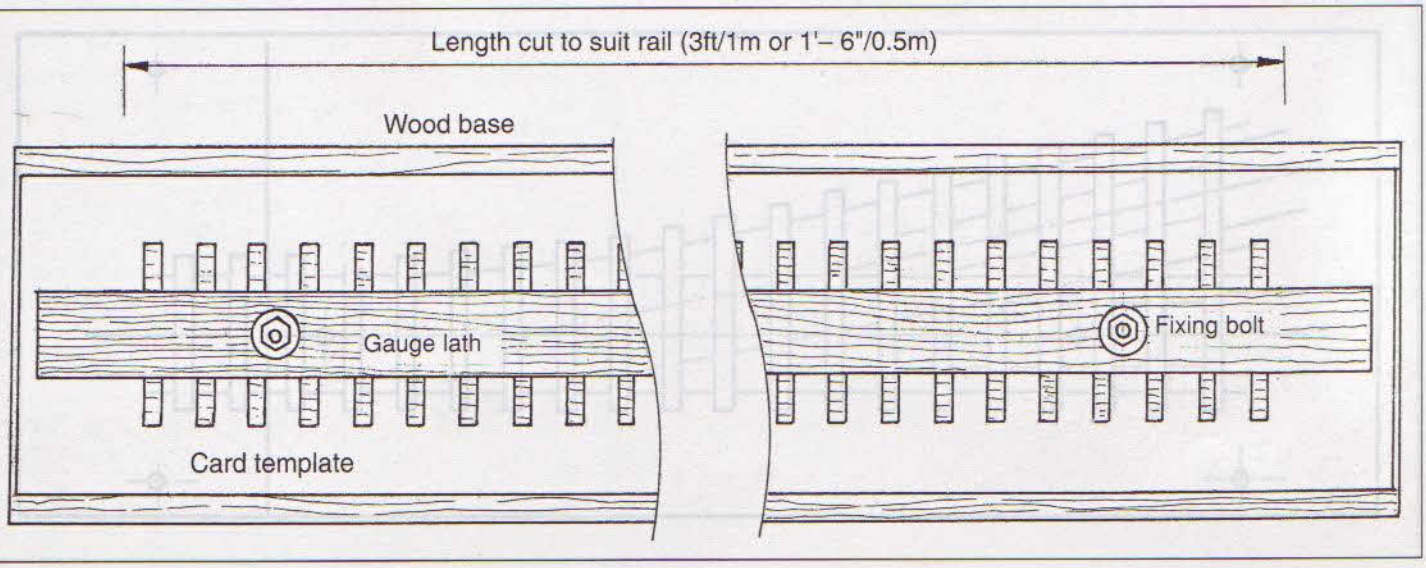
There are two schools of thought as to the best method of applying ballast. One mixes the adhesive with the ballast before applying, which means you have to poke a sticky mess under the rails. The other, which I favour applies the ballast dry and brushes into position, using scraps of card or anything similar to hand to help form the shoulder. Once it is correctly laid, with no ballast on the sleepers or around tiebars, PVA adhesive, let down with an equal amount of tap water to which a drop of washing up liquid has been added to reduce surface tension, is dribbled on to the ballast, either with an eye-dropper or a small spoon. The ballast is then left to harden. Although initially the adhesive turns the mixture light grey, it is invisible when dry.

Buying track components

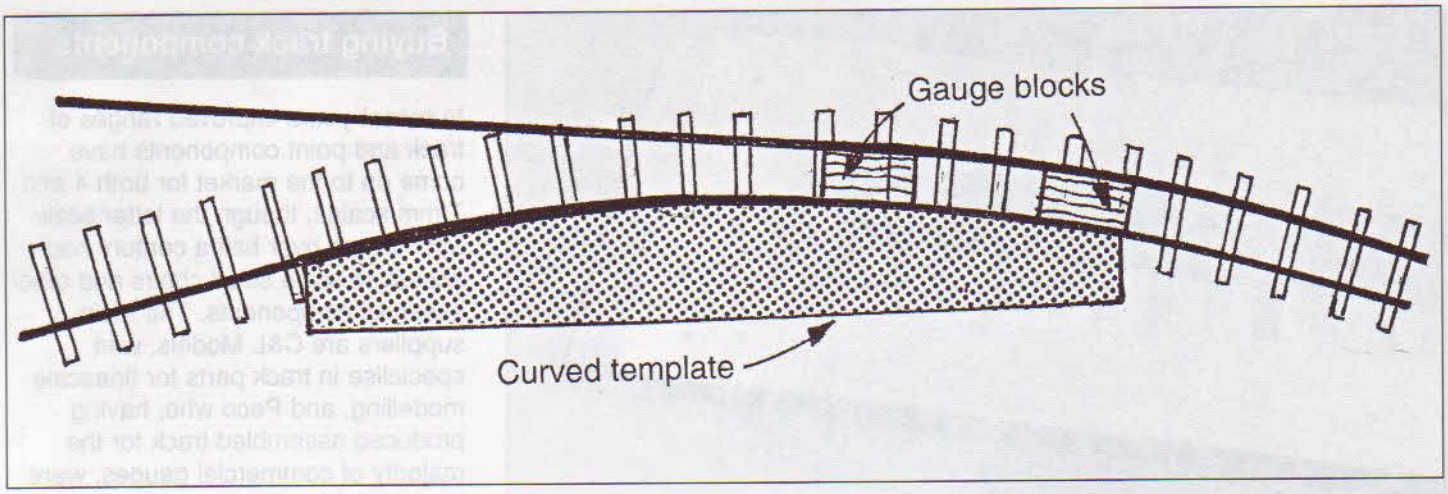
In recent years improved ranges of track and point components have come on to the market for both 4 and 7 mm scales, though the latter scale has for well over half a century had access to scale sized chairs and other essential components. The main suppliers are C&L Models, who specialise in track parts for finescale modelling, and Peco who, having produced assembled track for the majority of commercial gauges, went back to the beginning by reintroducing the Individulay concept for modern flat-bottom track. The new Individulay is a vast improvement over its original version in both detail appearance and ease of assembly.

I pointed out that the cost of individual components is greater than the cost of ready-assembled track. This is because with ready-assembled track there are just two parts involved, the rail and the base. They are assembled in a machine, packed in batches of 25 in a straight-forward card container and sent out with minimal instructions. With individual sleepers and chairs, small fiddly parts have to be counted and individually packed, and very detailed assembly instructions must be provided.

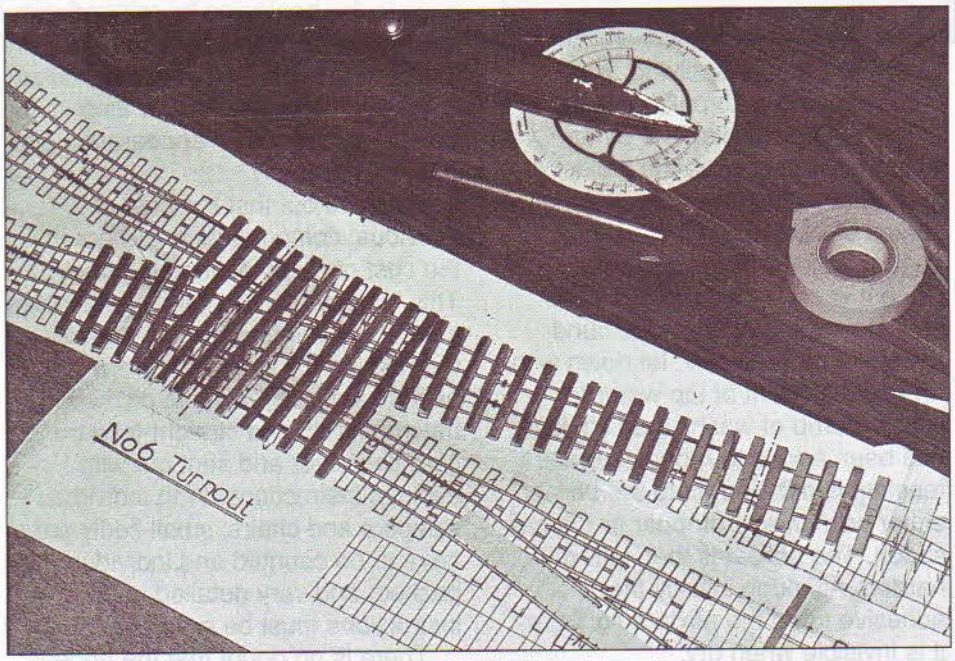
There is no doubt that the appear-



Jig for assembling PCB sleeper track.



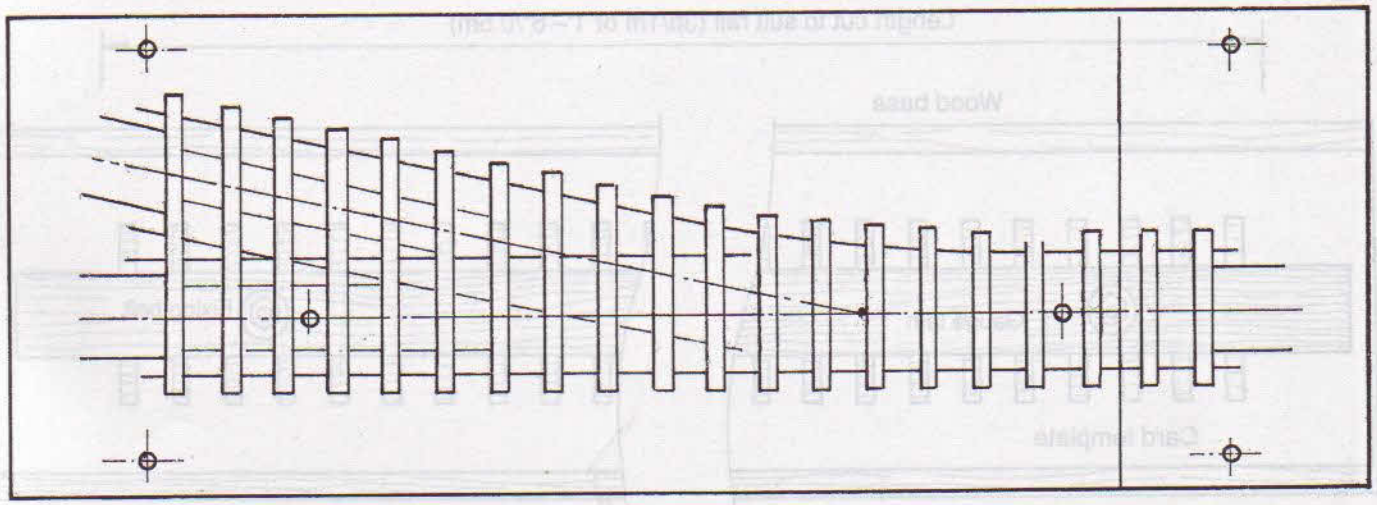
Using a template with PCB `half track' to produce curves.



Early stages in the construction of a point complex. The point plans have been taped down onto a board, PCB sleeper strip is being cut to length and fixed in place using double-sided adhesive tape.

ance of hand-built track using modern components is superb, and in photographs, where the parts are reproduced larger than actual size, the effect is astounding. Often the only clue to tell you that this is a model and not the full size prototype is the inability of the camera to get everything in sharp focus.

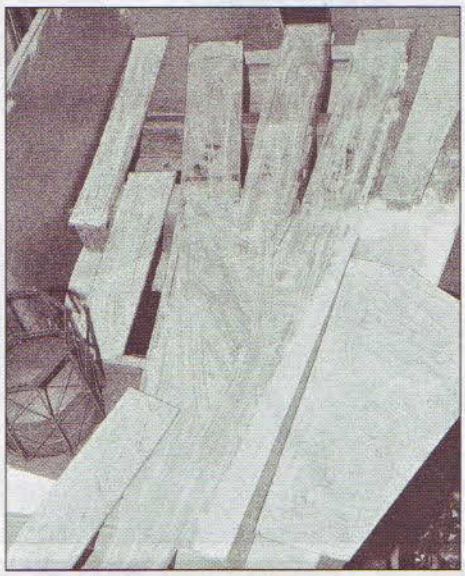
Sleeper spacing jig for standardised point.



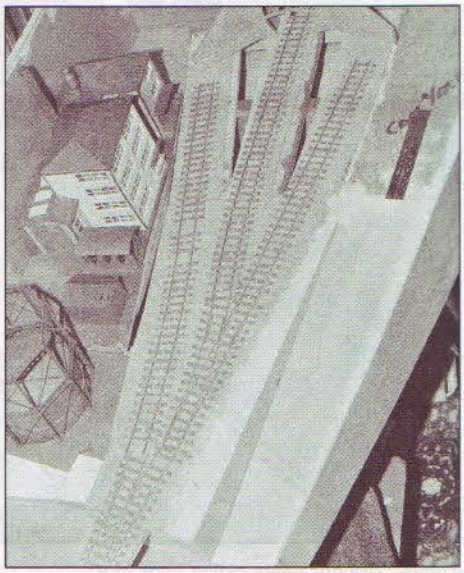
Track gauge for point jig.

According to those who have worked with the parts, it is no more difficult than the apparently simpler methods I have described. I have no reason to doubt this but the fact remains that everyone concerned has had a good deal of experience with soldered track construction. Whether a newcomer would find it so simple is unanswered. Therefore, while I would not attempt to stop anyone from starting track assembly using these superb fittings, I would advise a little initial trial with the low-cost wooden sleeper and pin method. If you aren't temperamentally adjusted to track construction – and there are many who are not so gifted – you have only wasted a little rail and your time. If indeed you have wasted anything; a dozen hours and a few pounds outlay is not much to pay to discover you find the whole thing a tedious bore.

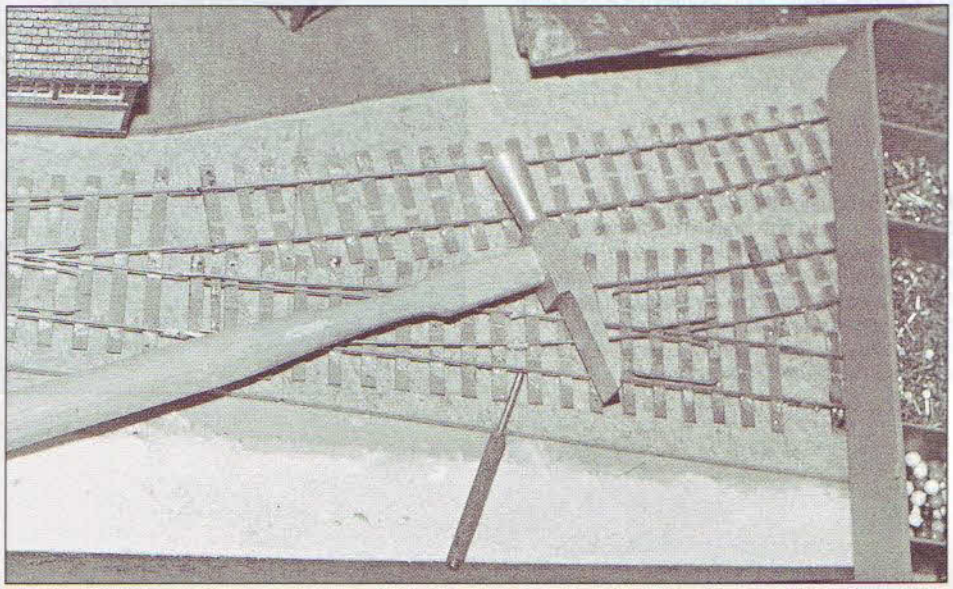
Before I leave the subject, I should mention one important advantage of soldered track construction. Small errors can be readily corrected with a hot soldering iron and a pair of pliers. In addition, it is not too difficult to repair track in situ, though as always, where serious trouble arises, relaying with new or bench-reconditioned track is usually the quickest way of resolving the problem.



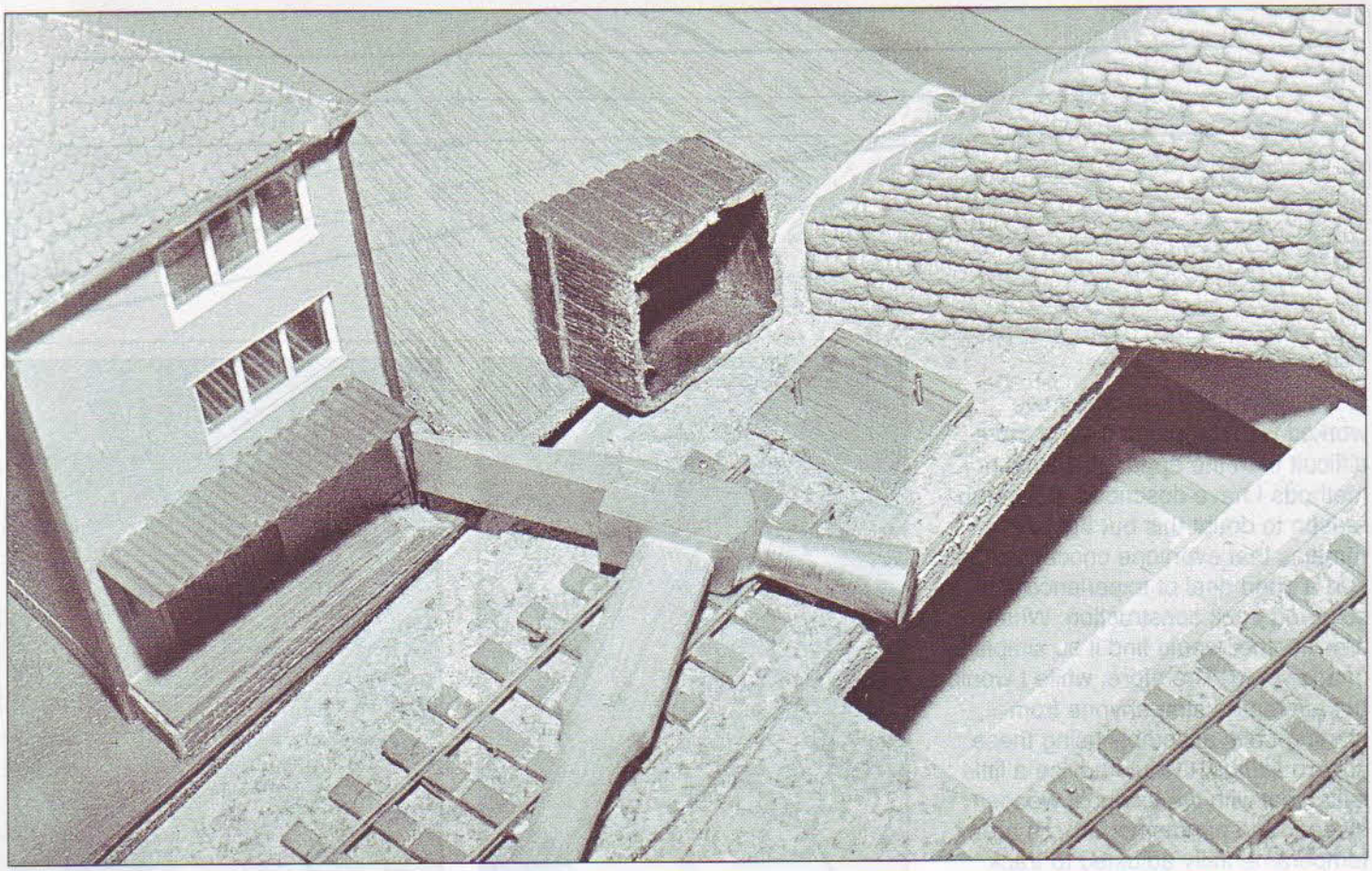
The first stage of tracklaying on the coalyard section was to cover the plywood bases with cork underlay cut from 1/8 in cork tiles stuck down with contact adhesive. It will be seen that the gasholder for the gasworks has already been finished; there's no rule that says you must progress in a linear fashion.



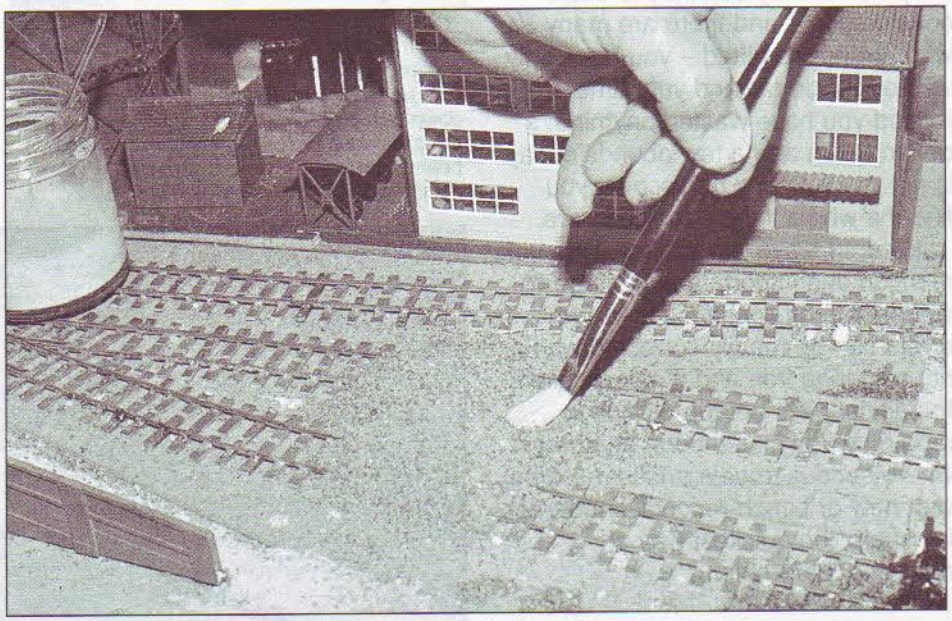
The underlay is down and the track is laid roughly in place. The buildings for the gasworks have also been put in place, together with the tunnel mouth. A little landscaping has taken place and the joints in the roadway have been smoothed over with a coating of plaster.



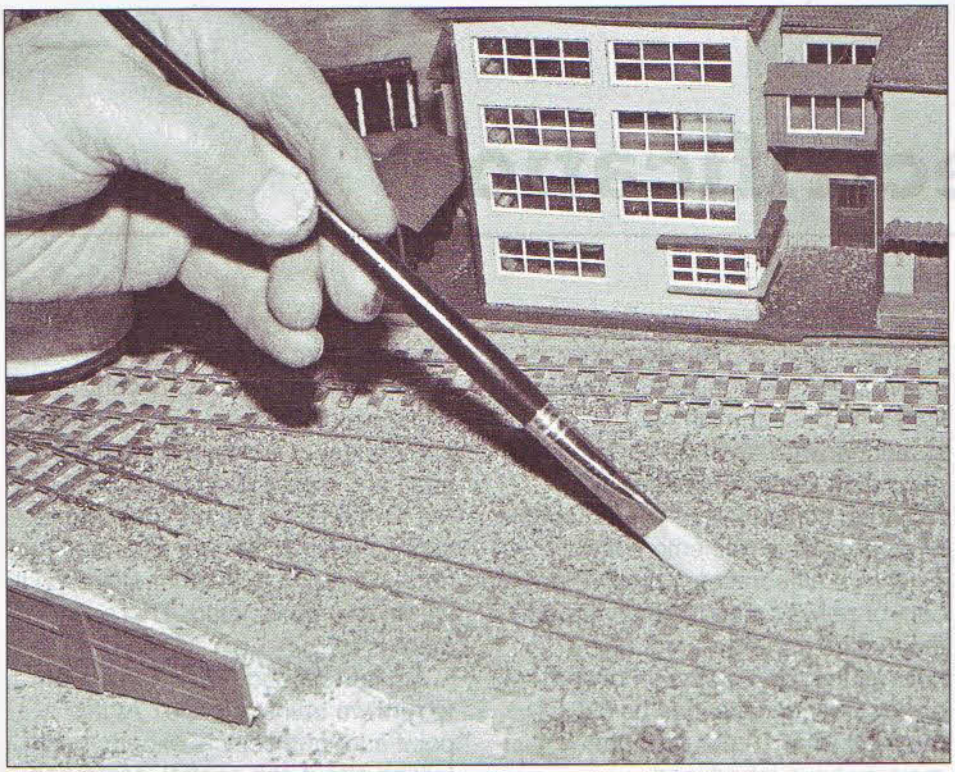
***Right:** Tracklaying in progress. Track is pinned down through pre-drilled holes with 3/8 in steel pins, using a light jeweller's hammer with a small pin punch to drive the pins home. A part of my pin box is to the right, just in front of a sleeper gap which was filled before I went any further.*



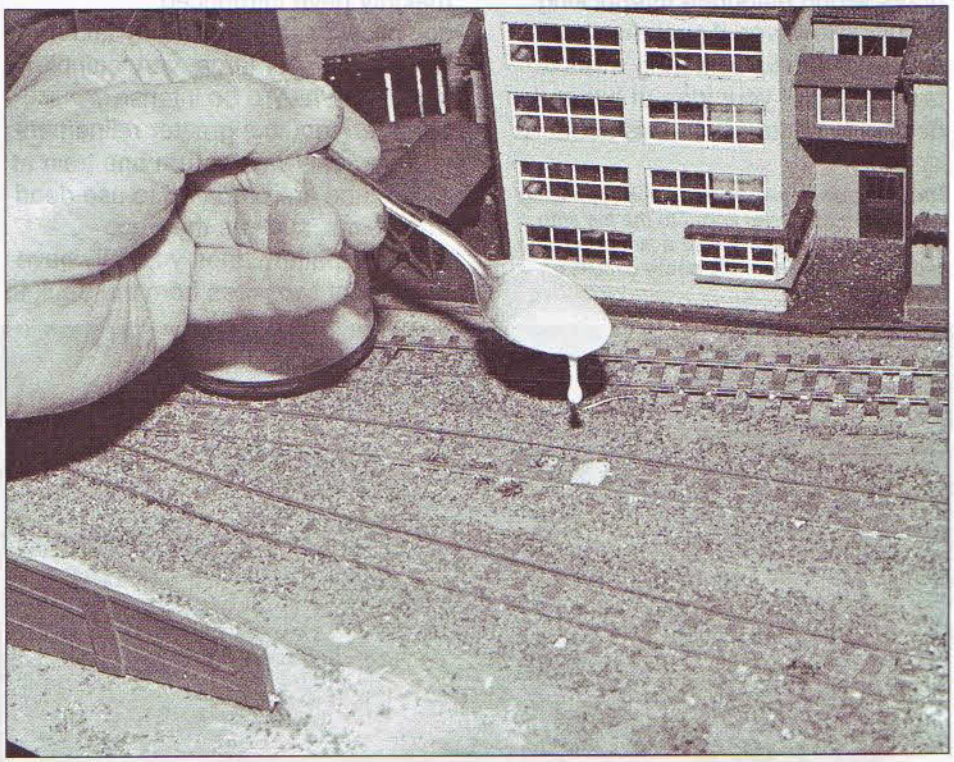
Above: *The gasworks siding ends in a sleeper-built buffer stop, another useful track accessory from Peco. It has seen use on another layout, where it was merely stuck down and soon got knocked off. This time I decided it was not going to be so vulnerable so a small piece of 3 mm ply has been cut to fit snugly inside and is pinned to the base. A good fillet of epoxy resin completes a very firm fixture.*



Right: *Eventually, the track had to be ballasted. I used fine granite chippings and initially dumped a heap in the middle, as happens on the prototype. However, instead of having a plough fitted to a redundant goods brake van, I used a large flat artist's brush from a cheap carded set. The jar on the left contains the diluted PVA adhesive.*



Above: *The same brush was used to tidy up the edges of the ballast and to tease the material gently into the correct places. This is a lot easier to do than to describe in detail, but it does help to spend some time looking at full size track.*



Right: *Once the first batch of ballast had been spread out to my satisfaction, it had to be stuck down. This was done with PVA woodworking adhesive, diluted with an equal quantity of water with a drop of washing up liquid added to reduce the surface tension and so let the mixture flow freely between the grains. The glue is either dropped from an old teaspoon, as shown here, or through an eye dropper. The whole area of ballast needs to be thoroughly soaked and left to harden. Afterwards, although the ballast still looks loose, but it takes brute force to shift it.*

Chapter 9

Simple Electrification

Model railway electrification is child's play. After all, most eight-year-old children, given a basic train set system, manage to connect it satisfactorily and get the trains running. Yet many adults approach the task with trepidation and succeed in convincing themselves that it is an esoteric subject and that an MSc degree is a prerequisite.

Yes, you can delve deeply into electronics and computers or have a wonderful time installing banks of relays. You can spend many happy hours wiring elaborate interlocking circuits. However, if spending a couple of weeks soldering wires to tag strips isn't your idea of fun and designing control circuits is about as appealing as filling in your tax returns, you don't have to bother. Leave that sort of thing to those who love it and use the simple, straightforward approach preferred by most enthusiasts of the hobby. Although control systems are capable of considerable refinement and extensive elaboration, some 90 per cent of railway modellers go through their entire career without going beyond the simple straightforward arrangements described below. Of the remaining 10 per cent, the majority have introduced complications because they find it fun. Only a very large, very complex layout that has to be intensively operated requires greater refinement.

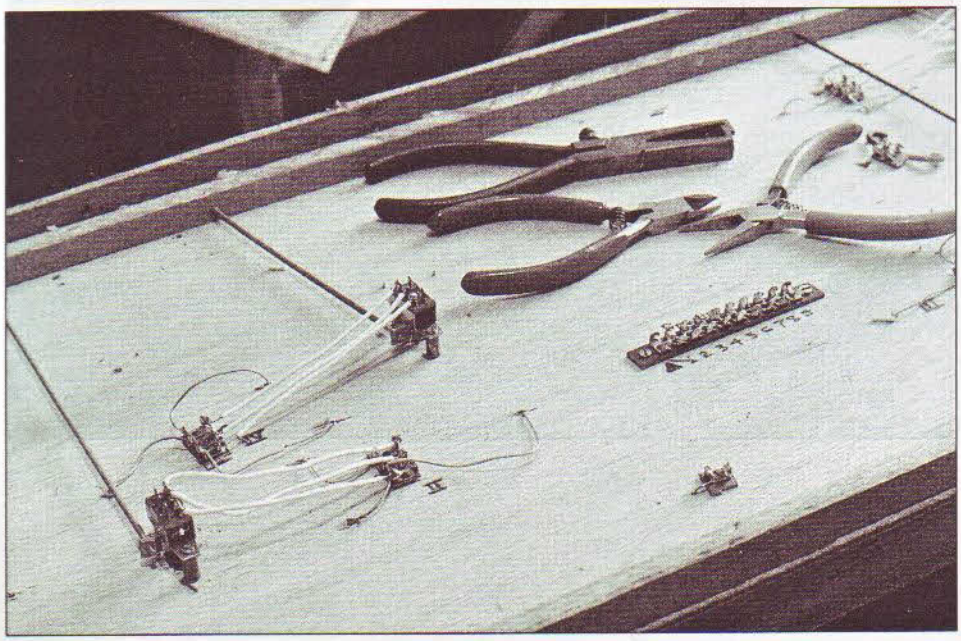
If you only want to run one train at a time and are prepared to use dead frog points, such as the Peco Insulfrog pattern, then you only have to connect two wires from the track to the power unit, place a locomotive on the track, turn on the power and enjoy yourself. When you want to add a second locomotive, you simply put the first in a siding, throw the point and isolate it. You can now run the second loco. When you want to change over to the first you need to put the second in another siding so it can in turn be isolated. That's all there is to it.

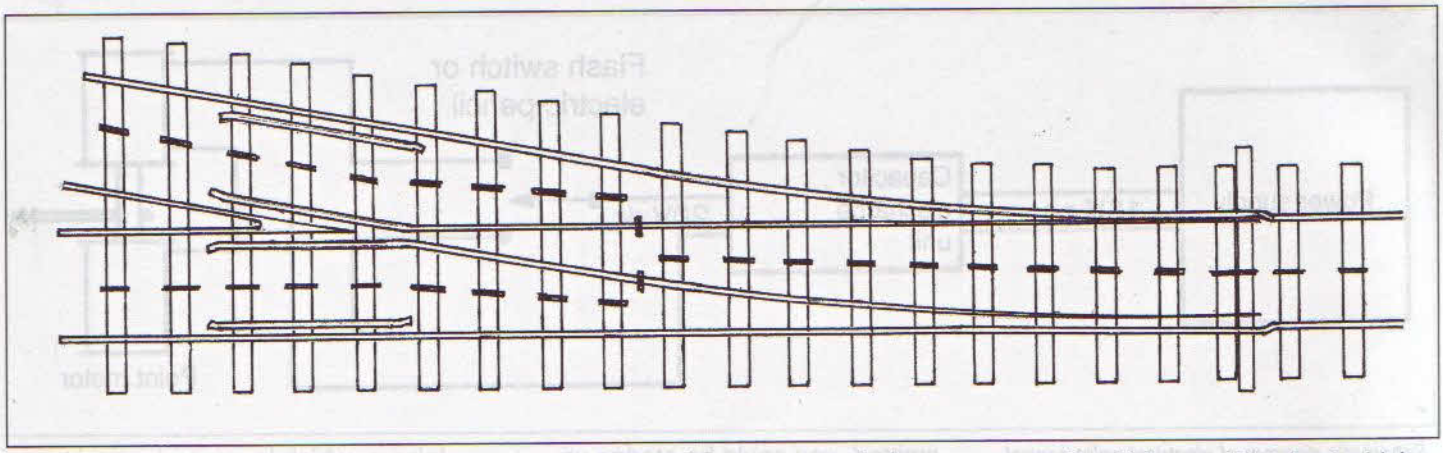
So far so good. What if you want to run two trains at once? At this point a lot of electrical experts begin talking about cab control, command control or else begin to explain the underlying principles of track circuits and automatic control. All this is not only mystifying, it is also unnecessary because it overlooks the practicalities of operating two trains at once.

If you have two trains on the same section of track, then they must move in unison. If you stop the one in front, let alone reverse it, a collision is inevitable. To run two trains independently on a layout, you need two independent circuits, or to put it another way, you need double track, with each track fed from a separate control.

In practice, the number of trains you can run independently on one layout depends on the complexity of the layout, which in turn is determined by the overall size of the model. There is, however, a more important restriction, namely that you can only control one train at a time. On a large layout it is possible to start one train and leave it to lap the main line whilst you deal with another, but on a relatively small, simple layout it saves a good deal of

The changeover switch of the point operating mechanism has been linked to the tag strip with short wires. To the right a larger tag strip has been installed for the power circuits on this baseboard.





Insulation gaps on a PCB turnout. This is arranged so that the point blades are always at the same polarity as the adjacent stock rail, which is preferable to having the blades electrically connected to the frog.

trouble and a fair amount of money if, initially, you adopt the `one engine in steam' rule and avoid all complexities. When you want to go further into the subject, I would refer you to my book *Model Railway Wiring* (Patrick Stephens Ltd, 1989) which explains the principles in greater detail.

Basic equipment

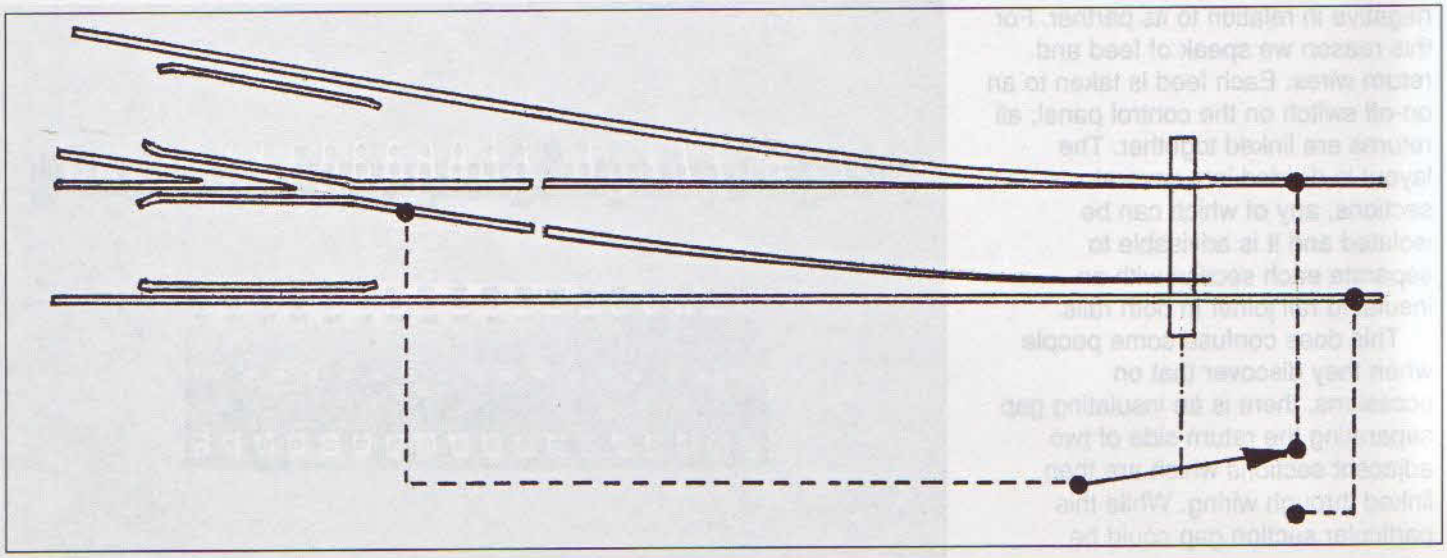
To power a layout you need a power unit, a combined transformer, rectifier and controller. The most useful types have a variable DC supply to run the train and an independent 16 V ac uncontrolled output which is intended for auxiliary circuits. These are usually point motors, but the 16 V ac can also be fed into a separate rectifier/controller which can be located at the other end of the layout. Such a unit is reasonably priced and sufficiently versatile to meet most needs at the outset. It will always be useful, no matter how you develop the layout.

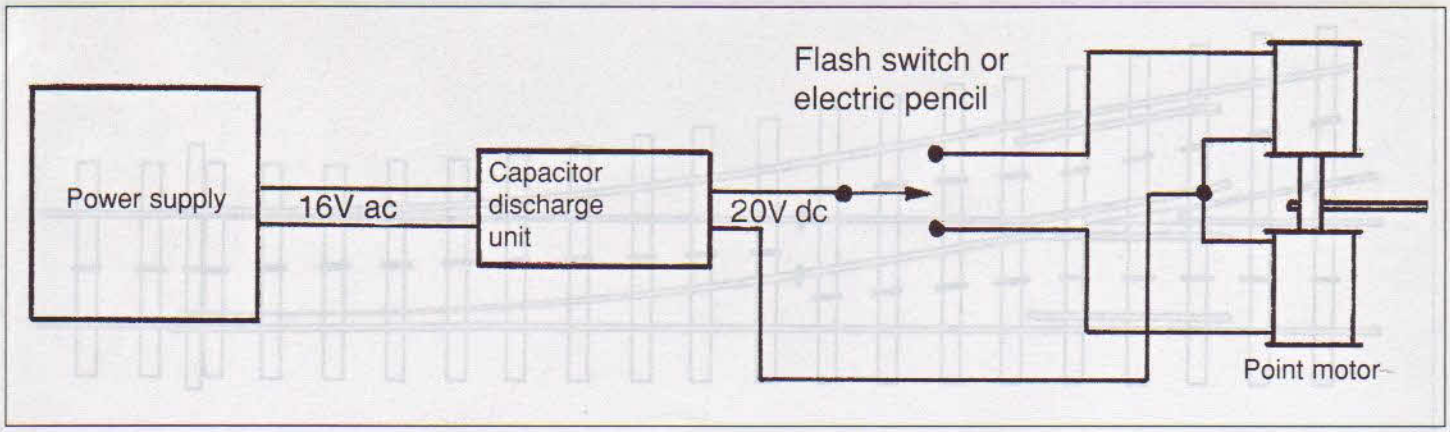
Points

Two rail wiring is fairly obvious, until you come to points. The type of points supplied with sectional track systems and the Peco Insulfrog range are wired so that you can't set up a short circuit. Peco Electrofrog and most of the more advanced types, including those you build yourself, will have a 'live frog' which is connected to the stock rails through some form of changeover switch so that this section of the point is connected to the appropriate running rail.

With this class of point you can easily get a short circuit. There are two simple rules. The first is that you arrange the feed to the toe end of all points and introduce insulated breaks to avoid connecting a frog to either the feed or return circuit. The rules are given in more detail in *Model Railway Wiring*. This also covers such matters as the wiring of diamond crossings and reverse

Basic wiring for a live frog, two rail point. One reason why I use a slider switch as part of a mechanical point operating system is that the contacts are there for immediate use. Most modern point motors include a changeover switch, or can have one fitted.





Schematic diagram of electrical point control, incorporating a capacitor discharge unit.

loops. These can become a little fraught, so the simple approach with diamond crossings is to use a commercial pattern with insulated frogs. The simple way round the complexities of the reverse loop and triangle is not to include them in the first instance.

Feed and return wires

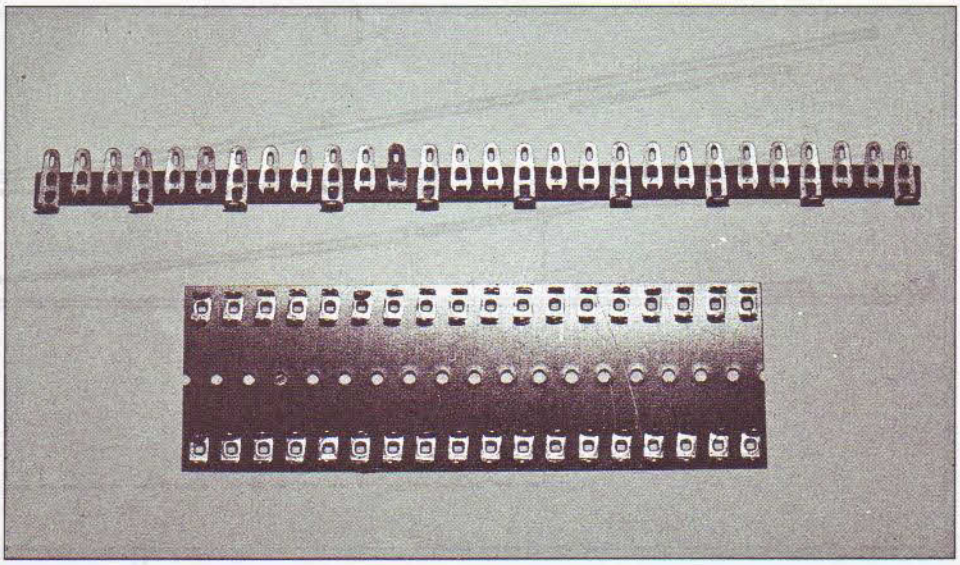
As model railways operate on dc current, a lot of people talk of positive and negative rails and wires. However, to reverse the locomotive you reverse the polarity of the rails and so, strictly speaking, the rails carry an extremely low frequency ac supply with an irregular cycle and any given rail can be positive or negative in relation to its partner. For this reason we speak of feed and return wires. Each feed is taken to an on-off switch on the control panel, all returns are linked together. The layout is divided into several sections, any of which can be isolated and it is advisable to separate each section with an insulated rail joiner in both rails.

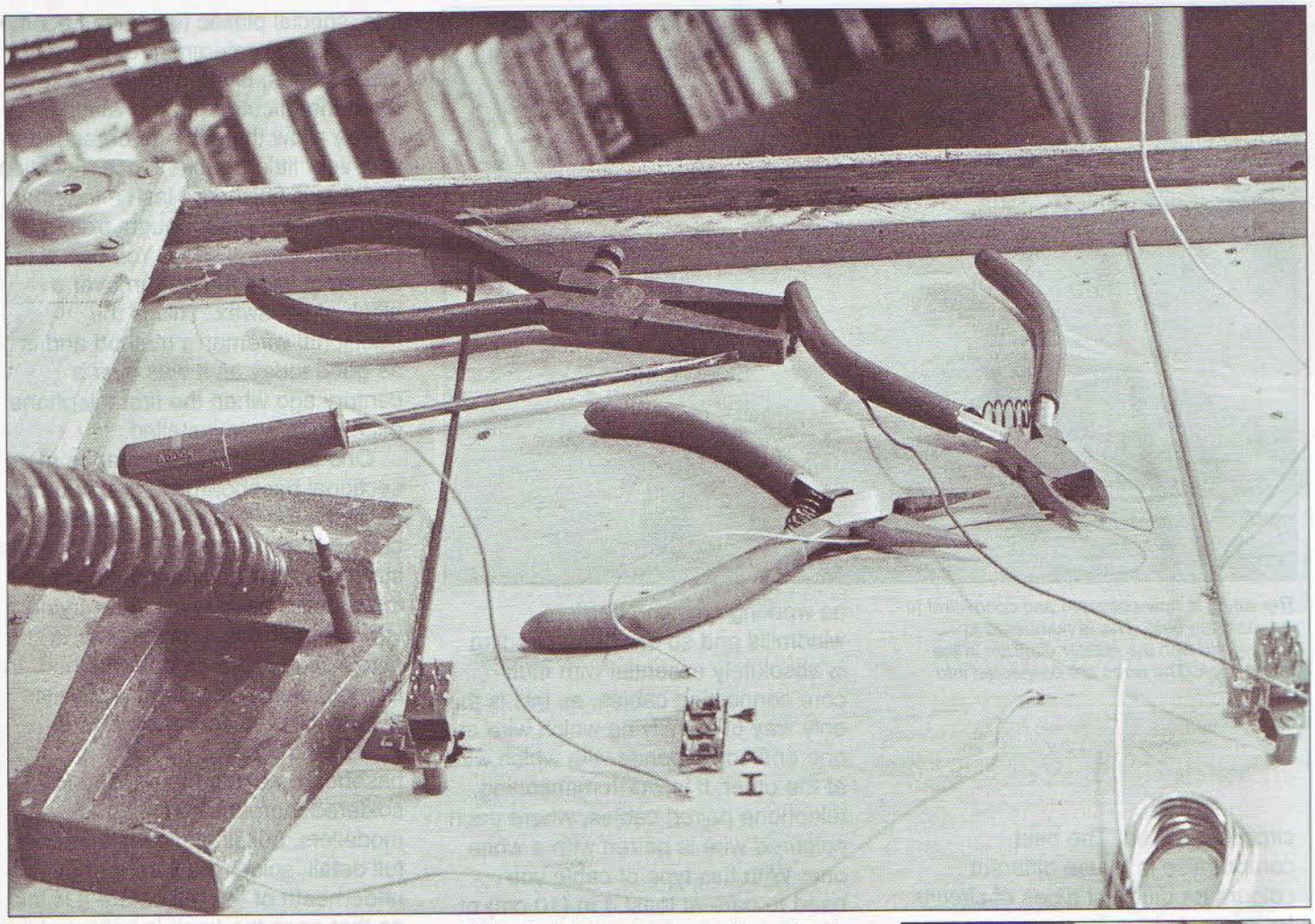
This does confuse some people when they discover that on occasions, there is an insulating gap separating the return side of two adjacent sections which are then linked through wiring. While this particular section gap could be omitted, you could be storing up trouble if at a later date you decide to add an extra point into one of the sections. There is also the possibility of linking too many return rails together and carrying the supply for a long distance along the rails. This can give rise to voltage drop, which when you only begin with 12 volts maximum can be quite serious.

It is worth going into this matter in detail. The best rails are made from nickel silver. It looks like steel and doesn't corrode, but it does have a high electrical resistance. Rails have a reasonable cross-section, though the finer scale sizes favoured today have a higher resistance per metre than their older counterparts. You cannot neglect the resistance of a long length of rail.

Worse is to come because rail joiners, which in general we rely on for electrical connections between rails, are inefficient in this role and tend to get worse with age. So long as you only have a few in a section you can get away with it, but if you try to use the entire return rail of even a modest layout as your common return, you're asking for trouble. You can easily get 10 ohms or more in your circuit and that's enough to slow anything down and bring a heavily loaded train to a halt. Put in a few extra connections to low resistance copper wire and the trouble is in practical terms, eliminated.

Two types of tag strip. The lower pattern with two solder tags at each location is preferred. Frequently the centre is sawn through to provide two rows of tags which are cut to length. A No 1 woodscrew fits comfortably into the centre of the tag.



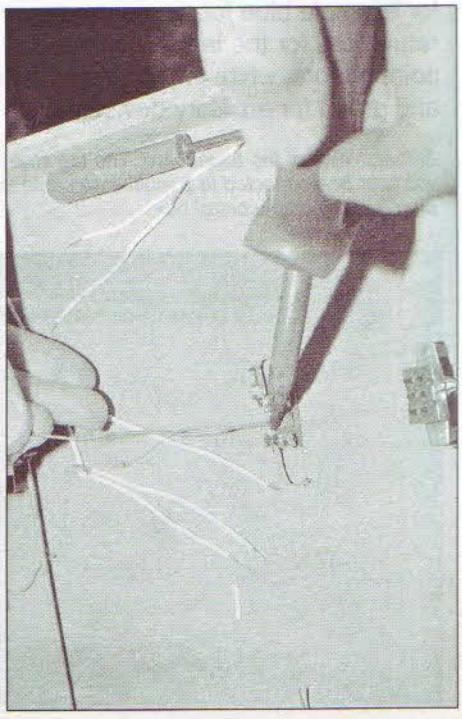


Above: *Preparations for wiring. The soldering iron stand is on the extreme left, with a wire stripper just beyond the screwdriver. The pair of small snipe- nose pliers are used to bend and clinch the ends of wire into solder tags, whilst the side cutters on the right are needed to cut and trim the wire. A coil of cored solder is in the right foreground.*

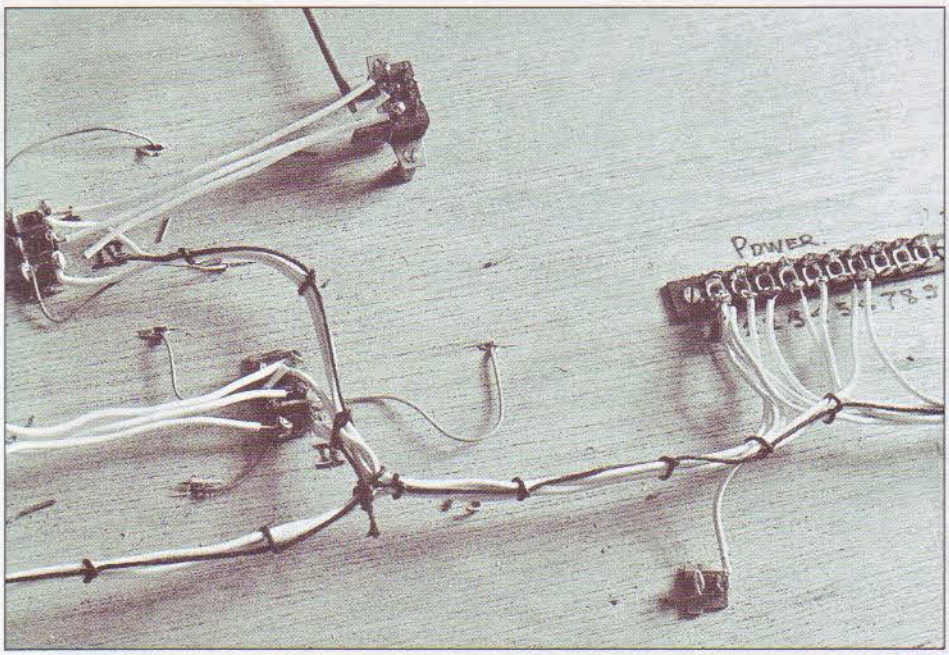
Methods of wiring

So much for the theory. When we turn to the practical side of wiring, there are two possible methods. The bad system is to link the various parts with the shortest possible length of wire, going directly from the track to the control panel. This soon leads to a cat's cradle of wires under the baseboard which defies identification after a couple of weeks. The good system, which is shown in the photographs, is to make good use of tag strips and to run the wires around all possible obstructions, producing a neat cable at the end. At the same time, you make a record of which terminal on the tag strip is connected to which length of track, or which switch on the panel. On a portable or transportable layout, you will also use tag strips to connect the jumper sockets and cables and again note which is which.

Another method of identifying circuits is colour coding. This is only partially successful on a model railway due to the number of different



Right: *Soldering a wire to a section of tag strip. The wire has already been bent and clinched around the tag, the hot iron is placed against it and the cored solder pressed against the iron. The tag strip was cut from the double row pattern tag strip seen in an earlier photograph. In this instance, I am connecting the dropper wires from points to a three-tag strip.*



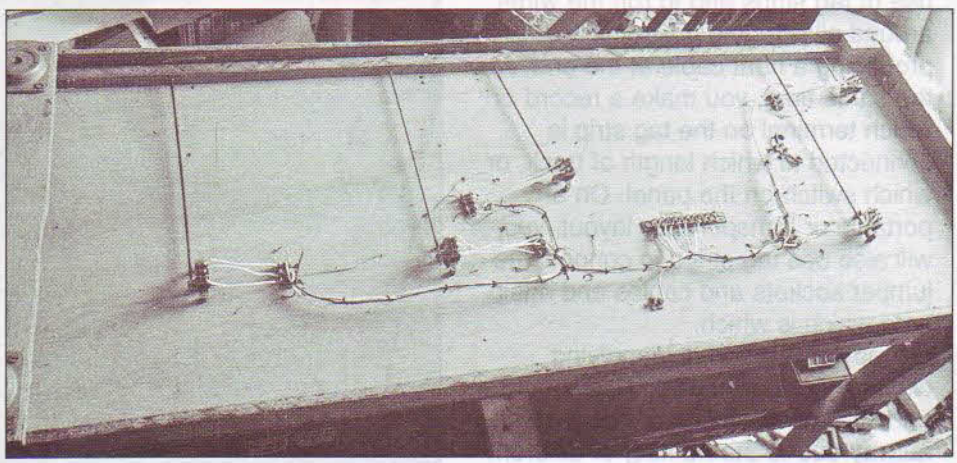
The wiring is now complete and connected to the main tag strip. This is numbered to correspond with the master diagram in the wiring book. The wires are connected into cables.

circuits involved. The best compromise is to use different colours for different types of circuits, for example blue for the common return, red for the feeds, black for point motors, white for lighting circuits and green for auxiliary devices such as working crossing barriers, windmills and so on. Colour coding is absolutely essential with multi-core connecting cables, as this is the only way of identifying which wire at one end corresponds with which wire at the other. It is worth mentioning telephone paired cables, where each coloured wire is paired with a white one. With this type of cable you need to bare at least 4 in (10 cm) of wire to be able to identify the pairing. Telephone engineers often strip off 1 ft 6 in (0.5 m), but their junction boxes are designed with this in mind.

There are various approaches to cabling the loose wires together. Of late, special plastic ties have become popular. My preference, during the initial stages, is the simple wire twist, often the offcuts from the wiring. These allow the cable to be added to with very little trouble. Once a section of cable is finished, I lash it together with waxed thread, bought from a proper cobbler's shop. You can also use stout linen thread run over a block of beeswax. This is the traditional wireman's method and is as good today as it was over a century ago when the first telephone exchanges were installed.

One of the main advantages of sectional baseboards is that you can easily tip them on to their sides to carry out the wiring. Even so, there is still the matter of carrying the wires through the baseboard. After trying various methods, I have come to favour the simple dropper method. In its most elementary form it consists of some 2 in (5 cm) of bare wire, threaded through a hole in the baseboard next to the rail and soldered thereto. Advanced modellers, building finescale track in full detail, solder the wire to the underneath of the rail before it is laid so that once the track is ballasted it is invisible. When the baseboard is turned over, the bare wire can be connected to a tag strip, which is preferable to just soldering a length of insulated wire to it. Alternatively, a slightly longer piece of insulated wire is carried through the baseboard, which allows several droppers to be connected to a convenient tag strip.

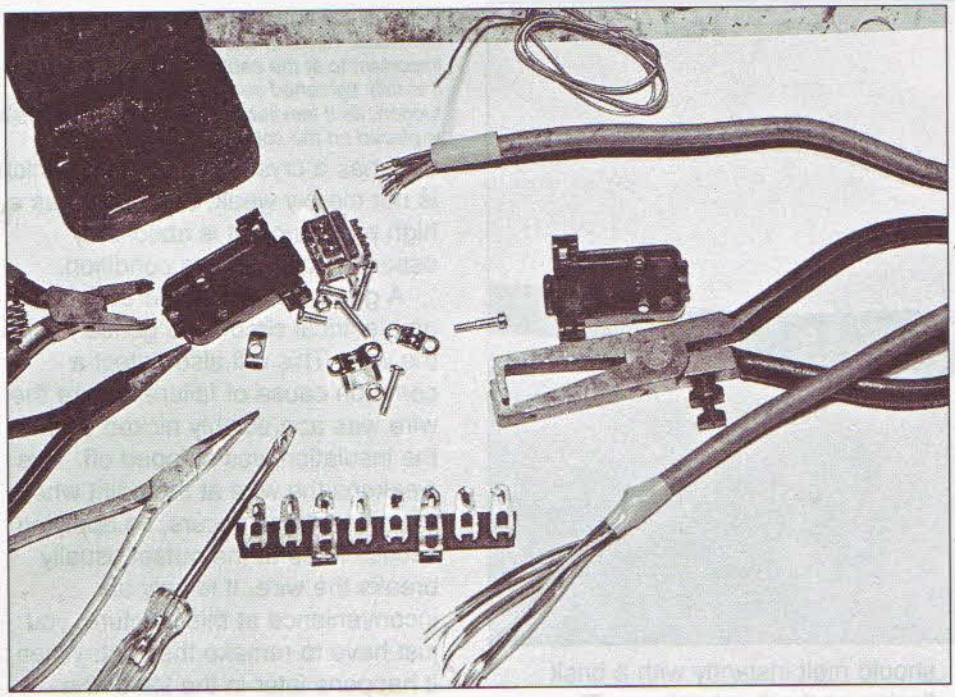
General view of the baseboard. The tag strip will later be connected to a multi-core cable to plug into the main control box.



Soldering

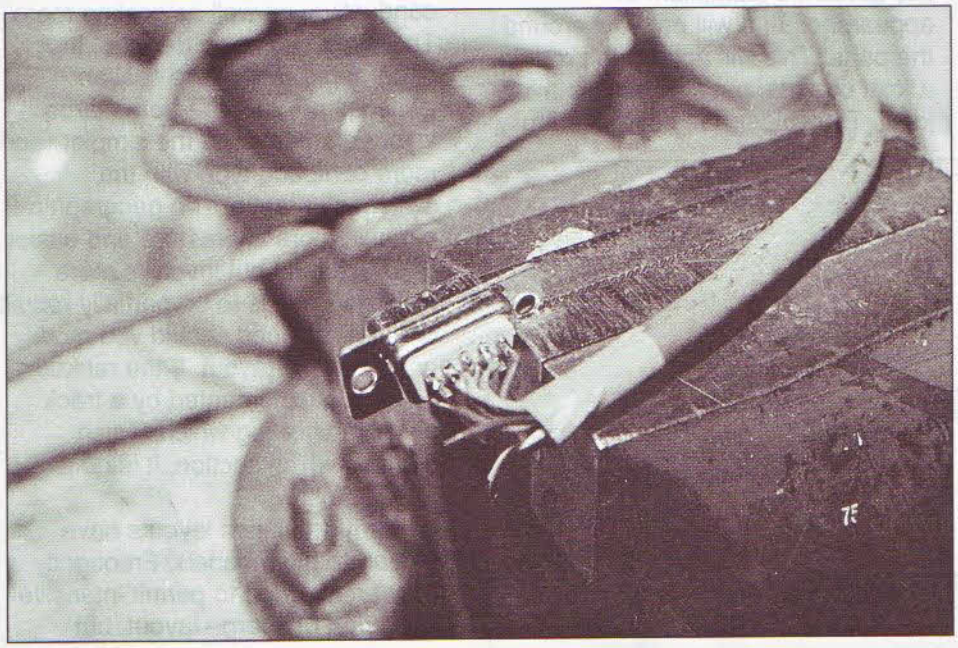
To solder wire securely to the rail, you must clean the metal. My pet tool is the business end of a small screwdriver, which makes quite an effective scraper for cutting through the inevitable oxide film that forms on both brass and nickel silver after a few weeks' exposure.

This brings me to the business of



On a portable layout, electrical connections are most conveniently made through multi-pin plugs and multi-cored cables. The D pattern plugs and sockets associated with computers are just as useful for model railways. Here we have the start of an eight-way jumper cable, a nine-pin D plug, dismantled, and eight-way tag strip, the necessary tools and the cable. Fine pliers are indicated as the spacing on the D plug is very tight. The eight-core cable has been stripped at each end and bound with adhesive tape. Note the different lengths for the D plug and tag strip respectively.

making a soldered joint. It is a simple technique, given the requisite tools, of which a *hot* soldering iron is the most important. The advent of the now universal electric bit has been a godsend. For wiring a 15 watt iron suffices but 25 watt is better. A fairly small bit is best and a proper stand is, I consider, a wise addition to the set up. The pattern with a heavy base and a coiled spring holder is best for this type of iron, since the hot end of the tool is nicely shrouded, with ample ventilation to dissipate excess heat. Providing you get into the habit of putting the iron back in its holder every time, the chances of an accident are greatly reduced and the only serious consequences of accidentally leaving the tool switched on overnight will be some reduction in the life of the bit and an increase in your electricity bill.



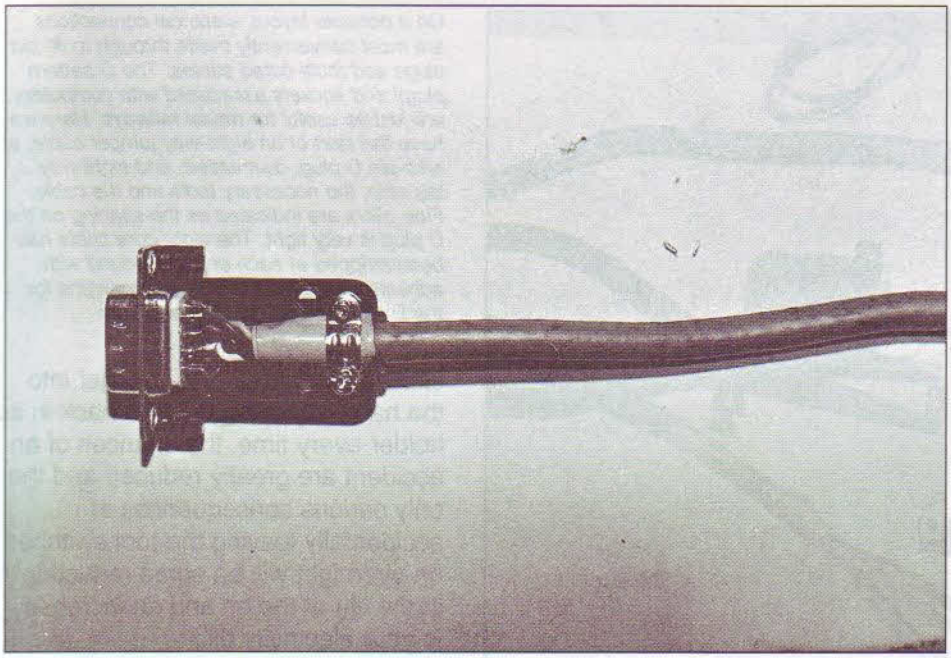
When soldering wires to a D plug or any similar fitting, it is much easier if the plug is held in a vice so it stays put while you carefully align the wire and apply the soldering iron. Even so, you feel you need three hands. My technique is to tin the wire ends, and trim them to fit the solder terminals on the plug, which are also lightly tinned. The wire is then held in the terminal with a small pair of pliers and the hot iron applied to them both.

The other essentials are solder and flux. The first is self evident, the second is often ignored since the most readily available form of solder has a fluxed core and it is often implied that nothing else is required. Don't you believe it.

The purpose of the flux is to assist the solder to flow. Part of this task is achieved by preventing any oxide build-up on the metal. You may have scraped it clean, but the moment you place a hot soldering iron against it, you bring it up to the point where the process of oxidisation moves into high gear. The flux film inhibits this.

Fluxes fall into two groups, the active fluxes, which are generally fluids and the non-active, which are pastes. The former is fine if you can wash the joint afterwards. With electrical wiring this is undesirable and frequently impossible. Paste flux is applied sparingly with a small spatula, almost always a scrap of wood, but occasionally the tip of a small screwdriver.

The only time you don't need to apply extra flux when using cored solder is where both joint surfaces are either pre-tinned (coated with solder) or specially prepared with an anti-oxidizing film. A good example of



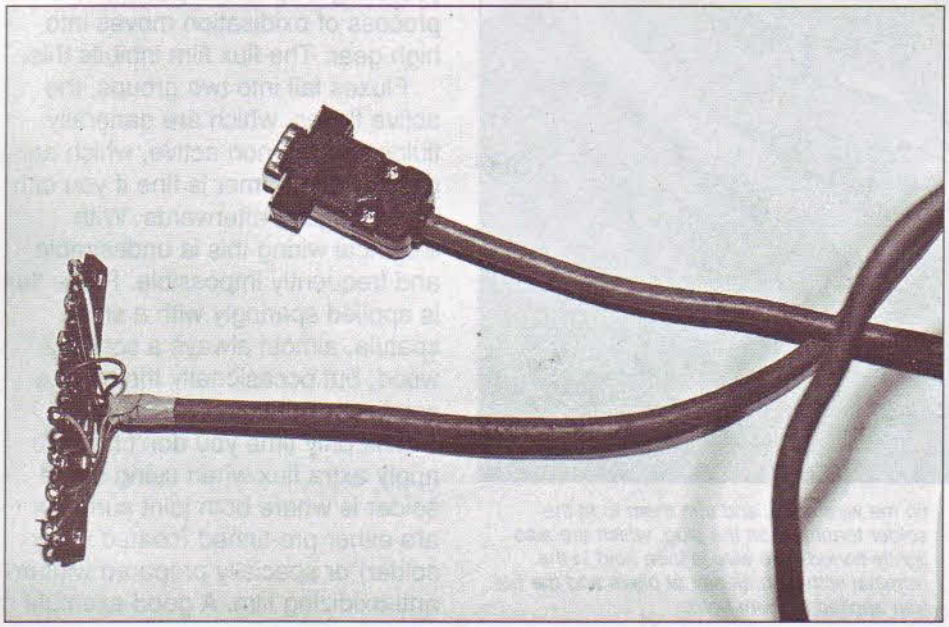
When all the wires are soldered to the plug, the plastic housing should be fitted. It is important to fit the cable clamp and to ensure it is fully tightened so that when the cable is tugged, as it inevitably will be, little or no strain is placed on the soldered joints.

the latter case is the solder tag found on most small electrical fittings, but this only applies where it is still bright. Old tags, the type you meet on surplus equipment or on items you've had in stock for some years, will have a dull appearance and need, at the very least, a little polishing with fine emery paper. In this case, flux will be advisable.

I have emphasised the importance of a clean joint, I must now add that it must also be hot. The cored solder should melt instantly with a brisk fizzing as the flux heats up. The molten solder should be bright and silvery, look like mercury and flow freely, running round the wire and on to the metal surface.

If the iron is not hot enough, the solder will form a pasty mass a little like tarnished aluminium in appearance and will not flow around the parts. This will appear to produce a joint of sorts, but the result is a 'dry joint'. The solder has not melted fully, so it has a crystalline structure which is not merely weak, but also it has a high resistance. It is absolutely essential to avoid this condition.

A good test of a soldered joint in an electrical circuit is a gentle tug on the wire. This will also detect a common cause of failure, where the wire was appreciably nicked when the insulation was stripped off. This weakens the wire at the point where the most stress occurs, so applying excess force at the outset usually breaks the wire. It is only an inconvenience at this juncture, you just have to remake the joint. When it happens later in the life of the layout, it is a disaster.

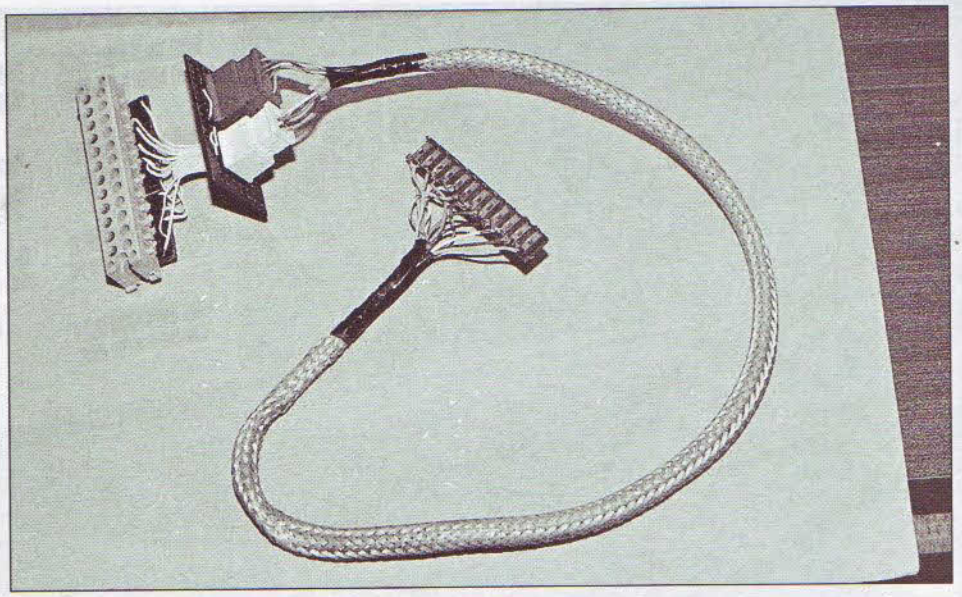


The ends of the completed cable. Multi-core cables have colour-coded wires, and the plugs are numbered. It is necessary to note the order of colours and keep these on record in the wiring book.

Control panels

Control panels are usually made from 3 mm ply. Aluminium sheet is harder to work and electrically conductive, as well as costing more. There are two basic designs, the geographic, where the section switches are arranged on a large layout diagram, and the simpler (and more compact) type with the switches in ranks. The geographic panel is more impressive and easier to understand but involves more work and needs to be partially rebuilt or even replaced should you modify or extend the layout. If the ranked panel is supplemented by a track diagram showing which switch controls which section, it is quite easy to follow.

Many exhibition layouts have elaborate main panels. Frequently they are needed to permit intensive operation of a large layout, but



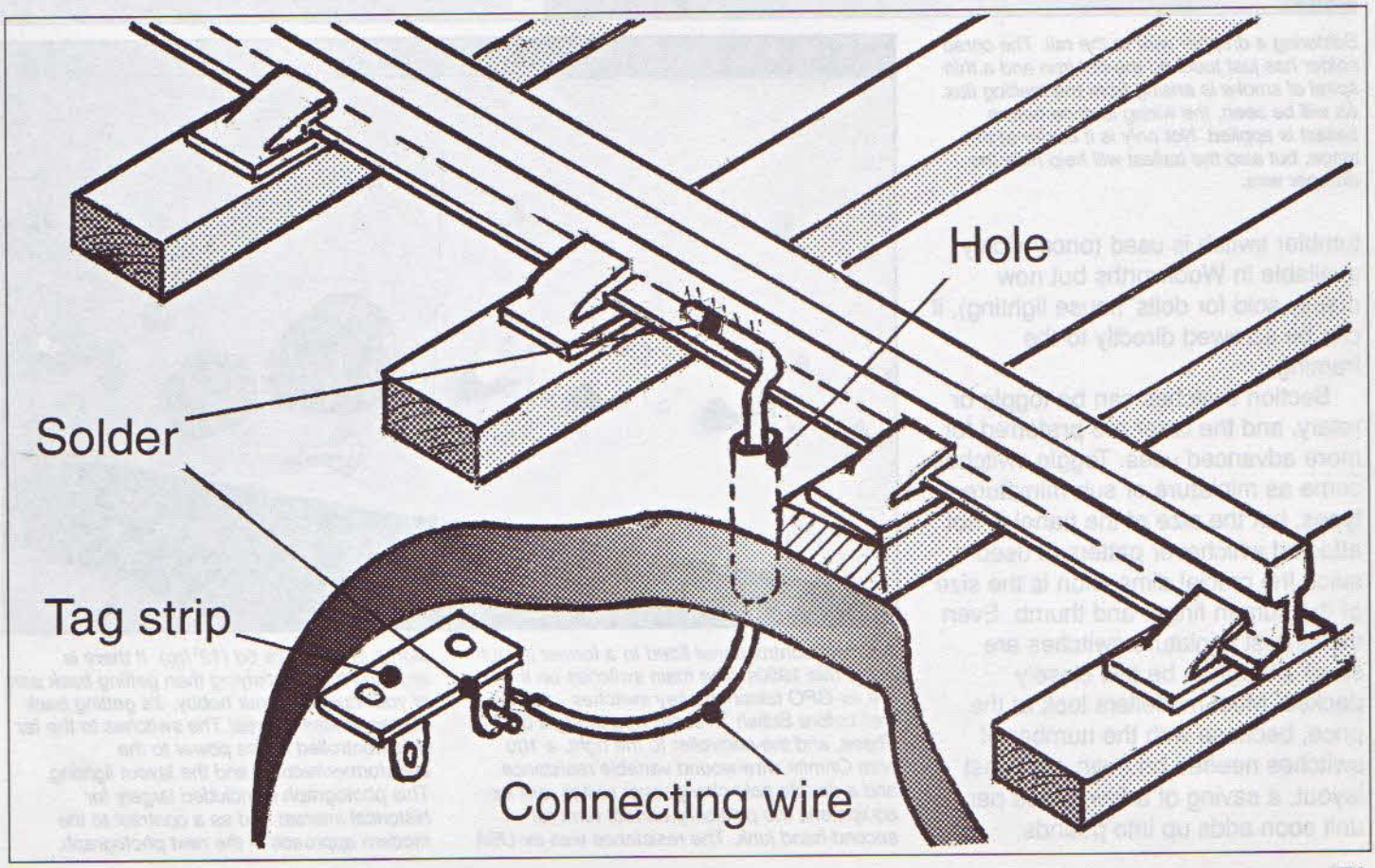
This jumper cable began life as part of a colour television set! The multi-pin plugs and sockets were provided to allow the various printed circuit boards to be readily replaced on servicing and, when the set wore out, I dismantled it out of curiosity. Two connectors are involved, and their trailing wires are neatly bound together with a length of braiding.

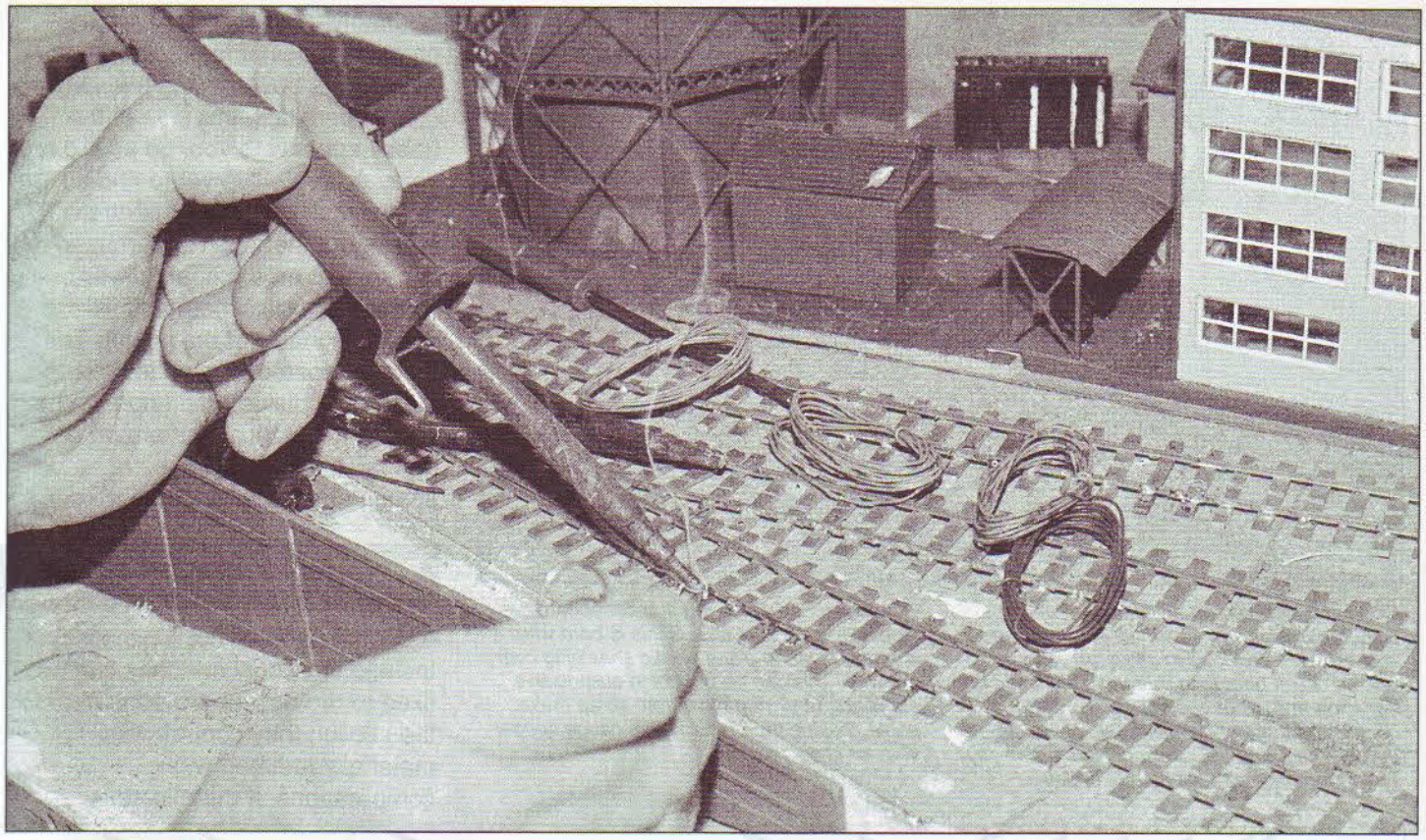
Connecting the rail to the sub-baseboard tag strip with a dropper wire. If this is bare wire, it is a good idea to place plastic sheathing over the wire. This can be bought in electrician's suppliers, but I strip mine from scrap mains cable, leaving the useful heavy gauge copper wire for other projects.

invariably they exist because the group includes at least one member who enjoys building and maintaining control panels. If this side of the hobby appeals to you, go ahead and enjoy yourself. I've yet to find a type of electrical indicator or control equipment that hasn't been used to good effect on a model railway although most of them add little to the functionality of the layout. The main purpose of such panels is to please the builder and impress the viewer. If electrical matters do not appeal, opt for a simple, straightforward arrangement.

Switches

A control panel is not a necessity. Instead individual switches can be fixed to the baseboard edge near to the section they control, with materially reduced wiring complications. If the miniature

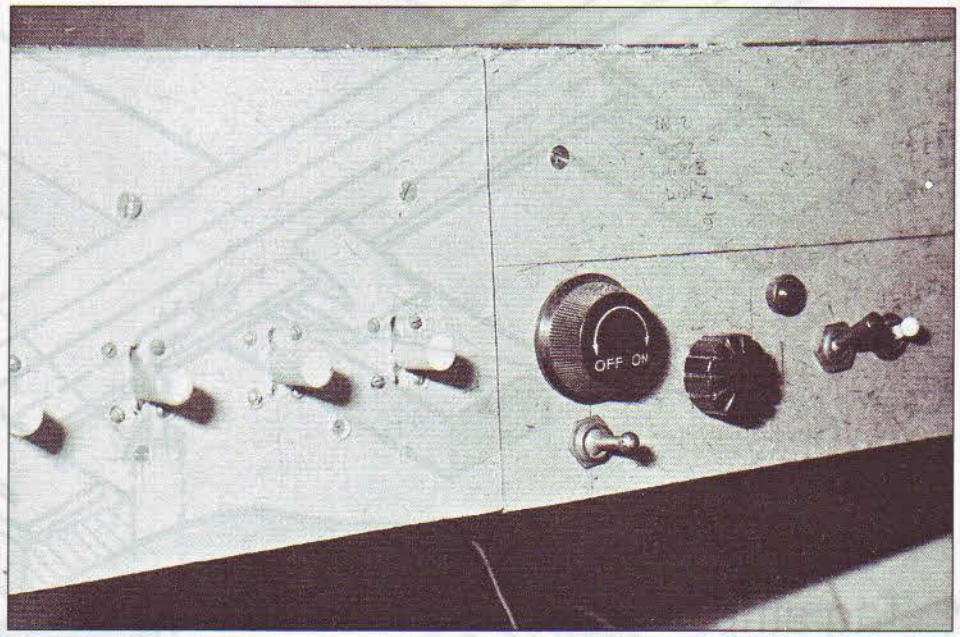




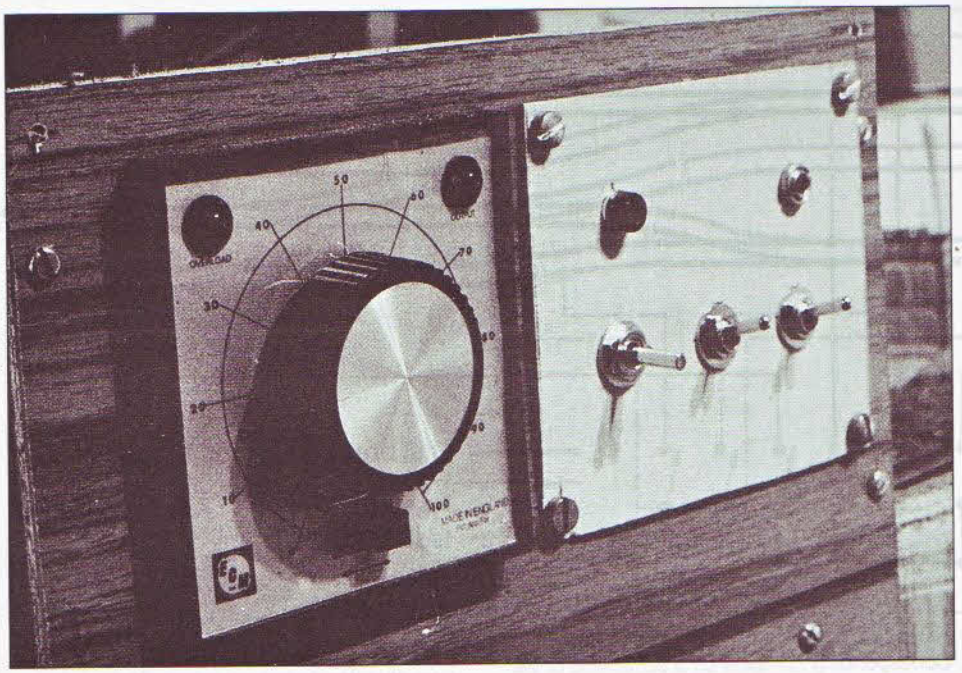
Soldering a dropper wire to the rail. The cored solder has just touched the hot iron and a thin spiral of smoke is arising from the melting flux. As will be seen, the wiring is done before ballast is applied. Not only is it easier at this stage, but also the ballast will help hide the dropper wire.

tumbler switch is used (once widely available in Woolworths but now mainly sold for dolls' house lighting), it can be screwed directly to the framing.

Section switches can be toggle or rotary, and the latter are preferred for more advanced uses. Toggle switches come as miniature or sub-miniature types, but the size of the panel is not affected whichever pattern is used since the crucial dimension is the size of the human finger and thumb. Even the largest miniature switches are small enough to be this closely packed. Most modellers look at the price, because with the number of switches needed on even a modest layout, a saving of a few pence per unit soon adds up into pounds.



A simple control panel fitted to a former layout in the mid 1950s. The main switches on the left are ex-GPO telephone key switches - this is well before British Telecom was thought of. These, and the controller to the right, a 100 ohm Ohmite wire-wound variable resistance and a double pole changeover switch, are ex-equipment, the politically correct term for second-hand junk. The resistance was ex-USA stores and cost 2s 6d (12½p). If there is anything more satisfying than getting back part of your taxes for your hobby, it's getting back someone else's taxes! The switches to the far right controlled mains power to the transformer/rectifier and the layout lighting. This photograph is included largely for historical interest and as a contrast to the modern approach in the next photograph.

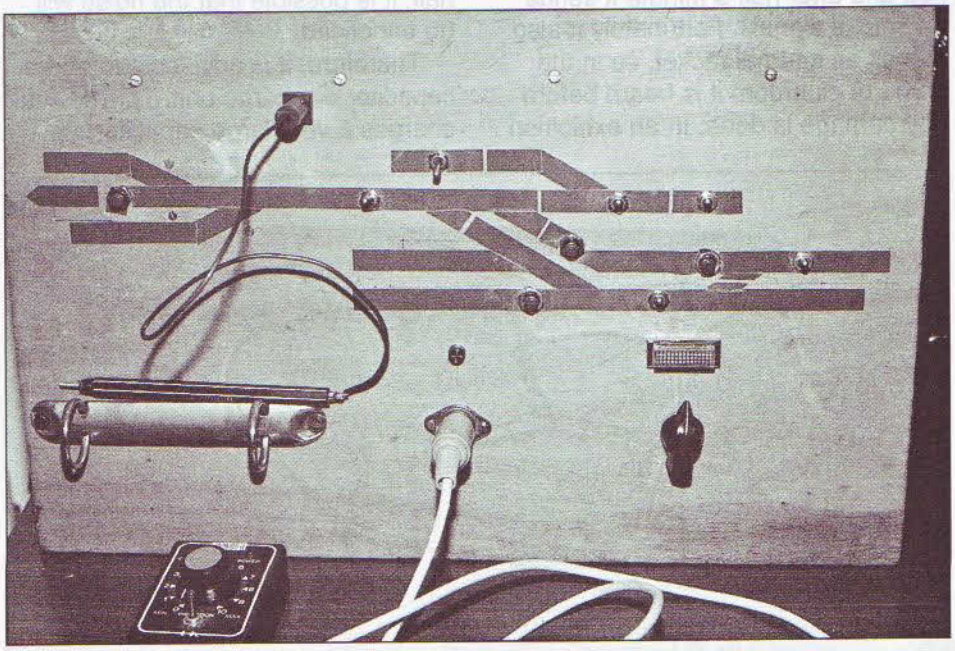


Another basic control panel for a small scheme that only needed three section switches. The controller is an ECM unit with electronic feedback, and includes power on and overload LED indicators, a far cry from the elementary resistance controller in the previous photograph. Paradoxically, it costs about the same as a 100 ohm wire-wound resistance now the war surplus stocks have been exhausted. It gives infinitely better control. The section switches are sub-miniature pattern and are mounted in a piece of melamine plastic, the type provided for domestic work surfaces. Regrettably this is not only difficult to obtain but also modern sheets are rather too thin for this use. Above the section switches we have a power on indicator and a 3.5 mm jack socket connected to the power supply. This was arranged so that when the plug was inserted, power to the layout was cut off. The neater appearance of modern equipment will no doubt have been noted.

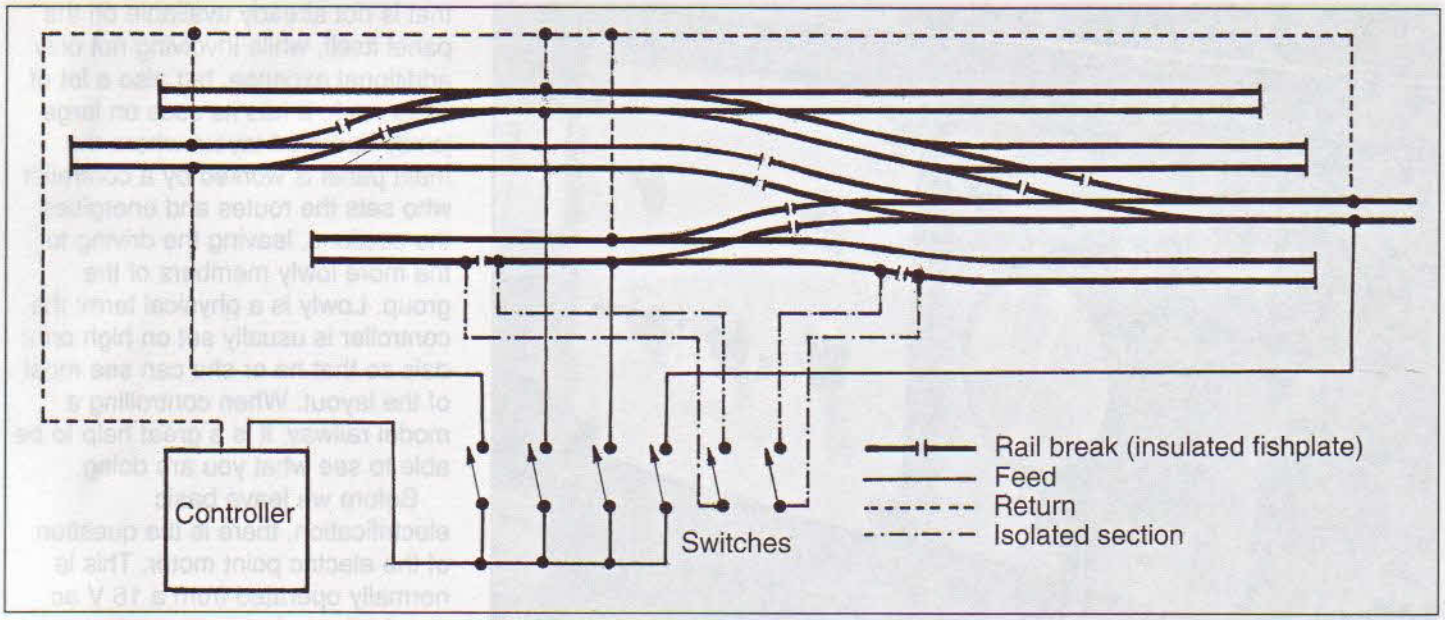
While the simple, single pole on-off switch is fine for a basic panel, the more expensive centre off double pole switch has much to recommend it. For a start, in addition to isolating the section, it can also connect it to either of two controllers. For all but the most elaborate of layouts, this will provide a convenient, very flexible system of control and will, on suitable layouts, allow two trains to be independently controlled by two operators.

A spare pair of contacts will remain, which can be used to control lights on an illuminated panel. For the majority of layouts, this is only a gimmick which will impress visitors but which provides no information that is not already available on the panel itself, while involving not only additional expense, but also a lot of extra work. It has its uses on large jointly operated layout where the main panel is worked by a controller who sets the routes and energises the sections, leaving the driving to the more lowly members of the group. Lowly is a physical term; the controller is usually set on high on a dais so that he or she can see most of the layout. When controlling a model railway, it is a great help to be able to see what you are doing.

Before we leave basic electrification, there is the question of the electric point motor. This is normally operated from a 16 V ac supply, through a momentary contact (flash) switch. It is important to realise that the current should only flow for a fraction of a second. If the coil is energised for more than some 10-15 seconds it begins to get



The front of the control panel for Brill. *The track diagram is made from Dymo strip. The sub-miniature on/off toggle section switches are located at their feed points and several push-buttons for magnetic uncoupling ramps have been inserted. The two points on the coalyard diorama are worked by electric point motors - electric pencil control is the chosen method. The probe plugs into a socket above the diagram and is shown resting on the clips for the flip cards, which will be used for timetable operation. The five Din plug and socket connect the hand-held controller to the panel, and directly above is a 'power on' indicator. The large indicator and semi-rotary switch on the right are the link with the fiddle yard controls. The switches are well spread out for ease of use; remember a control panel is not part of the small scale world.*

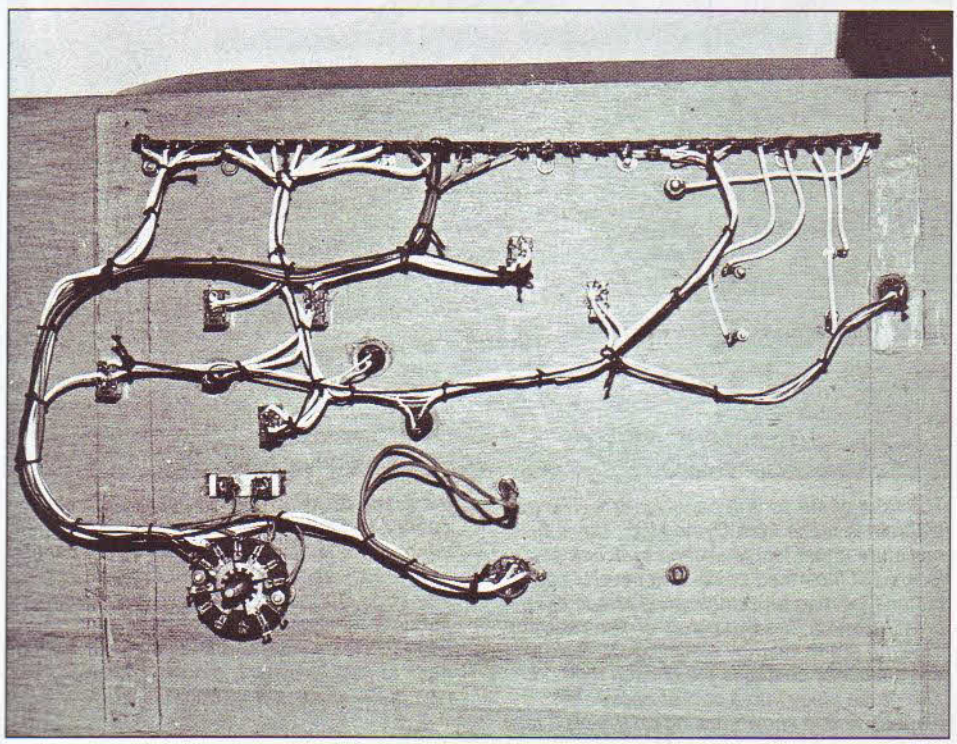


The full wiring diagram for Brill. *There are four main sections and two isolated spurs. This is about as simple a diagram as one could expect, and is just about the limit of easy comprehension. It is better to mark the position of feeds, returns and isolating sections on a simple track diagram and number them. Corresponding numbers on a schematic of the control panel indicate which switch connects to which feed. In practice, this means which tag on the control panel goes to which tag on the layout.*

hot, and after half a minute it sends up smoke signals. Fortunately it also makes an infernal racket, so in the home or clubroom it is heard before any damage is done. In an exhibition hall, it is possible that the noise will go unnoticed.

Therefore, it is advisable to add a capacitor discharge unit. This device charges a very large capacitor, generally through an electronic circuit with direct current. Through a characteristic of ac supply, the capacitor charges to slightly over 20 V, which gives the motor a very good kick and makes absolutely certain that the point is changed. At the same time, the unit contains a limiting device which means that should the power remain connected, the current is reduced so that the coils will not burn out. Such units add to the initial cost, but if they save burning out only one point motor, they will more than repay the outlay.

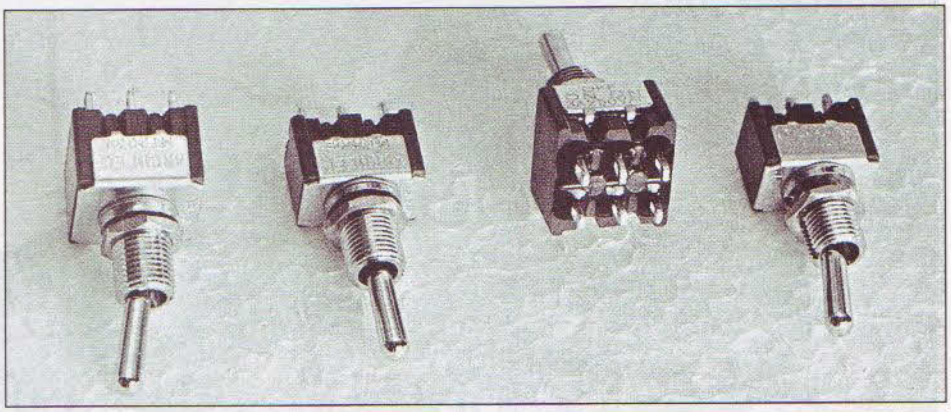
The control can be a special flash switch, a pair of push buttons or the probe and stud. This last system, often termed the electric pencil, is very cheap, very reliable, and ideally suited for use on a geographic panel. There are two parts, a pair of metal studs on the panel connected to each coil of the motor and a probe which is connected to the transformer or capacitor discharge unit. The probe is placed against the appropriate stud, the point moves,



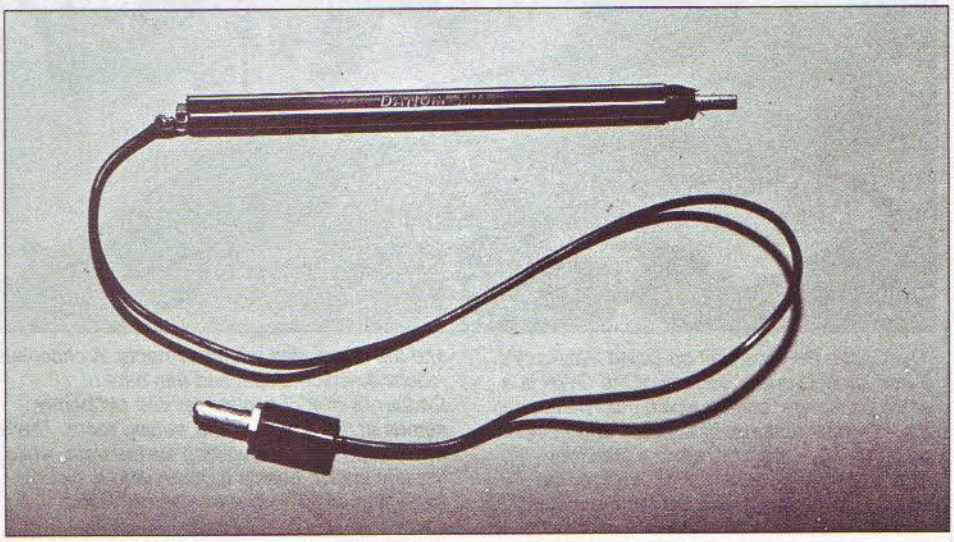
The rear of the control panel fully wired. Note how the wires are joined together to form cables, carried clear of the switches so that good access is maintained to all vulnerable parts.

that's that. Peco supplies all necessary components, largely for the benefit of those individuals who have to have 'the right thing'. The probe is easily made by pushing a metal rod down a discarded ballpoint pen body and soldering it to a length of flexible wire, the studs are round-head metal screws with solder tags on the back of the panel for ease of connection.

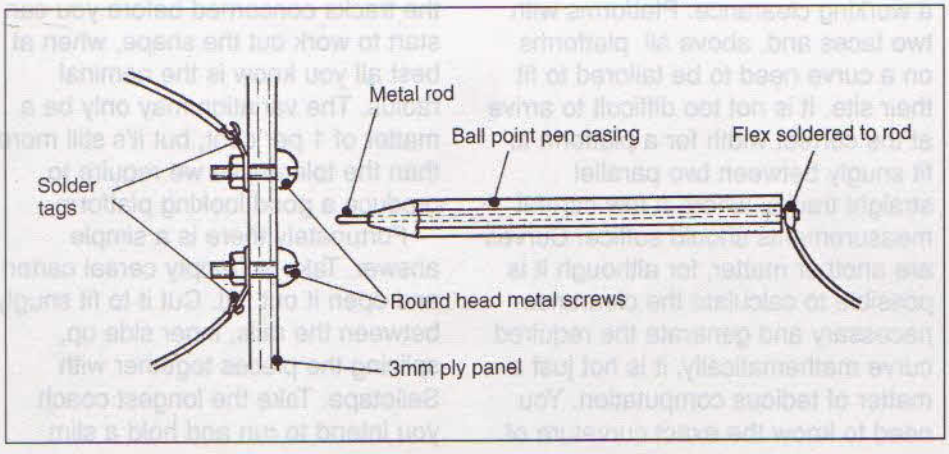
Although control systems are capable of considerable refinement and even more extensive elaboration, some 90% of railway modellers go though their entire career without going beyond the simple straightforward arrangements I have just described. Of the remaining 10%, the majority have introduced complications because they find it fun. Only a very large, very complex layout that has to be intensively operated requires greater refinement.



A selection of sub-miniature toggle switches. Their main advantage from the railway modeller's viewpoint is that they only require a 6 mm diameter hole in the control panel as opposed to the 12 mm needed for the larger miniature pattern. As the majority of power drills only take a 10 mm drill, this can be quite a problem.



The electric pencil probe, an old ballpoint pen body with a steel rod (from a wire coathanger) passed through the core. The end is threaded 8BA and the flex is soldered to a solder tag. A simple plug goes at the other end.



The 'electric pencil' pattern point operating 'switch'. In use the probe is placed in contact with one of the two studs. This type of point control is almost always found on a geographic panel, since with the studs on either side of the point it is obvious which one moves the point in the desired direction.

Chapter 10

Civil Engineering

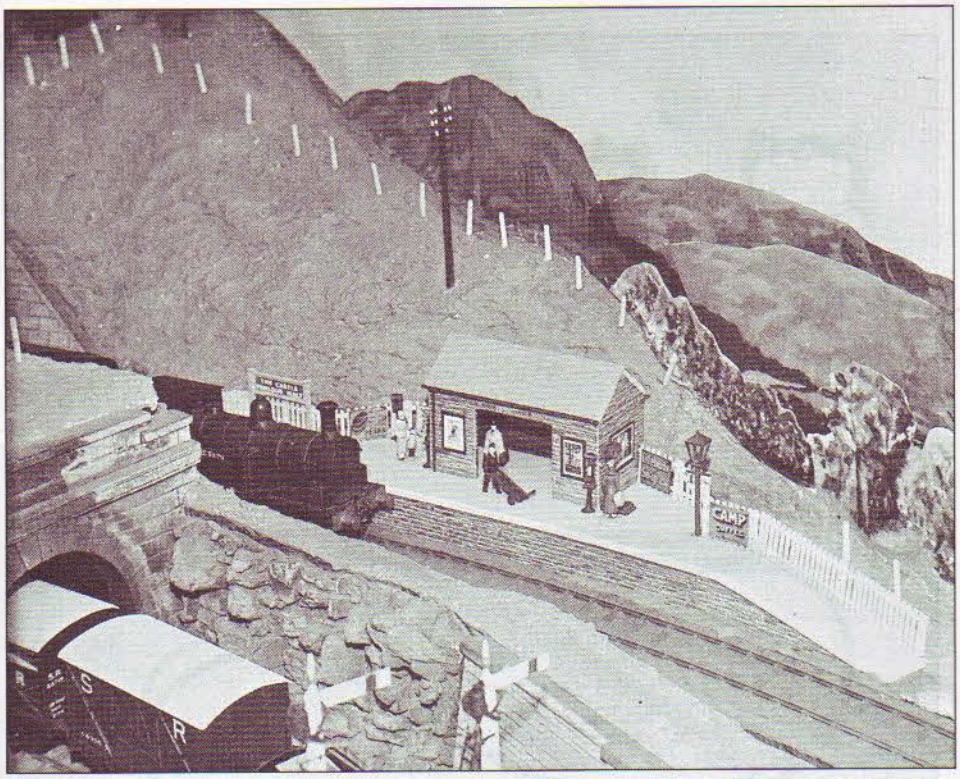
While it is possible to start running trains over the layout as soon as the tracks are in position and wired to the controller, the railway is still a very bare, featureless thing. Indeed, where dropped baseboards and open top sections exist, there are gaping holes which need filling, but before this we have to consider the civil engineering features that round out the railway proper.

The first feature we shall deal with is not generally regarded as part of civil engineering, though it is built and maintained by that department, namely the platform. It is a very prominent part of the British railway scene in more respects than one since, unlike the general practice elsewhere else in the world, it is raised approximately 3 ft 6 in (1.06 m) above rail level.

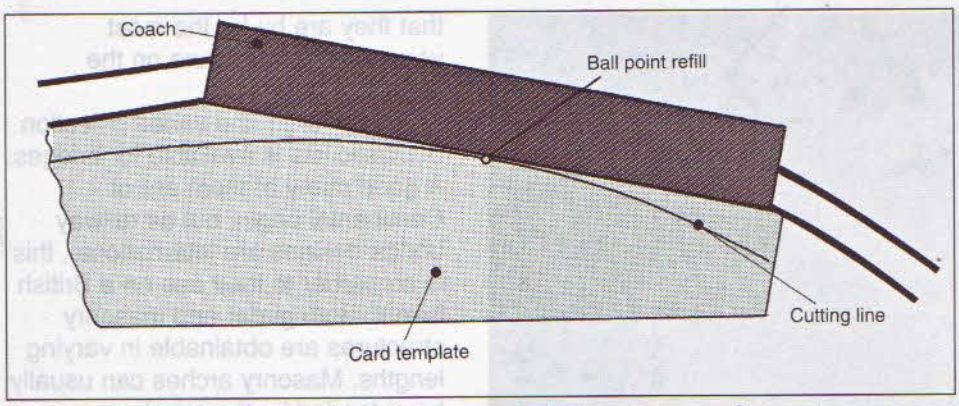
Not to beat about the bush, this is a confounded nuisance since unlike the low Continental and US counterparts it is almost on a level with the floor of a coach and higher than the outside cylinders on a steam locomotive. As a result, not only is it a more complex structure than the low level walkway found elsewhere, but also it has to be located with considerable precision. On the one hand it must clear the train, but on the other it must be close enough for there to be no unsightly gap between the platform edge and the side of the coaches.

Where the platform only abuts a single length of straight track, the adjustment is a matter of trial and error, the platform is slowly moved closer to the track until something fouls, and then withdrawn to provide a working clearance. Platforms with two faces and, above all, platforms on a curve need to be tailored to fit their site. It is not too difficult to arrive at the correct width for a platform to fit snugly between two parallel straight tracks, where a few careful measurements should suffice. Curves are another matter, for although it is possible to calculate the clearance necessary and generate the required curve mathematically, it is not just a matter of tedious computation. You need to know the exact curvature of the tracks concerned before you can start to work out the shape, when at best all you know is the nominal radius. The variation may only be a matter of 1 per cent, but it's still more than the tolerances we require to produce a good looking platform.

Fortunately there is a simple answer. Take an empty cereal carton and open it out flat. Cut it to fit snugly between the rails, inner side up, splicing the pieces together with Sellotape. Take the longest coach you intend to run and hold a slim



The Castle Perilous Halt on David Salisbury's 7 mm scale Lyoness *section of the GWR is a small passenger station which incorporates all the essential features of a steam age railway platform. Note the end ramp, a statutory requirement, the wood paling fencing, the stone-built waiting room, the lamp standard and the enamelled advertisements. A chocolate machine, which dispensed thin bars of Cadbury's milk chocolate for one old penny, stands at the corner of the waiting room. There are four passengers waiting for the train, while the tiny station boasts a porter who is clearly expecting some luggage to be delivered.*



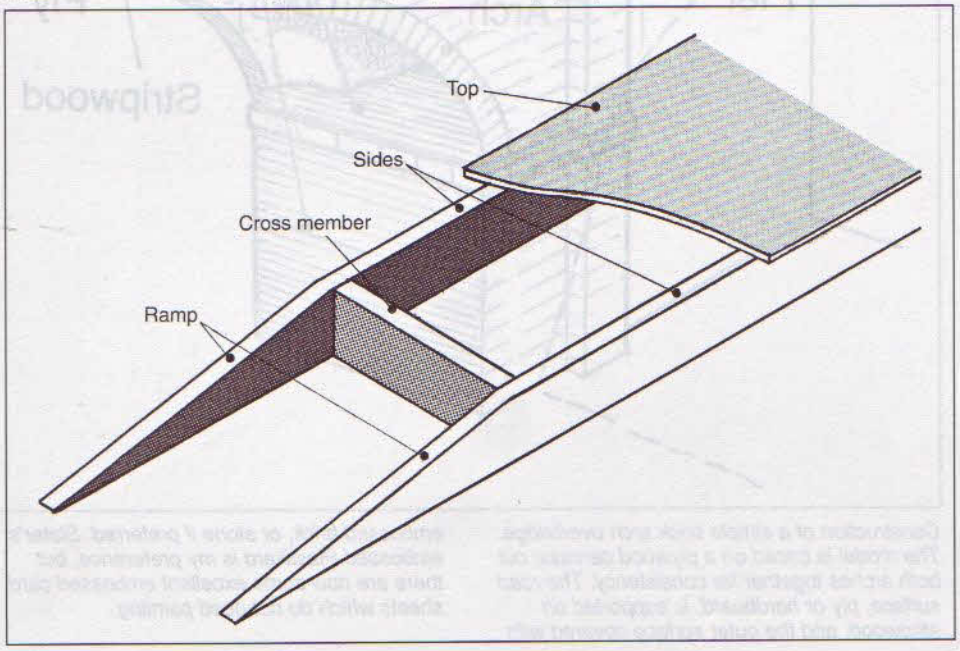
Marking out the shape of a curved portion of a platform, using a coach as a guide. In this sketch the curve has been exaggerated to show the overhang more clearly.

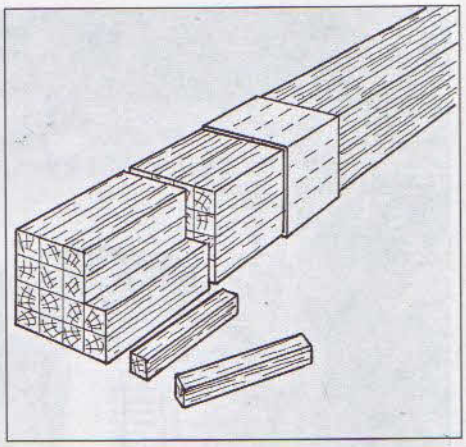
ballpoint refill hard against the centre of the side nearest the platform, with the tip resting on the card. Run the coach up and down. Repeat the process with the pen at the end of the coach. Now take your largest outside cylindered locomotive and, in a similar fashion, mark the clearance it requires. Remove the card, cut carefully along the innermost line with scissors and you have a template for your platform top.

Now using this template as a guide, cut out the platform from plastic sheet, thin plywood or even hardboard. It should fit perfectly, but to be safe put it in position temporarily and check, because it is a lot easier to remove any excess before the top has been pinned or glued to the supports. These can be made from stripwood, plastic sheet or cut from a solid chunk of chipboard. As a simple guide, using standard code 100 OO track, the combination of a 12 mm thick underlay and a3 mm thick hardboard or ply top is close enough to the theoretical height to satisfy all but the most obsessive of scale fanatics.

As an alternative, Peco and Ratio provide moulded platform edges which are used in conjunction with a plastic sheet top surface. These can be adjusted in situ to the correct clearance and firmly cemented in place before fitting the top. Unfortunately there is no simple way of marking out the exact size of an intricate platform top using these sides. The plastic sheet must be cut slightly oversize and carefully pared down to fit. You may well need a little judicious infilling, and I have found that the two-part body filler sold to hide small blemishes on a car is equally effective as a filler for plastic models. Mix very small amounts on a piece of scrap wood and carefully fill the gap, using a wooden spatula. If you are careful you should not need to do more than lightly sand the surface once the mixture has hardened.

Raised platforms are readily built up in this fashion. Either plastic sheet, thick card or wood strip sides and cross-members and ply or hardboard top can be used. The ramp at the end of a passenger platform has been a statutory requirement for well over a century, and to end in steps or a sheer drop is completely wrong. Even so many modellers have perpetuated this howler. Yes, there were a few exceptions, but this is definitely not a case where there is a prototype for everything.

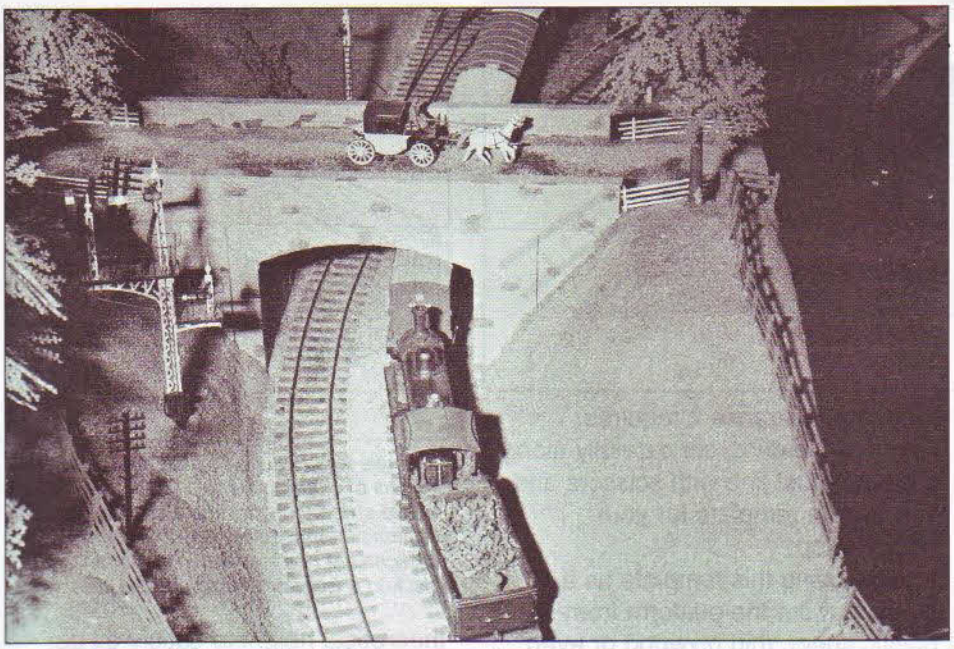




A simple way to cut a quantity of identical lengths of stripwood is to bundle anything from four to sixteen lengths into a compound stick, securing them together with Sellotape. The sections are best separated in a small mitre block to ensure an absolutely true cut.

Signals

This is an appropriate place to mention signals, since you will almost always find them at each end of the platform. More than any other single item, a signal placed in what



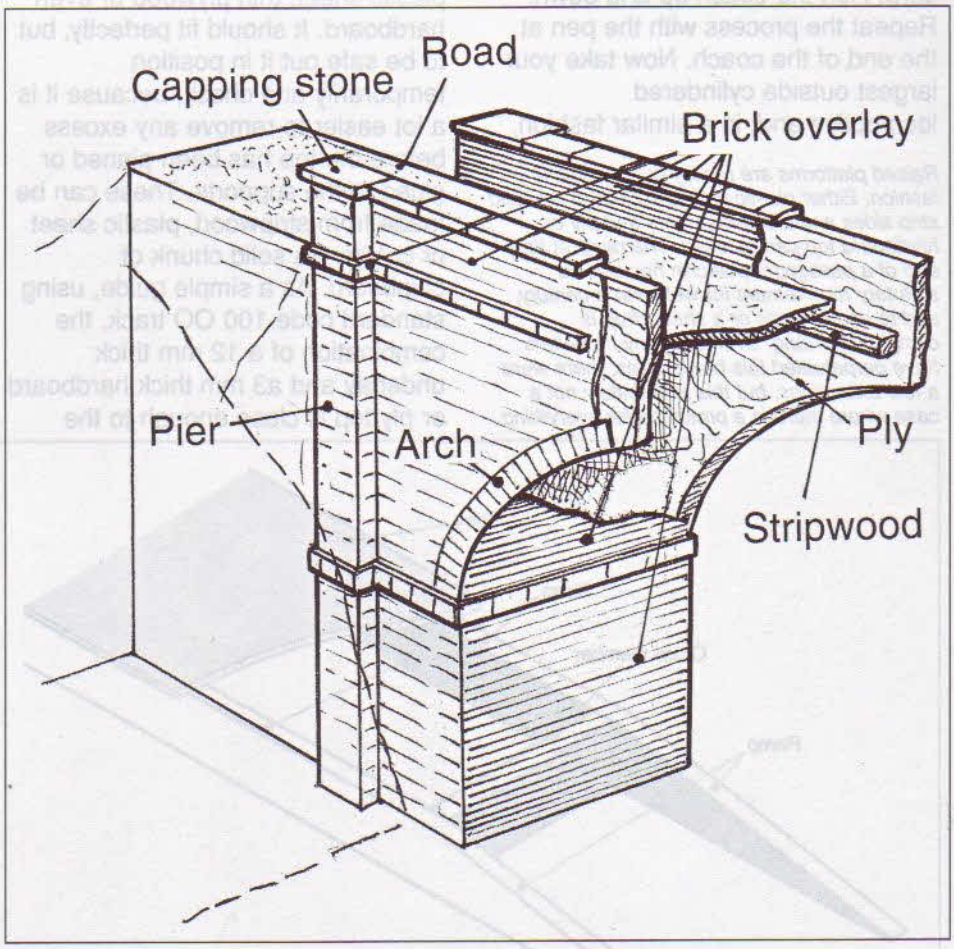
A brick-built overbridge on Alan Wright's Cheviotdale. *This photograph also shows how the slope of a cutting side should be arranged, as well as the correct positioning of the post and rail fence. The signal is interesting, a North Eastern Railway lattice post bracket signal controlling entry into the goods loop, main platform road and, through a subsidiary arm, to the merchandise siding. The system has been updated with upper quadrant arms by the LNER. The post is built up from Ratio signal kits.*

appears to be the right position makes the difference between a glorified train set and a serious model of a full size railway. It doesn't have to be absolutely right, nor does it have to work, though clearly both these features are highly desirable. It only needs to be there.

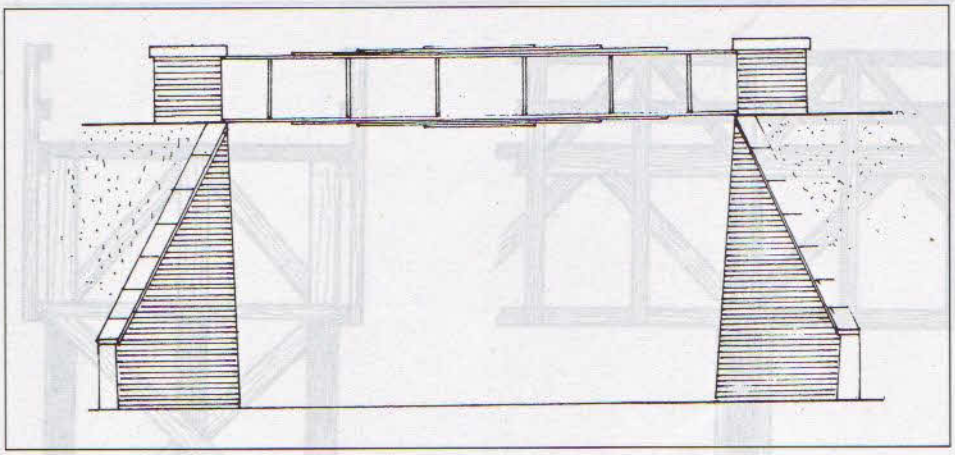
Bridges

Bridges are the most prominent part of the civil engineer's domain. To state the obvious, they are provided to carry the railway over roads, rivers and ravines and to carry roads or other railways over the line. They can be made of bricks, masonry, metal or wood, the latter material being extremely rare these days. They range from the lowly culvert to the awe-inspiring viaduct, and they can take many forms, which means that they are by far the most versatile scenic feature on the layout.

A very large and varied selection of plastic kits is available for bridges. A good many of them are of Continental origin, but as railway bridge designs are international, this is no barrier to their use on a British layout. Both girder and masonry structures are obtainable in varying lengths. Masonry arches can usually be extended by the simple process of adding a second or third kit. The same can be said for girder bridges, so long as you put a pier under the joint. It is surprising how many modellers think that because a girder bridge is straight and made of metal it can be joined together to



Construction of a simple brick arch overbridge. The model is based on a plywood carcass; cut both arches together for consistency. The road surface, ply or hardboard, is supported on stripwood, and the outer surface covered with embossed brick, or stone if preferred. Slater's embossed Plastikard is my preference, but there are now some excellent embossed card sheets which do not need painting.



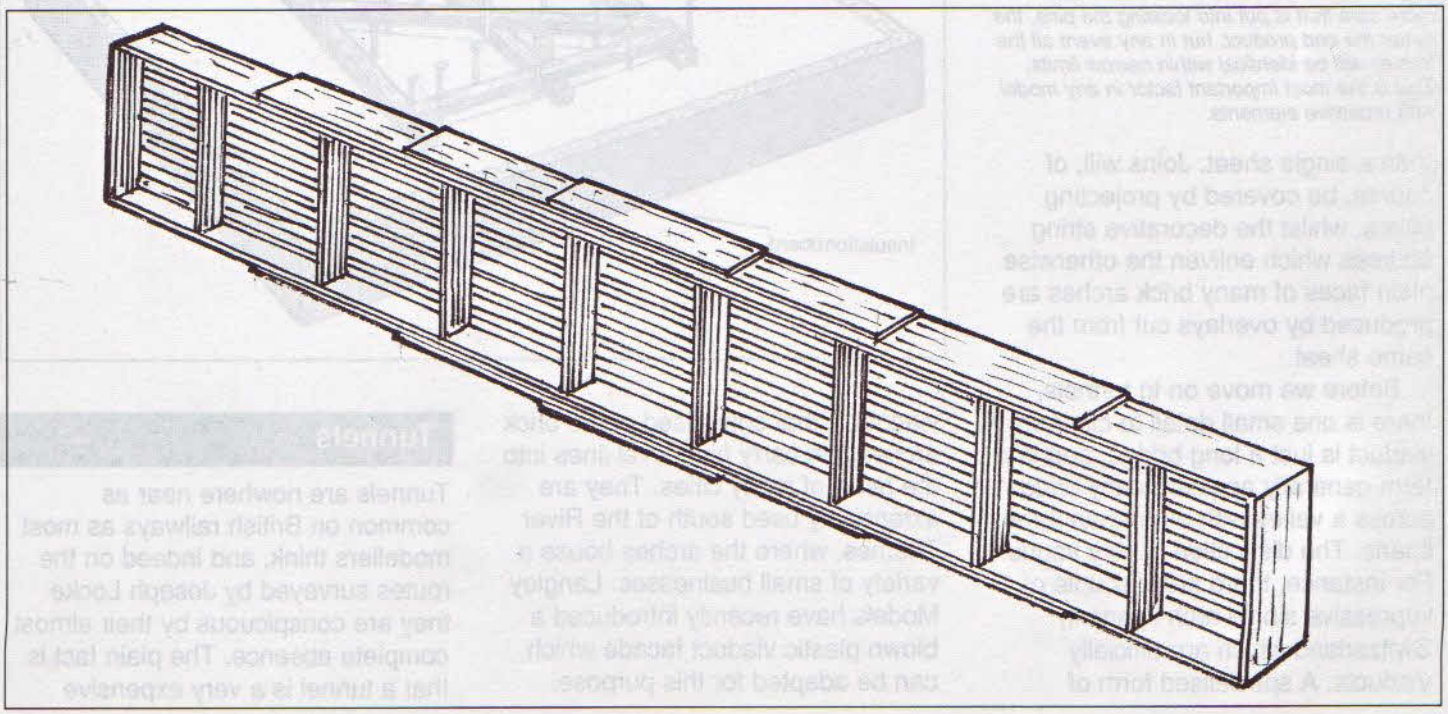
Elevation of a small plate girder underbridge, with brick end piers and abutments.

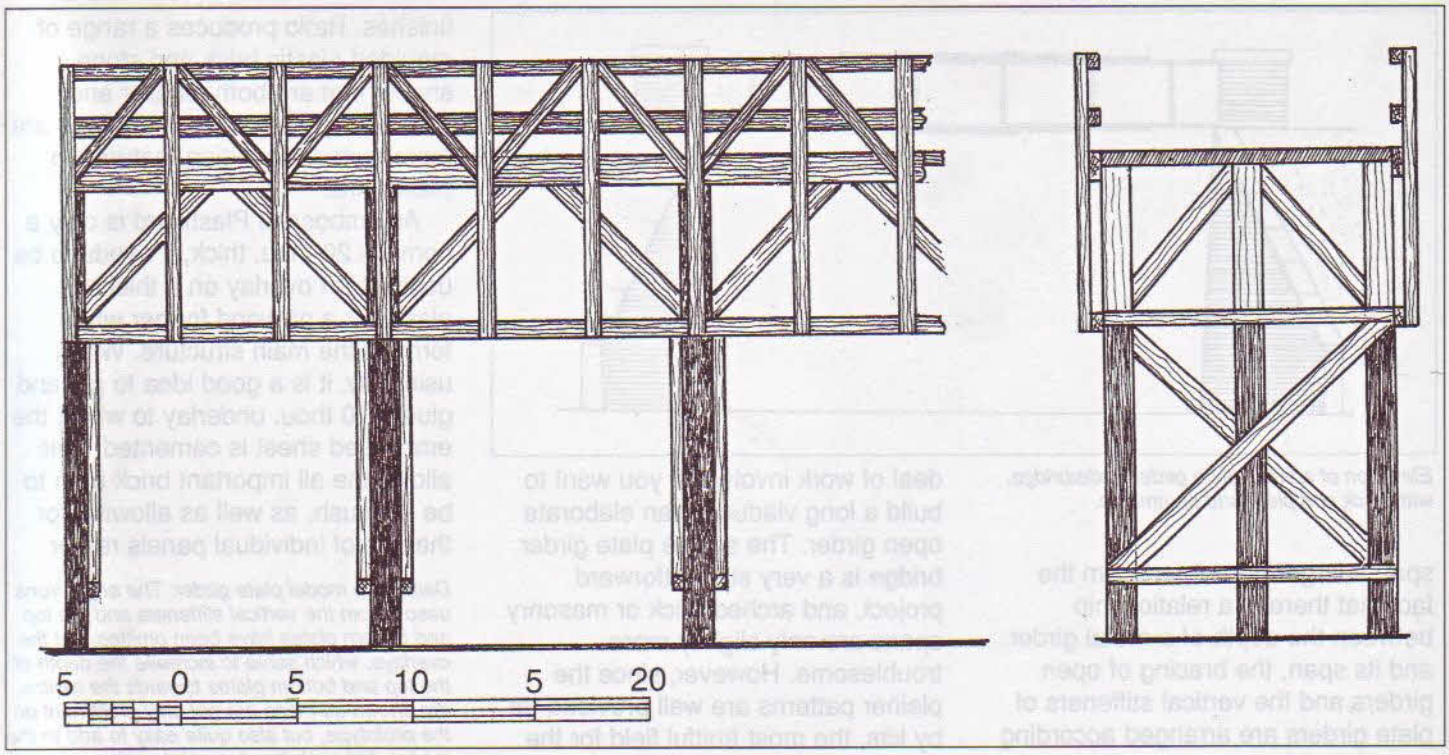
span a larger gap. Apart from the fact that there is a relationship between the depth of a metal girder and its span, the bracing of open girders and the vertical stiffeners of plate girders are arranged according to well defined principles. The kit designers know this and get these important features right for the span of the bridge. Double the span and the whole thing looks as if it is on the point of falling down.

Bridges are not difficult to model, though clearly there can be a good deal of work involved if you want to build a long viaduct or an elaborate open girder. The simple plate girder bridge is a very straightforward project, and arched brick or masonry spans are only slightly more troublesome. However, since the plainer patterns are well provided for by kits, the most fruitful field for the scratchbuilder is the more elaborate type of structure where a good deal of architectural decoration is involved. For this type of work I prefer to work with plastic sheet, using Slater's embossed Plastikard, which provides a reasonable selection of different brick and stone finishes. Ratio produces a range of moulded plastic brick and stone sheets that are both smaller and thicker than the Slater sheet, and are more suited for adding features to plastic kits.

As embossed Plastikard is only a nominal 20 thou. thick, it needs to be used as an overlay on a thicker plastic or a plywood former when forming the main structure. When using ply, it is a good idea to pin and glue a 10 thou. underlay to which the embossed sheet is cemented. This allows the all important brick arch to be set flush, as well as allowing for the use of individual panels rather

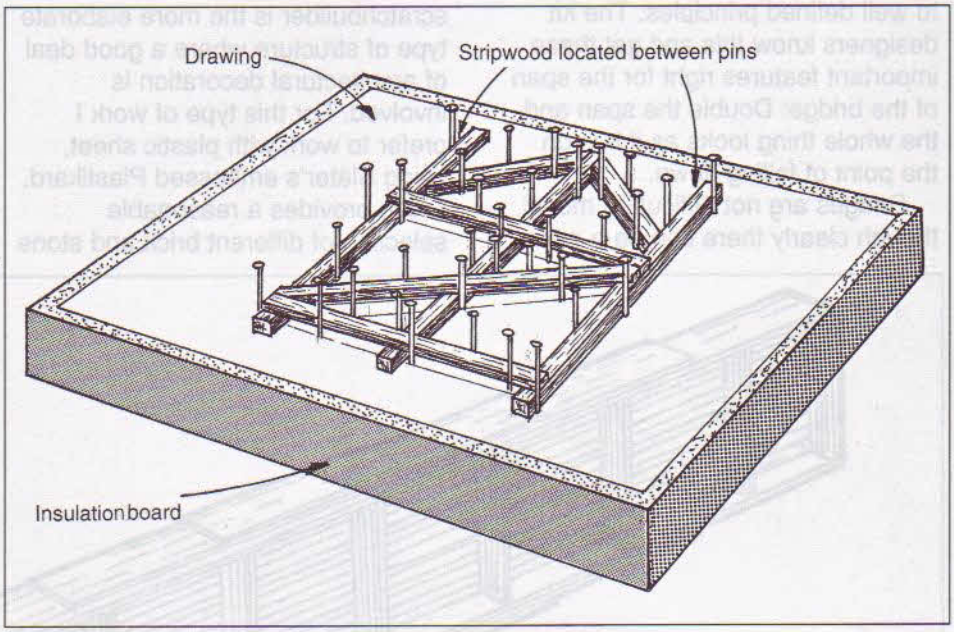
Detail of a model plate girder. The angle irons used to join the vertical stiffeners and the top and bottom plates have been omitted, but the overlays, which serve to increase the depth of the top and bottom plates towards the centre, are shown as these are not only prominent on the prototype, but also quite easy to add to the model. Although the deep plate sides are a prominent part of the structure, their main purpose is to keep the top and bottom plates apart while the vertical stiffeners are there to prevent twisting. Most of the load is carried by the top and bottom plates. As a rule of thumb, allow 1 in (2.5 cm) depth for every 1 ft (30 cm) of span for this type of girder. It is rare to find plate girders over 40 ft (12 m) in span. They will just reach across a normal carriageway with side pavements.





Above: *Side elevation and cross-section of a single track timber viaduct.*

Right: *A pin jig for producing the frames for the timber viaduct. The base is a piece of hard insulation board, over which a drawing of the frame is fixed. Initially, stripwood is carefully placed over the drawing and pins inserted on either side as shown. Once all the pins are in place, their heads should be snipped off to allow the finished frame to be eased out. The more care that is put into locating the pins, the better the end product, but in any event all the frames will be identical within narrow limits. This is the most important factor in any model with repetitive elements.*

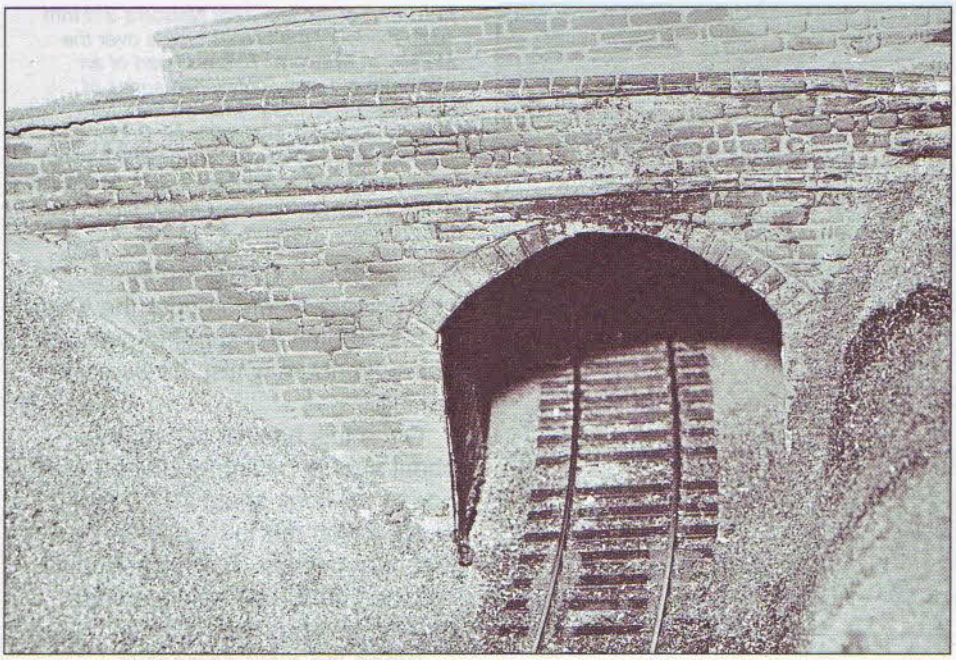


than a single sheet. Joins will, of course, be covered by projecting pillars, whilst the decorative string courses which enliven the otherwise plain faces of many brick arches are produced by overlays cut from the same sheet.

Before we move on to tunnels, there is one small detail to clear up. A viaduct is just a long bridge, and is a term generally applied to any bridge across a valley with more than three spans. The distinction is very vague. For instance, there are a couple of impressive single arch spans in Switzerland which are officially viaducts. A specialised form of viaduct is that comprised of the brick arches that carry high level lines into the heart of many cities. They are extensively used south of the River Thames, where the arches house a variety of small businesses. Langley Models have recently introduced a blown plastic viaduct facade which can be adapted for this purpose.

Tunnels

Tunnels are nowhere near as common on British railways as most modellers think, and indeed on the routes surveyed by Joseph Locke they are conspicuous by their almost complete absence. The plain fact is that a tunnel is a very expensive



Bridges form a convenient disguise for the hole in the backscene where tracks head off into a fiddle yard. This model is a typical example of coursed masonry construction. From this, the normal viewing angle, the gap in the backscene is not at all obvious.

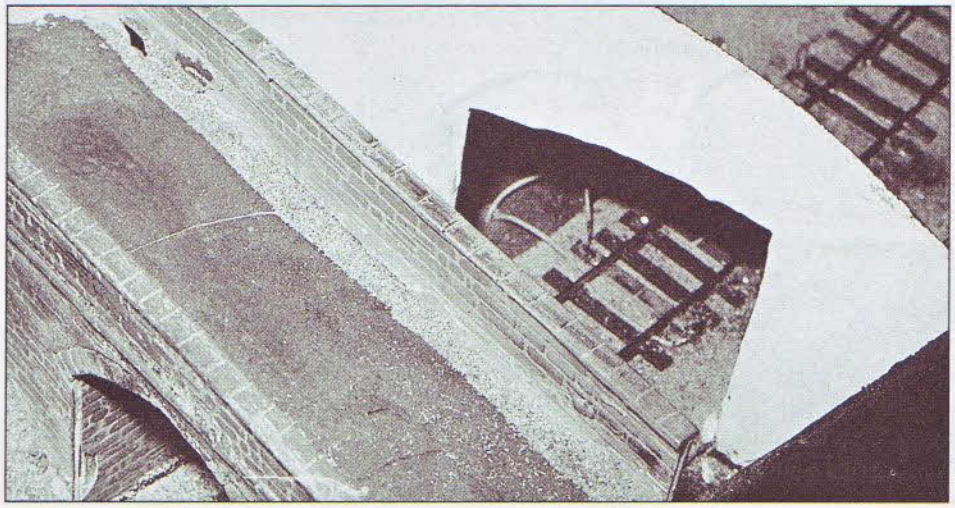
thing to construct, it is much more difficult to maintain than a stretch of open track twice its length, and is frequently something of a bottleneck. On a model the problems of maintenance are even worse, and before any extensive length of tunnel is constructed a means of access for track cleaning and removal of derailed stock has to be arranged. Derailments should not be more common inside tunnels, but when they do occur they give a lot of trouble, even when there is access. If there is no way of getting to the stock, the only alternative is to fish around with a bit of bent wire through the tunnel portal and hope you can get the train out without serious damage to it or, worse still because it will be unnoticeable, to the track.

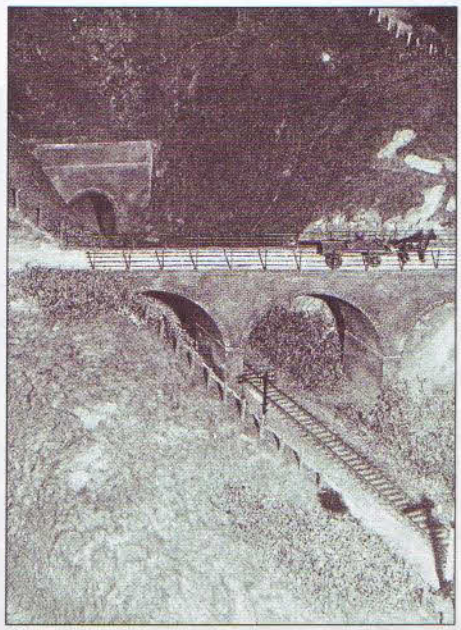
The visible part of a tunnel is the portal. This can be a very plain facade, constructed from engineering bricks, concrete blocks or, more simply, mass ferro-concrete poured into moulds in situ. As most tunnels are in fairly remote situations and the facade can only be clearly seen by the driver, there is no point in providing decoration. This has never deterred the civil engineer from erecting what are nothing more than the Victorian equivalents of the eighteenth-century follies.

Kits for tunnel mouths are available, which in the main are fairly plain masonry facades complete with wing walls. By far the most popular kit is the magnificent Faller replica of the Lorelei facades. These are visible from the river, and one good reason for taking a short cruise along the Rhine gorge is the opportunity for trainspotting it provides. Despite its origins, it does not look out of place in a British setting.

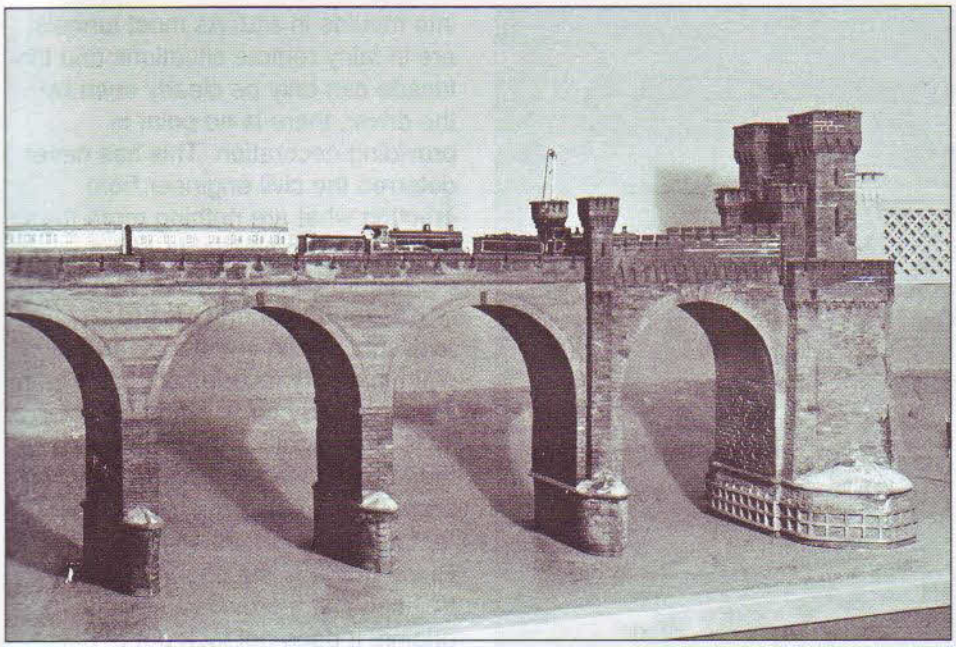
Although a turreted tunnel facade looks like a major modelling project, because it is only a facade, with little depth other than that provided by the turrets and mock battlements, makes it far less of a task than might at first appear. While such a model can be produced with the help of an

From this angle the deception is only too obvious. The track dives through a rectangular hole and is no longer ballasted.





A three-arch bridge over a single track line. It will be seen that the bridge has been laid out for possible double track, but the tunnel beyond precludes this option. The railings are very uncommon; a brick parapet is more usual.



Left: *Part of the late Jack Nelson's 3½ mm scale model of the LNWR bridge over the Mersey at Runcorn. This was part of an elaborate but sadly unfinished series of dioramas depicting scenes on the LNWR around Liverpool. Unusually for Britain, the models were HO gauge, the project having been conceived when there was a possibility that supplies for this scale would be commercially available.*

embossed or moulded plastic sheet, the fact that you do not have to produce an exact duplicate makes it an excellent subject for individual stonework.

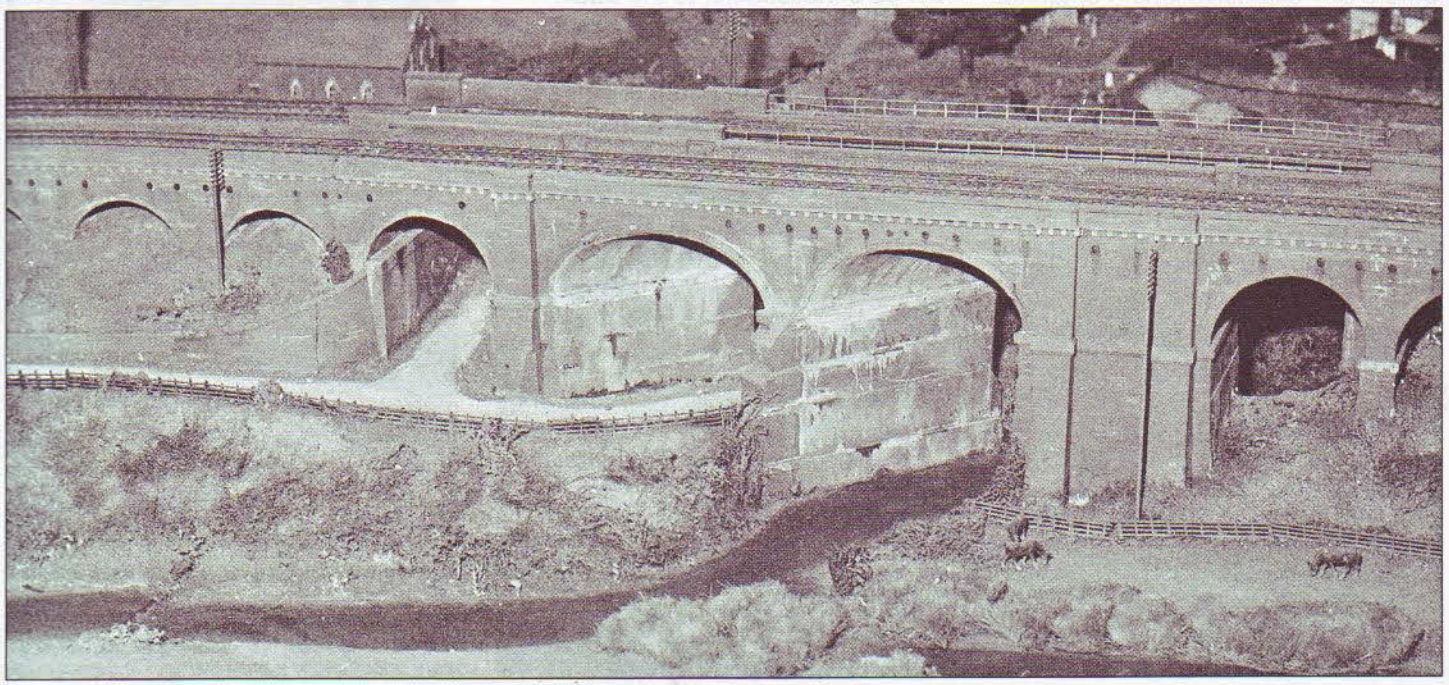
The best foundation for the model is a piece of 9 mm ply. The tunnel mouth is cut out with a fret saw, using a new coarse tooth blade for ease of working. The face is covered with 10 thou plastic sheet; my preferred adhesive is standard epoxy resin, with a few pins strategically located under the future turrets to hold the sheet in place for some 24 hours whilst the epoxy is setting.

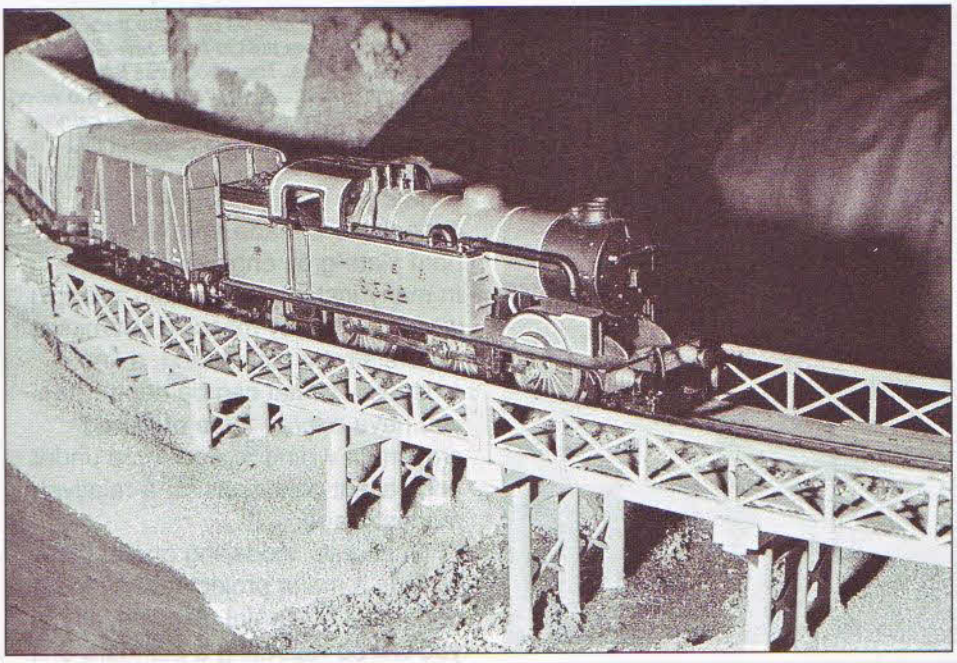
Once this has hardened, the sheet should be lightly scribed with horizontal lines about 10-20 mm apart, which are to help align the masonry overlay. The turret bodies are then built, with any openings that the design might dictate.

When the plain carcass is finished, including any overlays for the mock battlements, the surface is finished with stones cut individually from 20 thou sheet. The arch should be the first section to be laid down, starting with the keystone in reverse of prototype order. The horizontal courses go on next, the horizontal scribing making it easier to maintain level. The 'stones' are cut from the sheet, taking care to see that the

Part of the Midland Railway viaduct on the Model Railway Club's 2 mm scale Chiltern Green *project. This is a faithful model of the actual structure and included the later lattice girder on the goods lines. Although this was invisible from the normal viewing position, the elaborate girderwork was copied in full detail.*

The photograph also shows how effective simple plaster landscape modelling can be in experienced hands. The grass effect was produced by gluing carpet felt to the plaster, then when dry, ripping it off. The colouring was done with an airbrush.

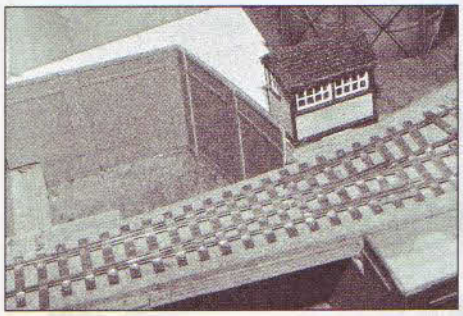




A low lattice iron viaduct on Alan Wright's Cheviotdale. *The design is reminiscent of the structures found on many NER branches, tubular cast iron pillars supporting a spidery-looking braced frame. The sides came from a Hornby suspension bridge! It will be seen that although the line is on a curve, the bridge girders are straight. A curved girder would be unstable in full size.*

arch stones are regular. The most convenient technique is to pick up each stone by jabbing the sharp end of your scalpel into it so it remains impaled until you've put it in place, then run a little solvent round the joins. It will probably be a good idea to practise laying stones on a spare bit of plastic sheet before launching yourself into the full blown project.

Most tunnels have wing walls to support the soil above the tunnel proper. These are made in a similar style to the tunnel façade, unless they form part of a more extensive array of retaining walls. These are far more common on the model than they are on the prototype because they allow multi-level tracks and scenic features to be squeezed on to a narrow baseboard.

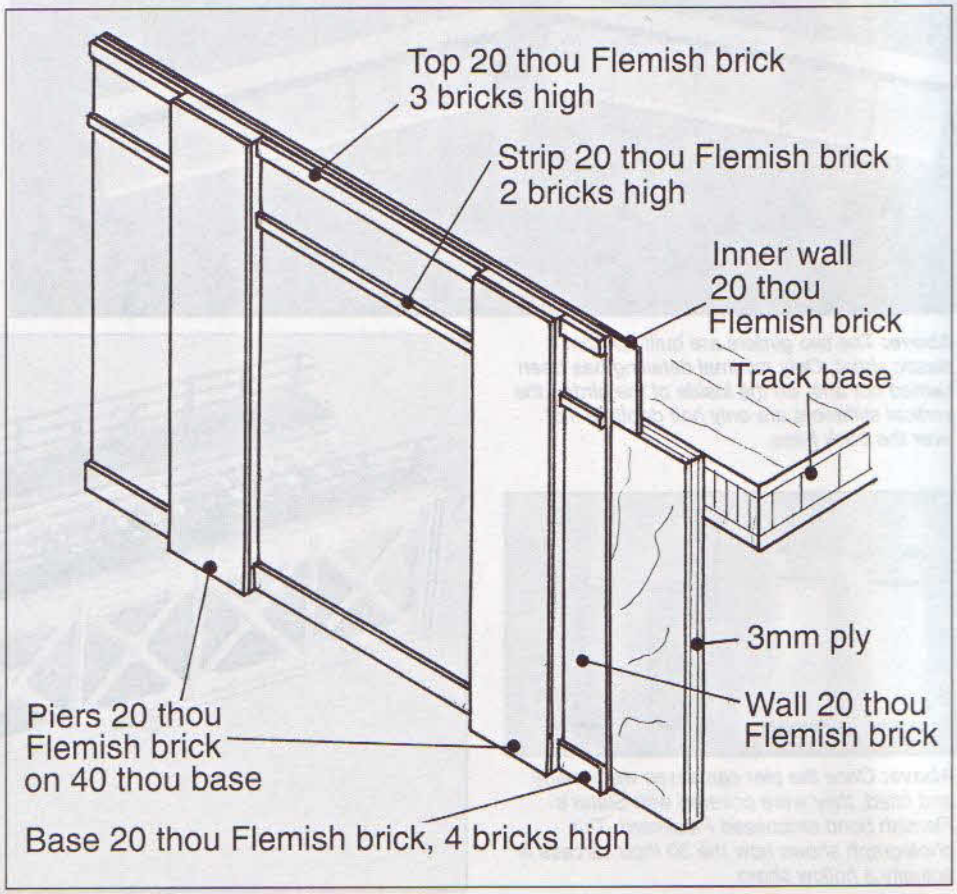


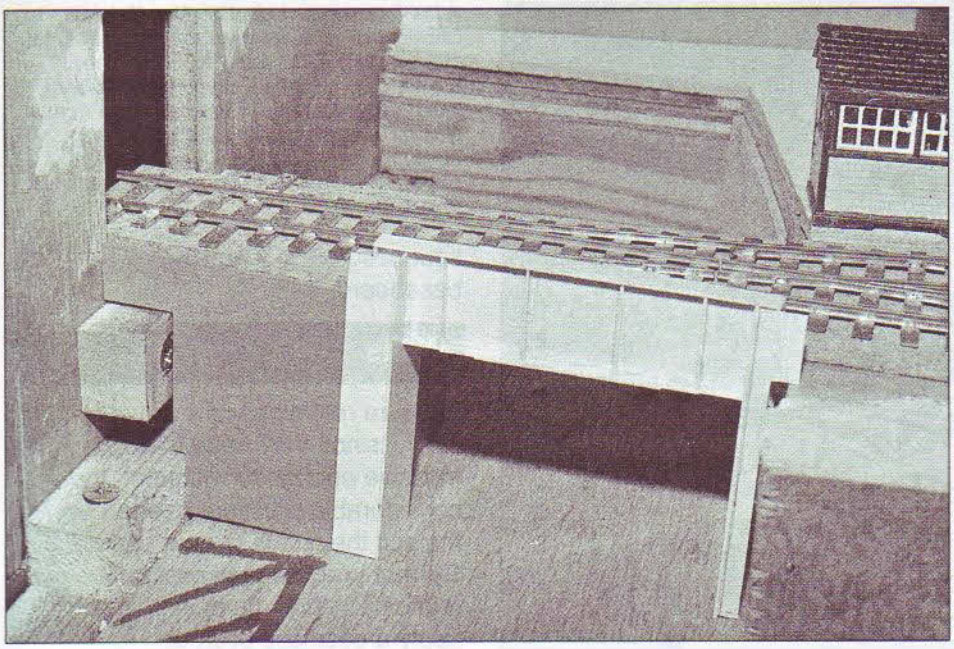
The coalyard diorama needed a girder bridge over the low-level road at the left-hand end. Like most underbridges, it is a cosmetic item, the track being amply supported by the 9 mm ply sub base. Brick retaining walls have already been installed. This is extremely simple design is described in the accompanying figure.

Walls

Full size retaining walls are very costly, since they need to be massive enough to withstand the considerable pressure exerted by the soil they have to hold back. Current practice is to cast bulk reinforced concrete in situ, and apply a cosmetic brick or reconstituted stone cladding where the wall is clearly visible. The bulk of retaining walls built in the nineteenth

Construction details of the simple retaining wall on the Brill *coalyard diorama.*

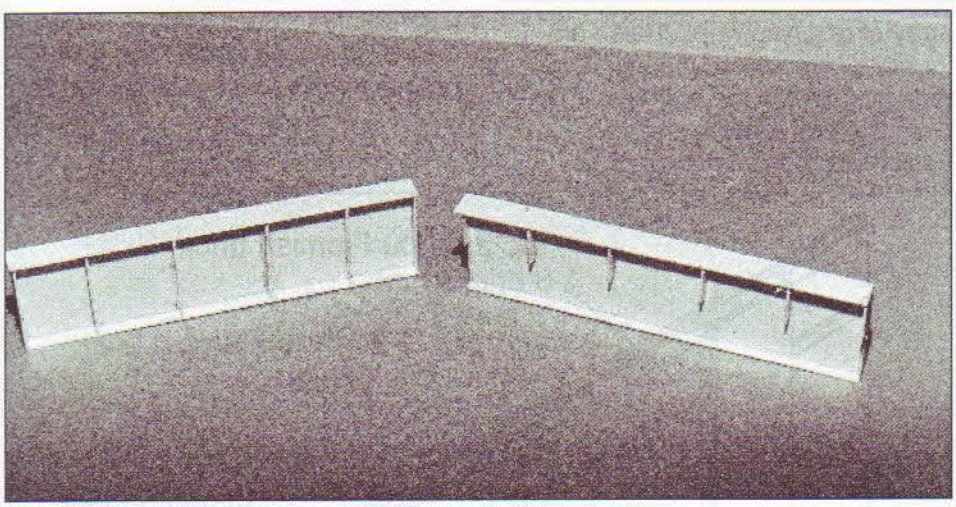




The girders were offered up to the track base and the brick piers built to fit - a reversal of prototype practice. This photo was taken before the previous shot of this area. The wood blocks supporting the backscene and carrying the track base can be clearly seen at this stage.

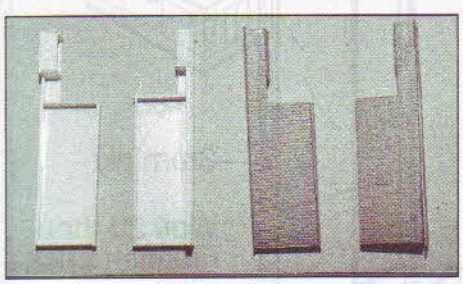
century were made from extremely hard slate-grey engineering bricks. In many instances the main strength was imparted by massive buttresses with relatively thin infilling, a fine example of what can be done when you have a large force of skilled craftsmen willing to work hard under unpleasant conditions for a relatively modest wage.

Of course, modelling one of these walls is a major project and needs a good deal of careful planning, since you will be repeating a standard unit many times along the length of the wall. The best approach is to make a careful sketch of the proposed arrangement and then build a short length as an experiment to determine what templates are needed to speed the job. However, for most model situations, where the walls rarely exceed 20 scale ft (6 m)

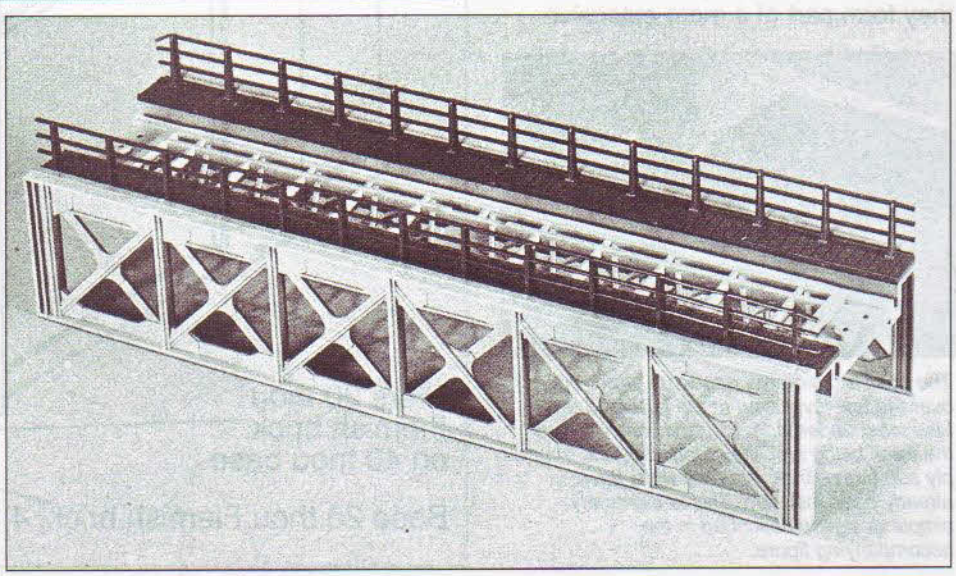


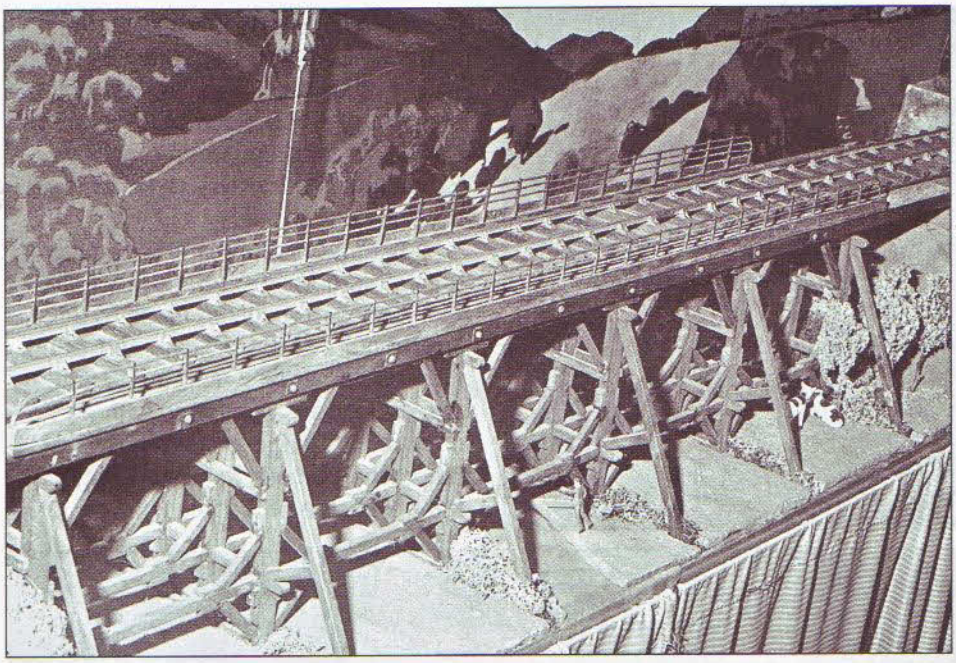
A commercial lattice girder bridge, designed to allow the girders to be below the track, as shown, or above. Of Continental origin, the model is intended for either OO or HO gauge layouts. Several of these models can be linked together on masonry piers to form a viaduct.

Above: *The two girders are built up from plastic sheet. Only minimal detailing has been carried out and, on the inside of the girder, the vertical stiffeners are only half depth to slot over the track base.*



Above: *Once the pier carcasses were made and fitted, they were covered with Slater's Flemish bond embossed Plastikard. This photograph shows how the 30 thou carcass is actually a hollow sham.*



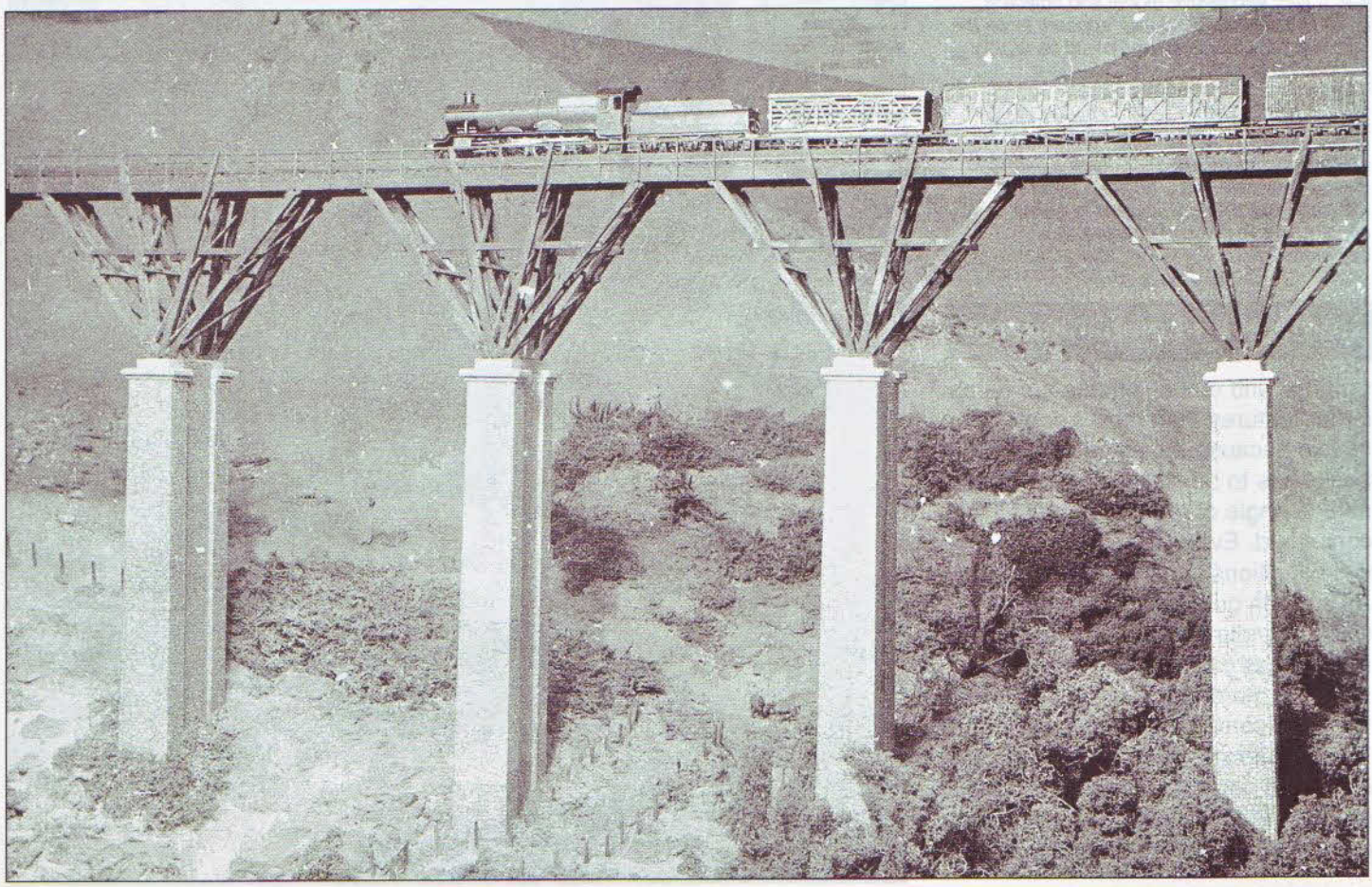


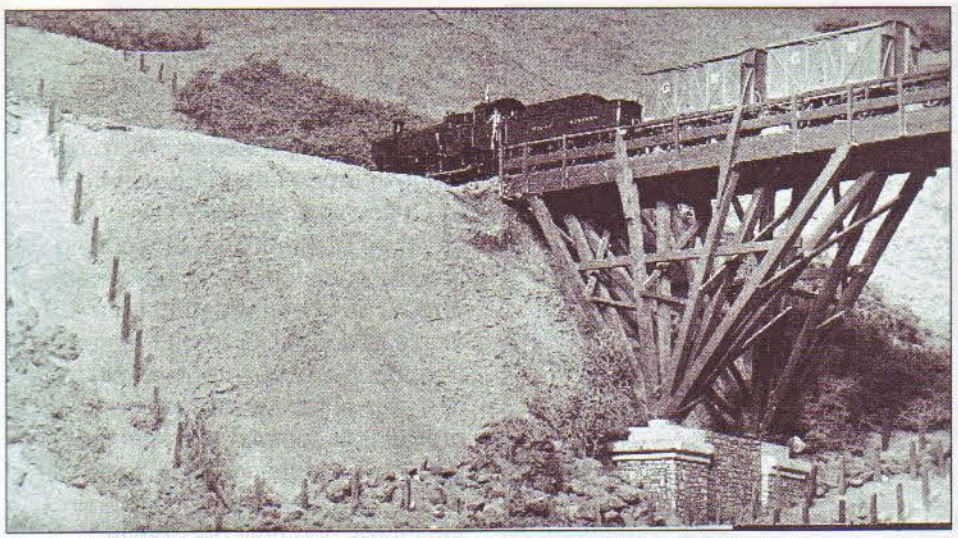
Above: *A very fine 7 mm scale model of a Scottish timber viaduct, in service on Norman Eagle's* Sherwood. *Although this material, extensively used in the first half of the nineteenth century, has long been superseded on the prototype, it is extremely popular with modellers because, despite its apparent complexity, it is actually a very straightforward prototype to model. What is more, you will use the prototype material.*

in height, the simple plain wall with regular piers and a little ornamental brickwork is perfectly satisfactory.

The full height wall is only to be found in urban areas. Elsewhere the toe wall, a relatively low structure at the bottom of a cutting is more common, especially where a route has been widened from single to double, or more frequently from double to quadruple track. It is a very attractive arrangement, providing a contrast between the dull brick and the verdant slope above. Toe walls are usually plain structures, the only decorative feature being the top capping.

Below: *A 'Hall' class 4-6-0 heads a milk train over* Pendon's *Walkham Viaduct. This is an unlikely scene, for although these slender structures were stronger than they looked, they were definitely not able to support the weight of a 'Hall' class locomotive. Modeller's licence is a wonderful thing.*





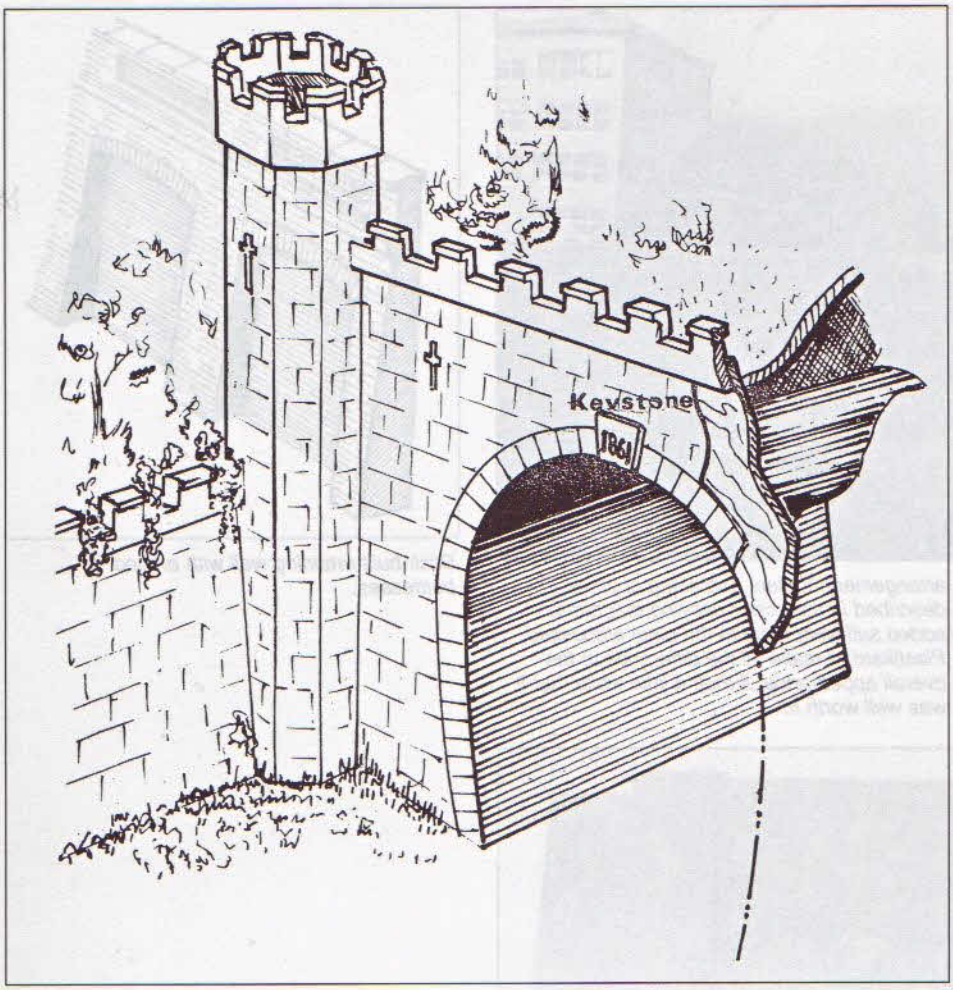
Above: *The best-known timber viaducts were Brunel's fan design, mainly associated with Cornwall and Devon, but also found on other parts of the old GWR. This is also the best-known model of one of these impressive structures, the first model of Walkham Viaduct on the Pendon Museum* Dartmoor *scene. The model is a close representation of Walkham Viaduct. Subsequent research has revealed that the end span was not quite correct. This was a very impressive model and nowhere near as difficult to build as it appears since the fans were standardised and could be rapidly assembled in a jig.*

Right: *This scene is, as any student of the British prototype will tell you, completely unrealistic. Railways do not cross a river and immediately dive into a tunnel – except that this particular model is located in Alpine country, where this sort of situation is commonplace.*

Cuttings and embankments

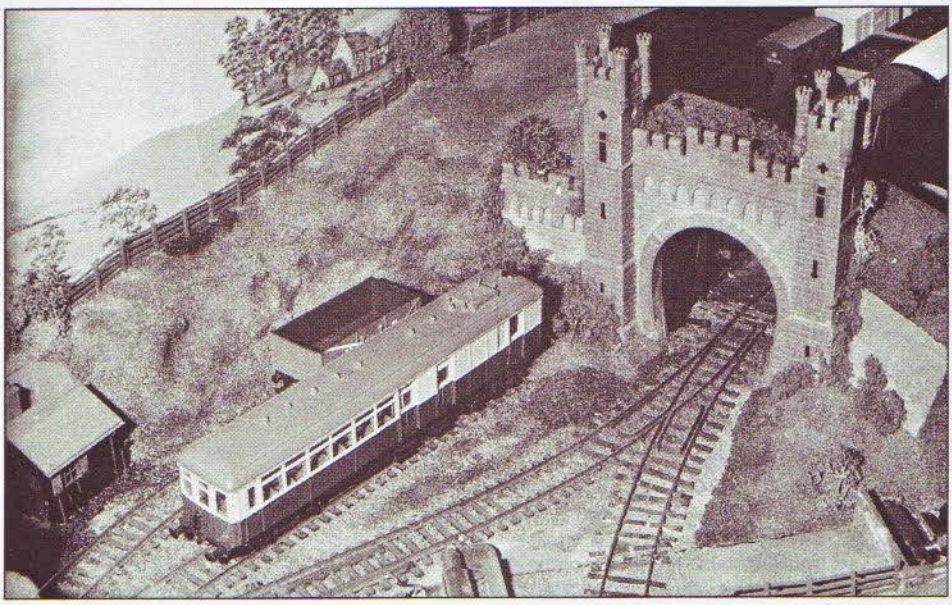
Cuttings and embankments are much larger features than most people realise because the slope of the banks has to be slightly less than the natural angle of repose of the soil concerned. Even so, under extremely wet conditions there can be landslips. As a rough guide in sandy or clay soils an angle between 30° and 45° is as much as can be expected, whilst even the more stable chalk subsoil will need something between 40° and 50°. Embankments, which are formed by tipping, tend to be flatter than the adjacent cuttings. Only in rocky areas can you have free standing, near vertical cutting sides, but even here embankments are frequently broad based. It is only where the line is cut into a very steep slope that the stone spoil is used to construct a wall. Elsewhere the material is tipped over the valley floor.

Any embankment is an effective if unreliable dam. Therefore most are provided with a culvert close to the lowest point of the valley, even when there is no actual watercourse. Often this drainage is combined with an occupation bridge giving the landowner access to his property on the other side of the line.



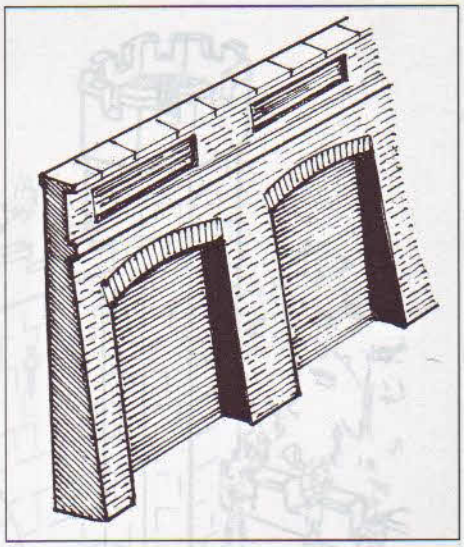
This castellated tunnel mouth is a fairly straightforward modelling project. It will be seen that, so far as the model is concerned, it is half an overbridge.

An important point to bear in mind is that the slopes are railway land, and that the boundary fence runs along the top of cuttings and the base of embankments. On the subject of fencing, Britain is unusual in insisting that all railway land should be fenced, a condition written into the enabling Acts. The exception is in urban areas, where the fence is viewed as a boundary demarcation and not a protective barrier. A simple post and rail or post and wire fence is the norm. While it is not too difficult to scratchbuild this type of fence, it's a tedious job and as there is a good selection of commercial fences on the market, very few people bother to make their own.

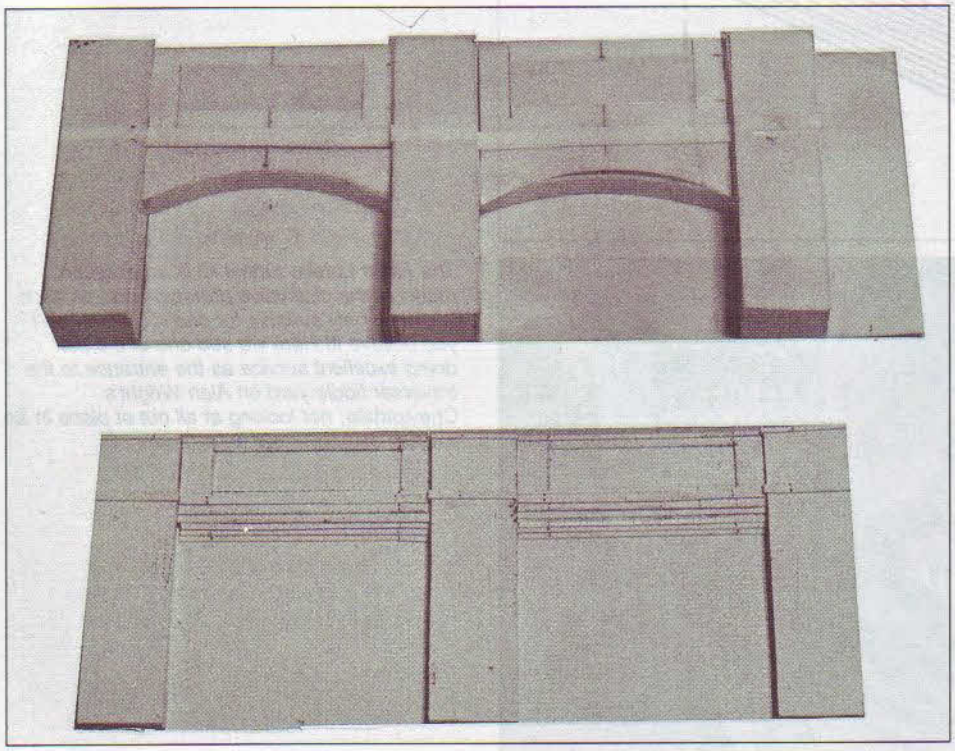


The Faller Lorelie *tunnel kit is an excellent model of the distinctive prototype and as such is clearly only suitable for one location. Don't you believe it! Here we see one of the pair doing excellent service as the entrance to the traverser fiddle yard on Alan Wright's* Cheviotdale, *not looking at all out of place in an English setting.*

The low level roadway on the Brill *coalyard diorama needed a brick retaining wall as a frame. In practice, it is probable that these relatively low walls would be straightforward, unrelieved brick, but the first sheets I put in place looked far too plain. A simple arrangement of piers and string courses, described in the accompanying diagrams, added sufficient relief to the plain embossed Plastikard to make all the difference to the overall appearance. It took a little while, but it was well worth it.*

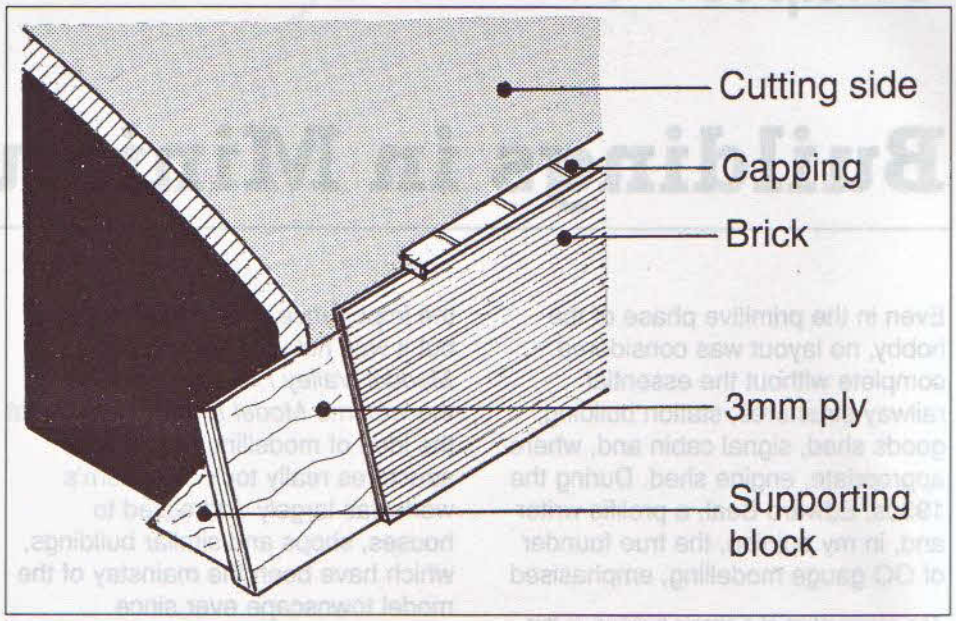


Brick-built retaining wall with arched buttresses.

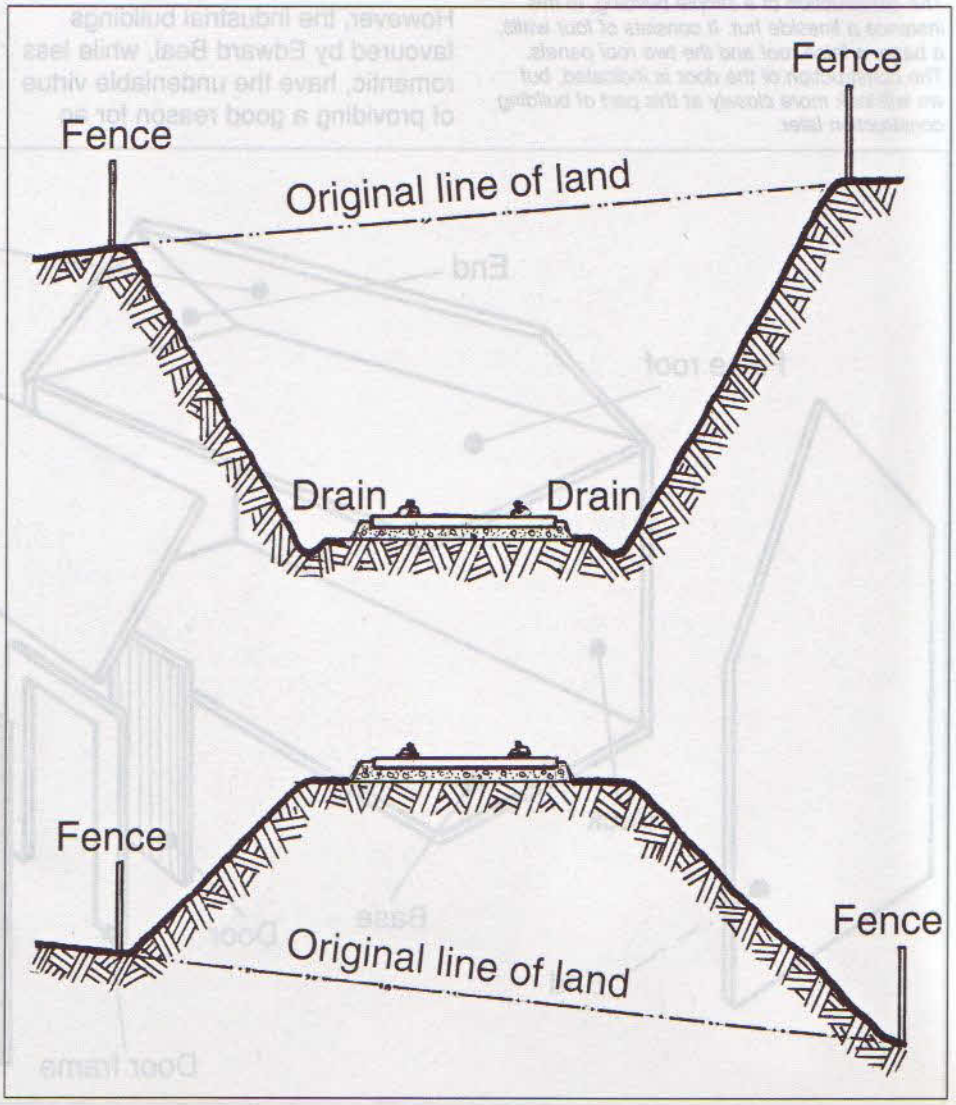


My son's Dugdale Road *was backed by a low retaining wall, quickly made by pasting blue brick paper on to hardboard. It has always been the one feature that let down the layout and we discussed an improvement. The upper sample is the first trial, a quick mock-up from 20 thou plastic sheet to see how it looked. While the result is quite impressive, it was too heavy for this situation. For the second trial for the* Dugdale Road *retaining wall I used Slater's Flemish bond and devised a fairly elaborate flat wall with shallow piers. This is the probable design for the final replacement. While these trial essays had all parts marked out individually, several sheet metal cutting and spacing jigs will be used for the finished model. This will speed both cutting and assembly and ensure greater uniformity.*

Modelling a toe wall in a cutting. This is a very useful space saver, though it is more commonly found where the original line of railway has been widened. It is occasionally found in towns where it saves purchasing extra land.



Typical cuttings and embankments. The cutting, which was made through firm ground, has a slightly steeper side than the embankment, which was made by tipping spoil from nearby cuttings over the ground and is therefore much looser in texture. Note the location of the boundary fence; the railway owns the slopes. There is sufficient flat ground on either side of the track to allow permanent way men to walk the tracks. This is frequently more generous than is shown here, but width is very precious on most model railways and we have to fudge a little. By the same token, the slopes shown are steeper than would be found in practice. When modelling a cutting or embankment, it is important to ensure that the land on either side of the railway appears to be contiguous. This is shown by the chain-dotted line.

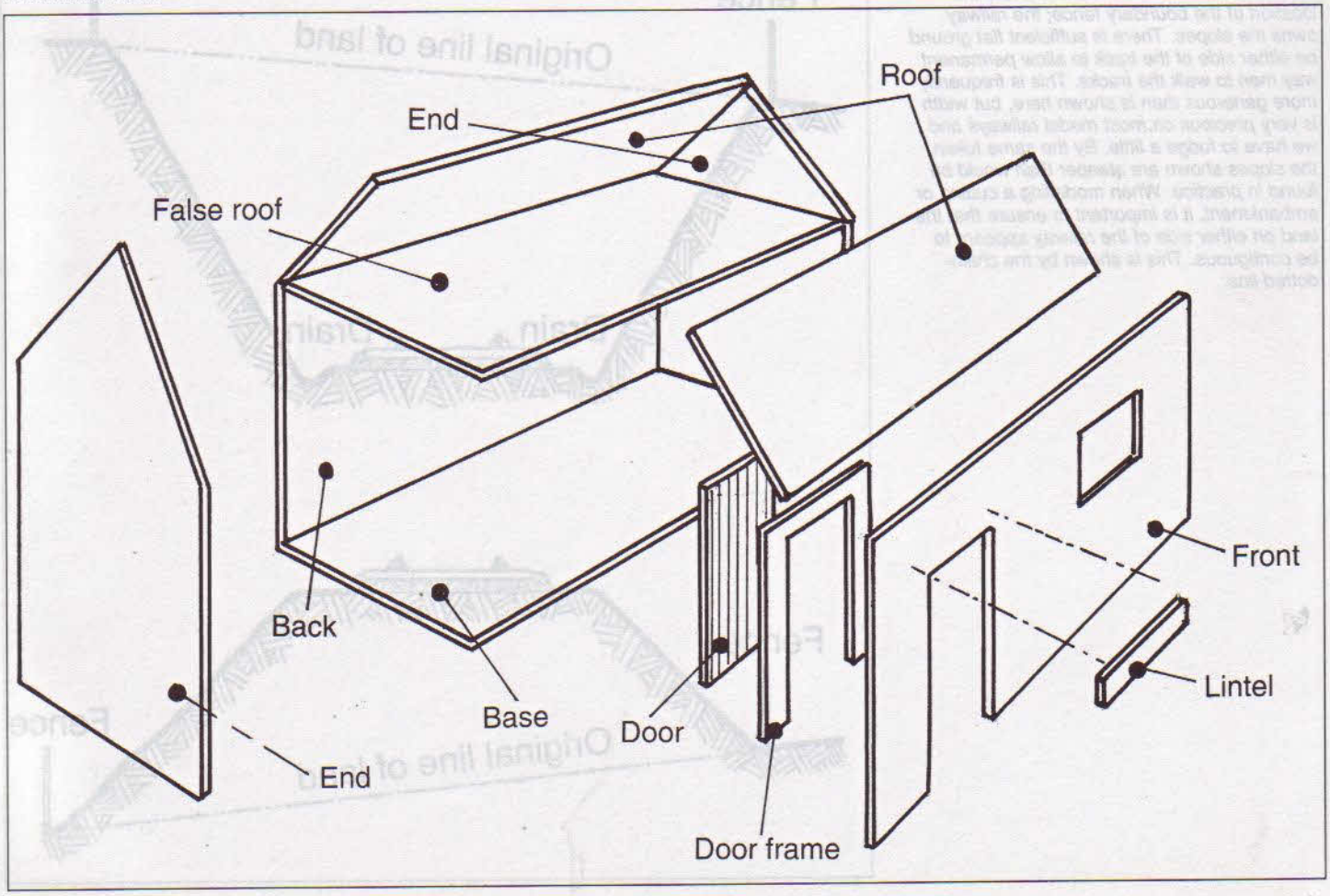


Chapter 11

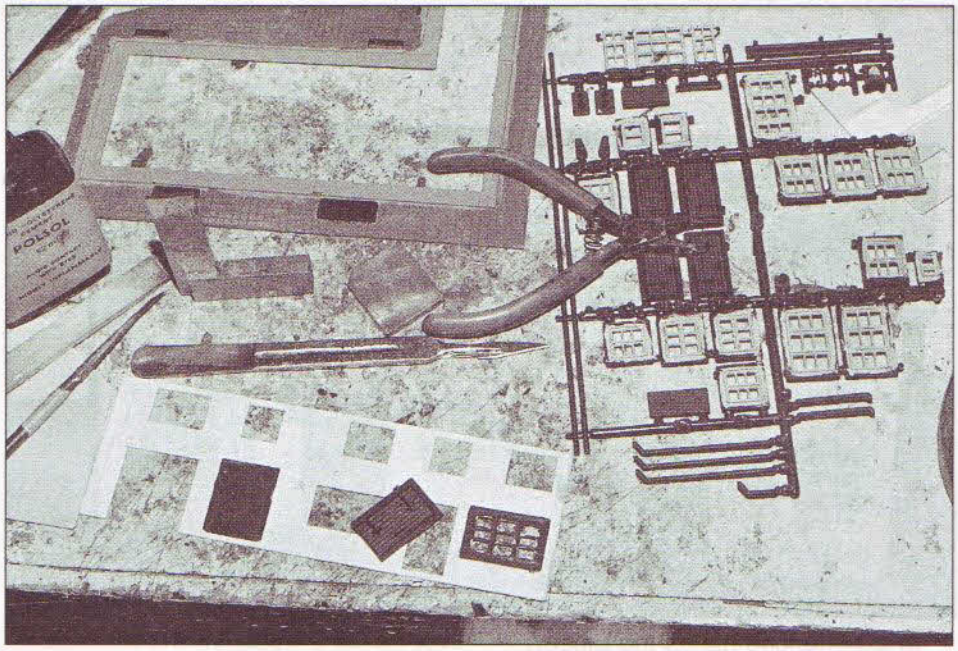
Buildings in Miniature

Even in the primitive phase of the hobby, no layout was considered complete without the essential railway structures, station building, goods shed, signal cabin and, where appropriate, engine shed. During the 1930s, Edward Beal, a prolific writer and, in my opinion, the true founder of OO gauge modelling, emphasised the importance of lineside buildings but it was not until John Ahern's *Madder Valley Railway* appeared in the wartime *Model Railway News* that the idea of modelling non-railway structures really took off. Ahern's work was largely addressed to houses, shops and similar buildings, which have been the mainstay of the model townscape ever since. However, the industrial buildings favoured by Edward Beal, while less romantic, have the undeniable virtue of providing a good reason for an intensive train service.

Unlike the locomotives, coaches and wagons, which are standardised products and, within a specific class, basically similar one with another, buildings come in a variety of forms and are assembled in many different combinations. Even where there is a high degree of initial standardisation, homeowners delight in adding personal touches. Agreed, restrictive covenants and leases, not to mention conservation areas, can restrict our natural desire to be different, but in



The construction of a simple building, in this instance a lineside hut. It consists of four walls, a base, a false roof and the two roof panels. The construction of the door is indicated, but we will look more closely at this part of building construction later.



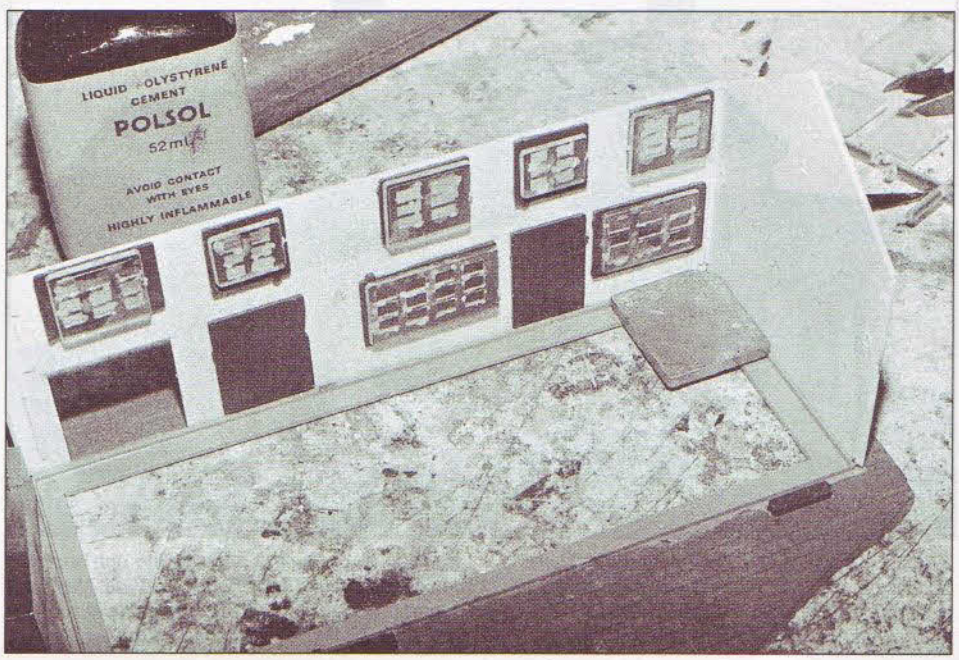
Getting ready to assemble a plastic building kit, in this instance, a Heljan pub. The window frames have been converted from their original dark brown to light cream. Doors and frames are being inserted into the side. The main tools are visible in this shot: a pair of small side cutters for snipping parts off the sprues, a scalpel for fine trimming, a small square and the solvent brush (with tape marker) close to the open bottle.

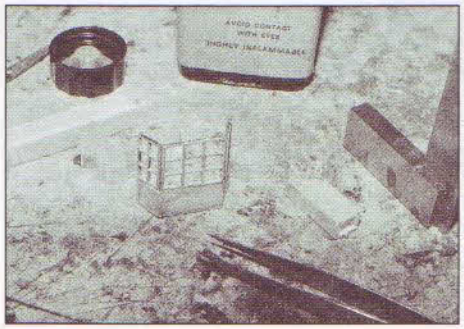
our model world we are architect, builder, landowner and tenant rolled into one, and can have any type of buildings we like around our railway.

The front wall, complete with glazed window frames and doors, together with one end wall is now erected on to the base. A small square of metal is used to check the internal angle.

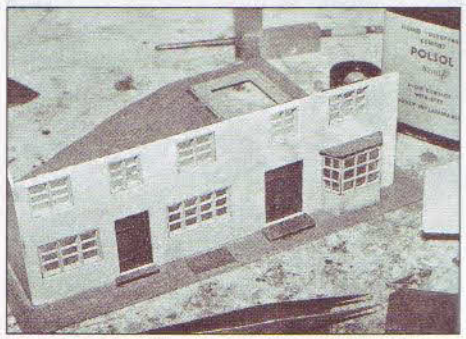
Building kits

Except at train set level, fully assembled buildings are largely confined to craftsman built models, often produced to special order. The main commercial thrust is towards kits.





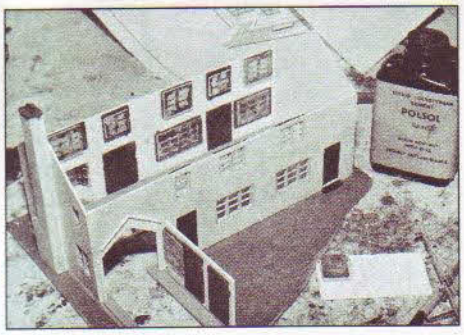
The pub has a bay window to the lounge bar. This and the chimney pots are assembled as separate units and allowed to harden before being fitted to the main structure.



The front of the partly assembled kit, with the bay window in place. The other end wall has had its chimney attached.

This is understandable, for a model building consists in essence of roof, walls and base, enclosing a large amount of empty space. Reduced to these basic units it can be packed flat and put into a slim box, leaving the purchaser to provide the empty space. An assembled building is quite expensive to package and dispatch and would take up a lot of room in a retailer's storage and display space.

The most elementary building kits are cardboard cut-outs. Printing a full colour set of parts on to a sheet of card is relatively simple and inexpensive, though the pre-planning and preparation of the artwork is another matter altogether. Frequently these card cut-outs are aimed at children and the impression is given that they are easy to assemble. The results are usually indifferent because cutting, creasing and gluing a card model together calls for a good deal of skill and patience. As well as this,



All four walls of the main building are now in place and a start has been made on the outbuilding.

Work can begin on the roof. It is vital to see that this not only sits firmly on the sides, but also that the apex is perfectly closed. Roofs are very visible parts of a model building and need more attention than might at first be thought.

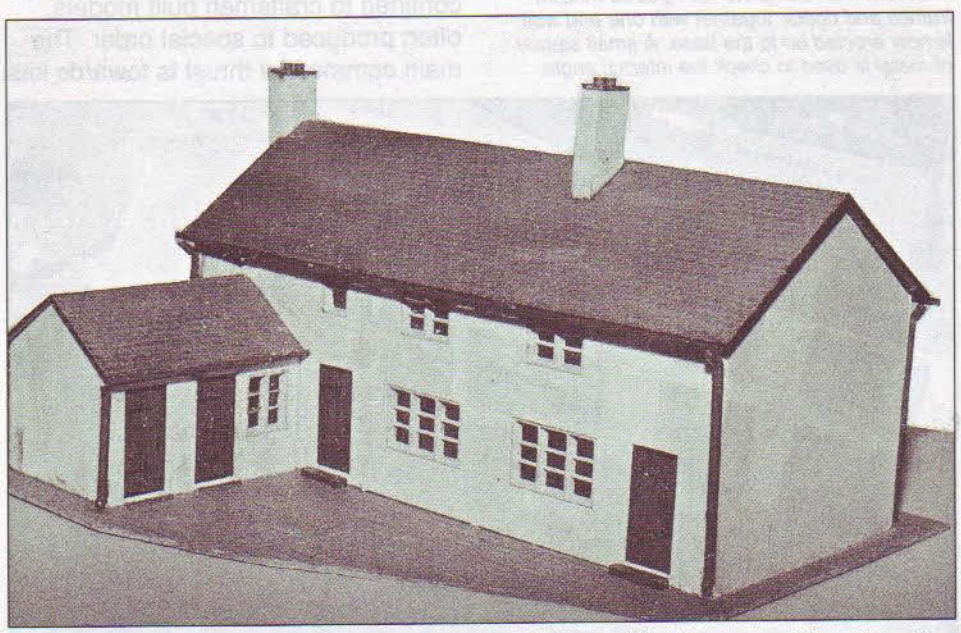
anything made from a single layer of thin card is going to sag alarmingly. Their only equal as a way of convincing youngsters they have no ability to build models is the Blue Peter school of modelling, which uses discarded packaging as the base material.

Two ranges have dominated the British market for decades, the Bilteezi series, printed on very thin card for the purchaser to cut out, and the Superquick models, printed on thicker card, partially pre-cut and provided with a separate instruction kit. A third range, Prototype Kits, which came later on to the scene, specialises in accurate copies of actual railway structures. The genre has seen a revival in recent years with some extremely accurate kits being made for a discerning market, while the earlier models have been revived.

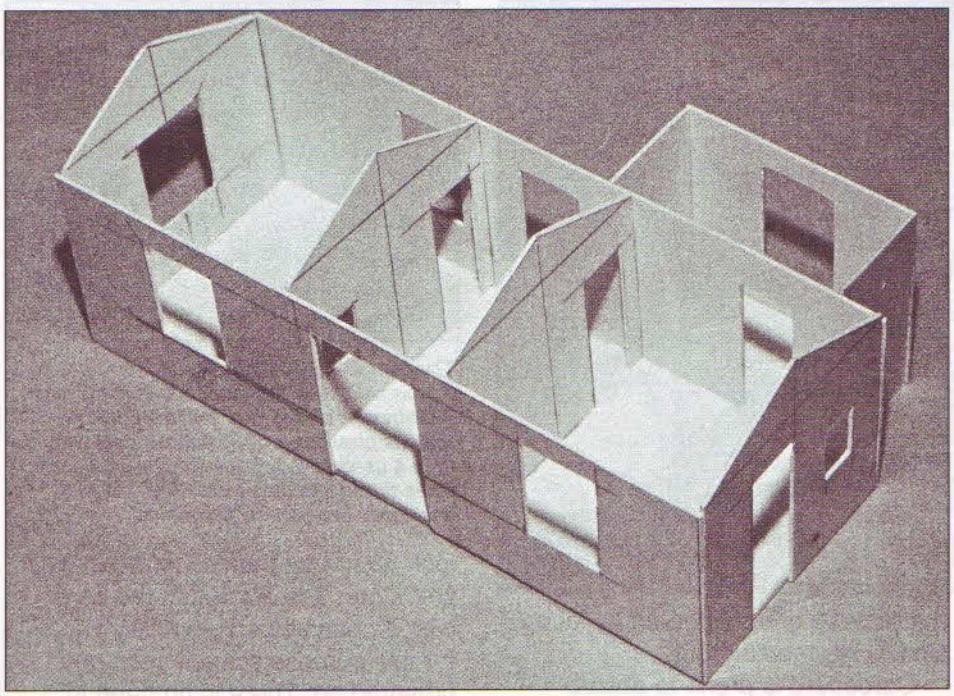
Once the roof is in place the final details can be added. The most important are the gutters and downpipes. This model also had a pub sign and a small canopy over the door.

In experienced hands the Bilteezi series, suitably reinforced, are extremely effective as backscenes, but the essentially flat nature of the models, with printed windows flush with the walls, makes them less suitable for foreground work. The Superquick and Prototype ranges, printed on thicker card and, with Superquick, partially pre-cut are more effective, since they provide a considerable degree of relief modelling.

The popularity of the Bilteezi and Superquick ranges in the '60s and '70s led to a lot of layouts looking remarkably alike. This was soon recognised as a severe disadvantage



The back of the pub is decidedly bare. There should be crates of empty bottles around, and a lean-to shelter from the back door to the toilet block would not come amiss. A further addition would be the name of the pub and the inevitable claim 'Good Food and Fine Ales' on the end wall, which can be applied with rub-on lettering. All these extras can be added later.



The first essay in scratchbuilding should be a simple square structure. This small GWR timber station building almost meets that requirement. I began with a 30 thou carcass, with doors and windows cut out, assembled on a plain sheet. It will be seen that the internal partitions and the various doors and ticket windows were cut out. Pencil markings can be clearly seen.

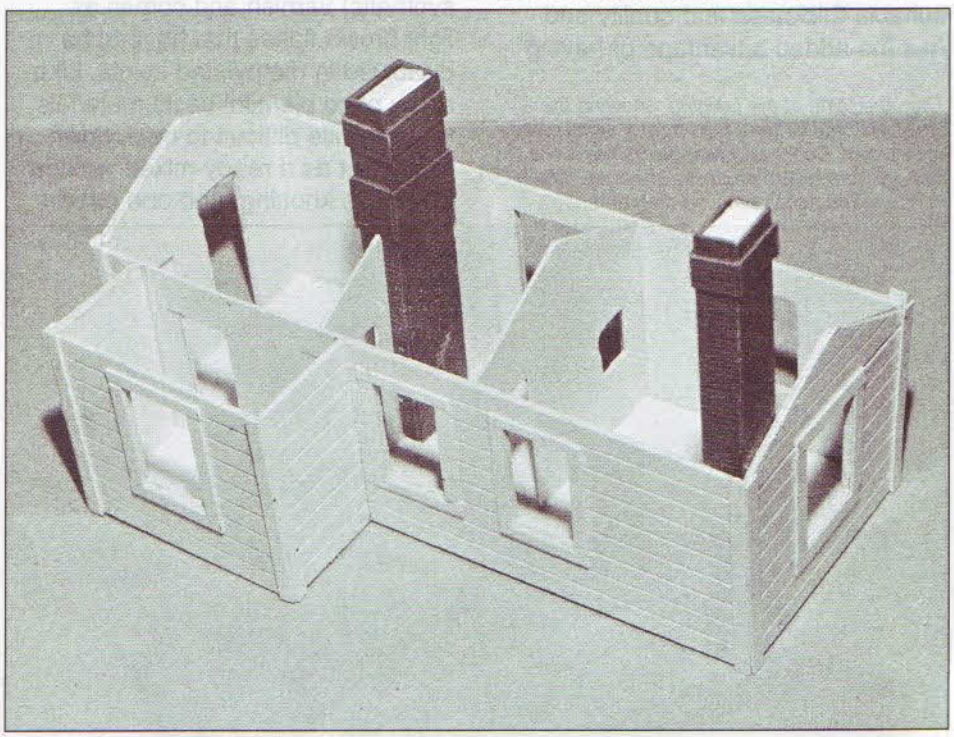
because the railway and lineside buildings are by far the best means of giving every layout an individual look. Into the bargain, building construction, which in its basic form is purely a matter of assembling several different shaped boxes together, is the most straightforward and rewarding field for scratchbuilding.

Making buildings from card

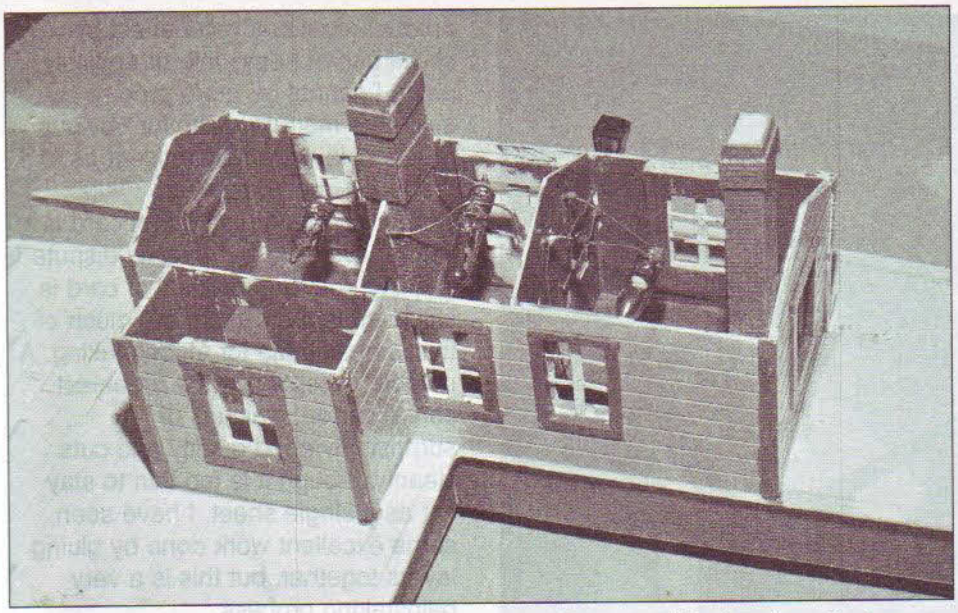
Card of varying thicknesses and qualities has long been a favourite material for building construction. It is readily worked with simple tools and, when combined with pre-printed 'brick' papers (in practice, these also include stone, slate and tile) can produce some remarkable results. The original Merco series was somewhat overscale and is no longer produced, but more recent patterns not only have more accurate sizes, but are also available in a wider range of brick bonds. The latest product creates a relief effect by skilful use of heavy ink, or possibly paint. I cannot be more precise since the manufacturer, for obvious reasons, is extremely reticent as to the techniques employed.

It is often suggested that card is readily available but I would dispute this. Agreed, a good deal of card is still used in packaging, but much of this is unsuitable for modelmaking. A notable exception is the breakfast cereal carton, which is of surprisingly good quality and cuts cleanly, though it is too thin to stay flat as a single sheet. I have seen some excellent work done by gluing layers together, but this is a very painstaking process.

A lot of the thicker packing card is too loose in texture and difficult to cut cleanly. Artist's suppliers carry stocks of superior boards, but in my experience they are naturally more concerned to offer a wide selection of colours rather than to provide a



Chimney stacks and external cladding – in this instance 'wood plank' embossed Plastikard – have been added to the plain carcass. The end timbers and window and door frames are carefully cut from strips of 20 thou. plastic sheet and applied on top of the cladding. One of the beauties of this type of building is that these details stand proud and are accordingly much easer to fit.



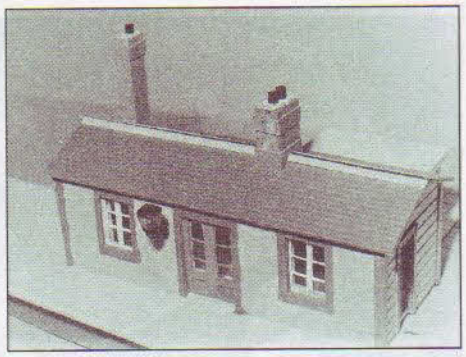
The building then had to be painted: light stone for the main panels, dark stone for the raised 'timbers' for a GWR/WR structure. The building is in place on a scratchbuilt plastic platform and has been provided with internal lighting.

choice of thicknesses. Letraset supply a graph board which is of suitable thickness and quality and has the added advantage of having a millimetre grid printed on its face, simplifying marking out.

Cardboard is prone to absorb moisture, but this can be cured and the texture of the material improved by soaking the card with shellac. This is a base for natural (non-synthetic) varnish and comes as light brown flakes that have to be dissolved in methylated spirits. Like many once plentiful basic materials, this is a little difficult to track down today, but as a ready-mixed version is sold as knotting, and one need look no further than a well stocked DIY store. It is applied to the card with a cheap brush, specially kept for this purpose since it soon gets gummed up. There is no need to worry about this as the methylated spirit base soon frees the hairs.

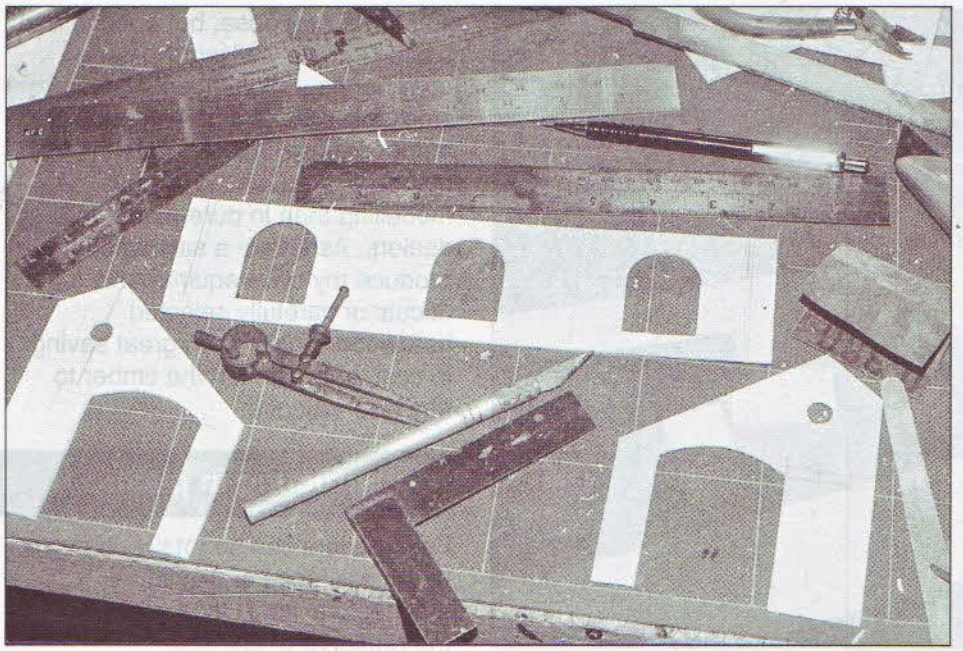
It is important to remember that whereas untreated card can be painted with water or poster colours, once soaked in shellac it will only take oil or acrylic-based paints. Furthermore, you should not apply shellac to pre-printed card kits as it changes the colour.

Thin card can be folded, preferable along a scored line. This feature is exploited in many card cut-out kits with the result that many people believe that this is the correct way to make a model building. In practice, setting out the folds and tabs for anything other than a very basic box is a complex exercise in practical geometry. On top of this, making a fold precisely along the desired line is easier said than done and, moreover, with anything thicker than a heavy writing paper, the corner has a distinct radius. As a thin-walled structure will inevitably warp, this process is unsuitable for serious modelmaking. It is far less bother to cut each wall or roof slope as a separate unit.

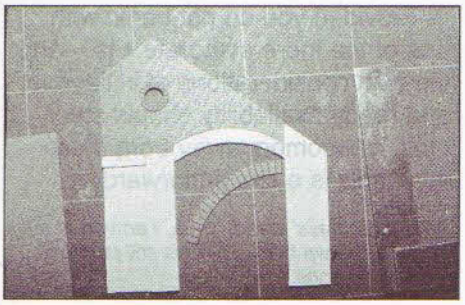


The completed building. The roof was cut from a Wills tile sheet, the roof ridge is made from two strips of plastic card and a length of Slater's plastic rod. The chimney pots were cut from a used ballpoint refill and inserted into holes drilled into the stacks. The 'cement' flashing is two-part car body filler.

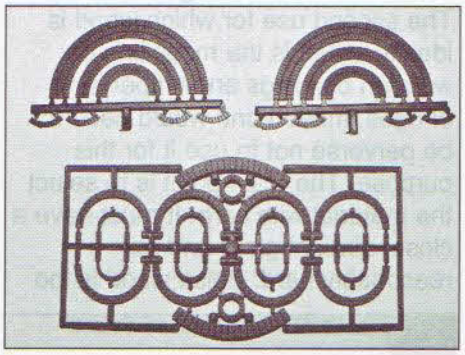
The other side of the building, showing the small external lantern, filed from a small piece of Perspex. Doors and window frames were built up from layers of plastic sheet as shown in one of the accompanying diagrams.



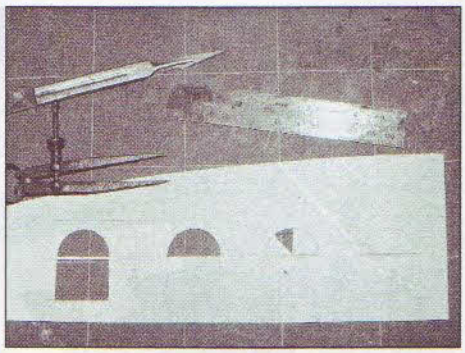
A major project on Brill *was the goods shed, which whilst small in prototype terms is the largest unit on the layout. The model is built entirely from plastic sheet and was begun by cutting out the two ends and front. At this stage the back was left in abeyance as the model is cut through by the backscene.*



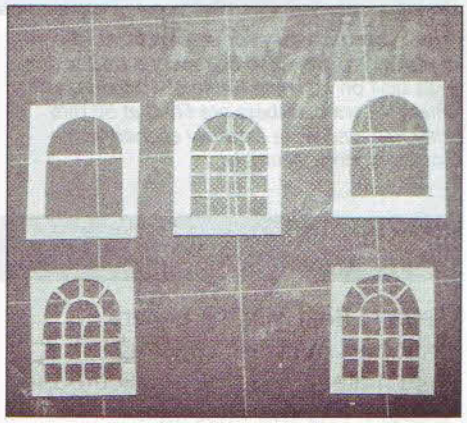
Once the sides were cut out, I set about adding the detail. Piers and string courses were built up by applying strips of 30 and 60 thou plastic sheet to the 40 thou sides. Slater's Flemish bond Plastikard was used for the cladding. (Regrettably they do not provide English bond, which is more appropriate for a railway building.) The arches are Ratio mouldings.



The most difficult structural feature to model effectively is the simple brick arch. It is possible to cut a vertical slice from a sheet of brick Plastikard, but this is not really prototypical because arches don't have courses. Building up with individual bricks is tedious, but help is to hand. Wills (upper arches) and Ratio (lower arches) provide a selection of mouldings which can be used in a variety of ways.



Commercial window frames are also available, both as plastic mouldings and brass etchings, but I elected to make my own from 20 thou. plastic sheet. The first step was to cut the main openings from the sheet. The curved tops were cut with engineer's dividers, a very simple matter with plastic card. Rather than try to push the entire half-circle out in one piece, I subdivided it into quadrants with deep cuts, and pushed each section out in turn.

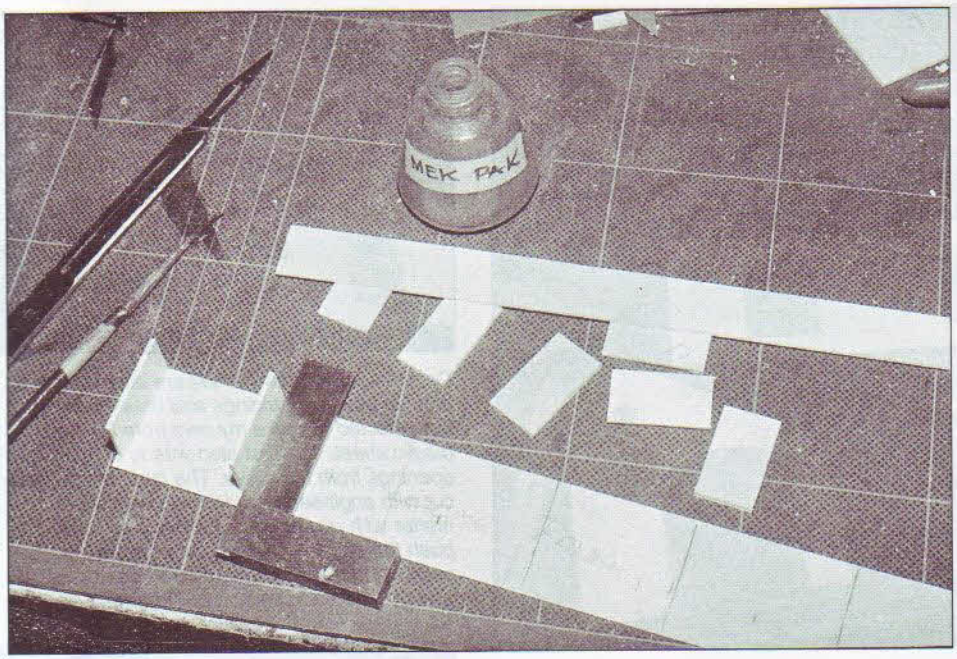


The window frames were made from two layers, the outer 20 thou section with a single horizontal sash bar and the frames proper, with the individual glazing bars cut from 10 thou sheet. It took a whole evening to cut out the three pairs of panels and about 10 minutes to cement them together.

Using plastic

For my own part I have never been wholly happy with card. I am not criticising the material. I know many modellers who use it to great effect, and freely admit that my own dislike stems from the fact it does not behave like metal, so when plastic sheet became available, I joyfully adapted to this. My personal opinion is that whilst either card or plastic is an excellent base for model buildings, printed card *and* plastic buildings on the same area of a model do not look right because the finishes are quite distinct.

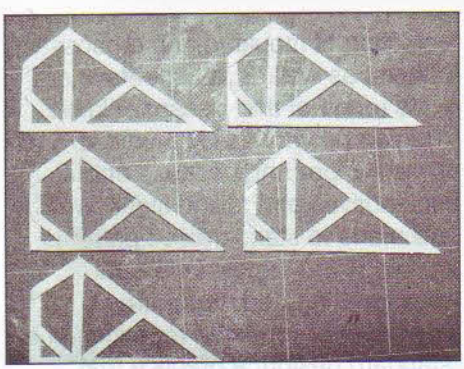
With plastic you not only have an extensive and growing range of building kits from which to choose, but you also have an equally exciting selection of moulded and embossed sheets, as well as flat sheets in a wide range of thicknesses. Plastic kits can be very easily modified. This is very important, because unlike locomotives and rolling stock, which are made to standardised patterns, buildings are largely individual creations. Agreed, there are examples of repeated repetition of a standard design, a practice that dates back to Georgian days, but the majority of townscapes are marked by their variety.



The loading platform, or at least what little of the platform projected beyond the backscene, was built on a simple frame of 40 thou plastic sheet. Cross-members are fitted at 50 mm intervals, and were carefully aligned with a square during assembly.

Wood

Before I deal with the general principles of plastic construction, a third material must be considered, wood. It has two important applications, the first as stiffening or even a complete carcass for a 'brick', 'stone' or 'concrete' structure. Plywood, preferably 3 mm thick, is a good general purpose structural material, readily cut with a fretsaw and strong enough to withstand rough handling. Stripwood is also invaluable for stiffening corners. The second use for which wood is ideally suited is the modelling of wooden buildings and timber bridges. Indeed one would need to be perverse not to use it for this purpose. The main point is to select the material with care. It must have a close, straight grain and be reasonably hard. Balsa wood is too soft for our purpose, but obeche and basswood are well worth considering. Good model shops stock this type of material, but it is more common in those catering for marine and advanced aircraft modelling than in pure model railway dealers. As I have a sawbench, I produce my own requirements from offcuts of carefully selected hardwood. There is no great saving in cost, but I can cut the timber to any size I require.



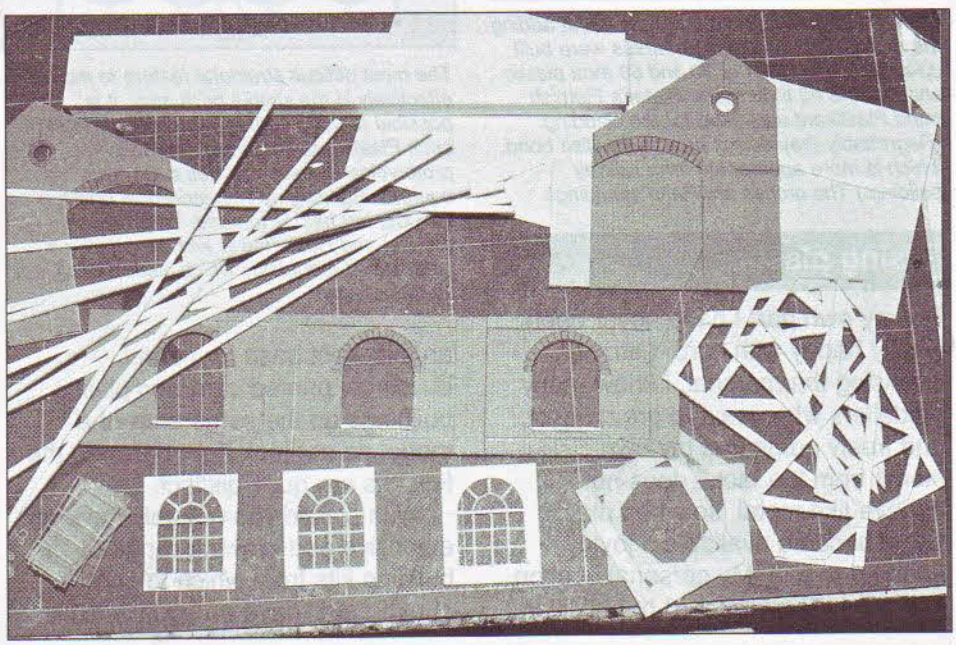
The roof is supported by five heavy timber principals. These were built up from 60 thou plastic sheet, cut into 4 mm wide (12 scale in) strips.

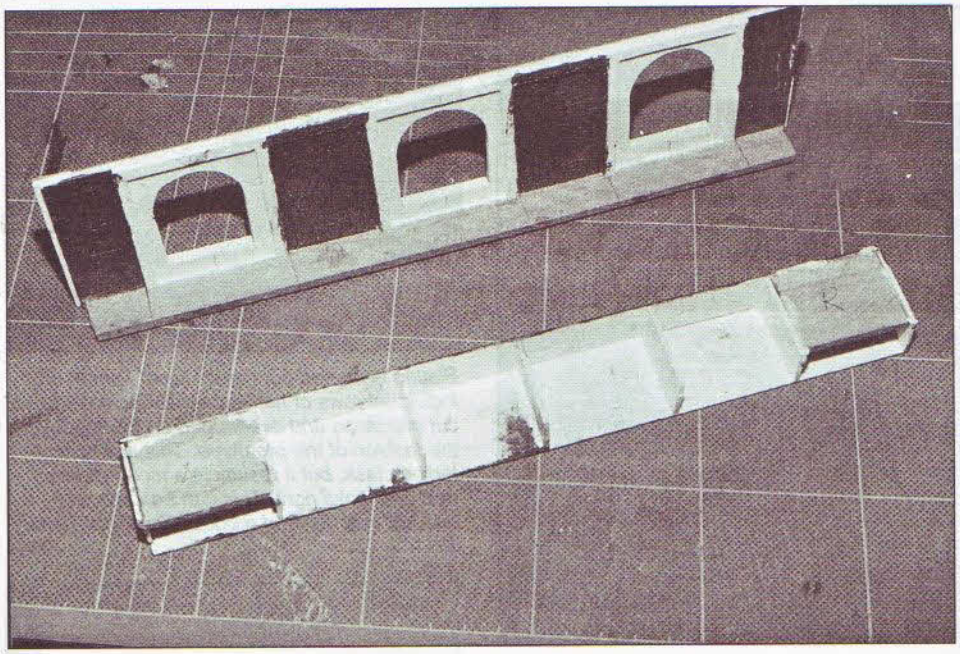
Constructing in plastic

Few readers can be totally unaware of the existence of plastic architectural kits. Once very much the preserve of German manufacturers, who still amount to the major sector on the market, there now a reasonable selection of British kits to choose from.

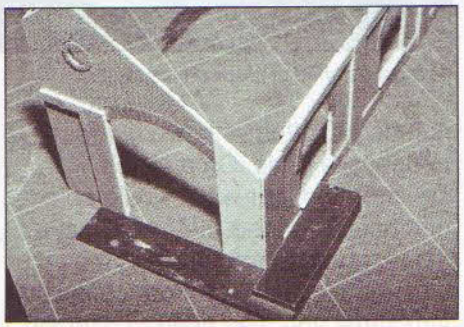
Provided you do not begin with one of the more elaborate kits – and the twin considerations of initial cost and ready availability should steer most newcomers away from these – assembly is a straightforward

After three days' steady work, I arrived at a kit of parts, shown here. There is still plenty of work to be done.





The inside of the front wall has been partially painted, but nothing has been done about the window openings. These have been provided with 40 thou thick surrounds, which allows for the window frames (20+10 thou) and a 10 thou thick sheet of acetate glazing. A wooden strip has been pinned and glued along the bottom, which prevents any warping of the wall and gives something to screw into when fixing the shed on to the baseboard. Wood inserts are also provided on the loading platform.



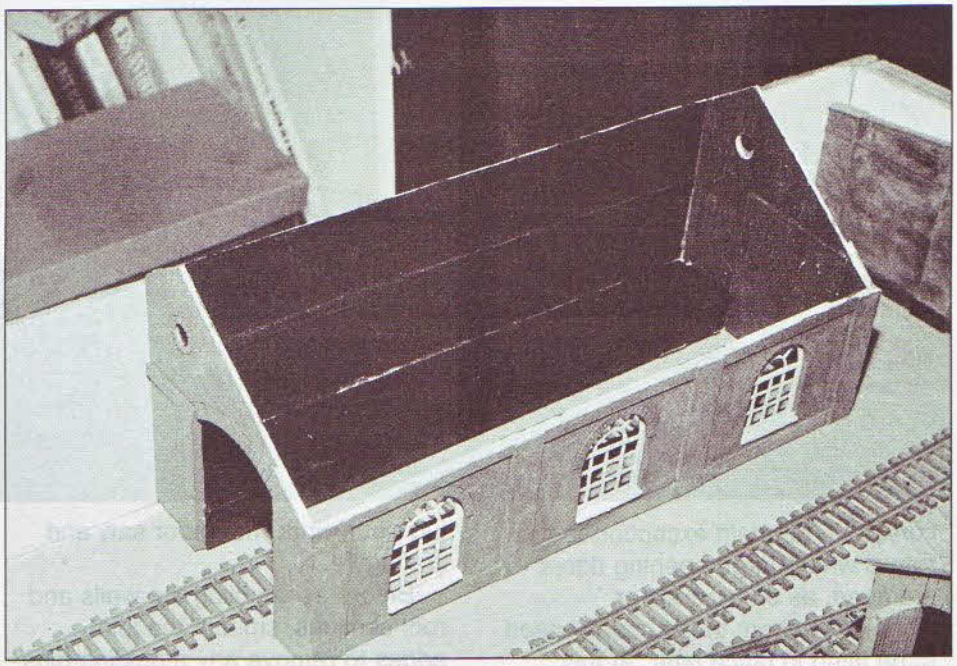
Assembly has begun, using a square to ensure that the front and end are at a true right angle. The various layers of plastic sheet are arranged to form a stepped housing, but the brick overlay on the end outer pier will be fitted when the joint has hardened.

enough business. Study the instructions before starting construction, not merely to determine the order of assembly but also to identify the parts. To be frank, some kit ranges provide nothing more than a sheet of exploded drawings, which with one caveat, is perfectly adequate. The snag is that the sequence of assembly is not given. In the simplest kits this should not be a problem, but in the more complicated structures you can run into difficulties.

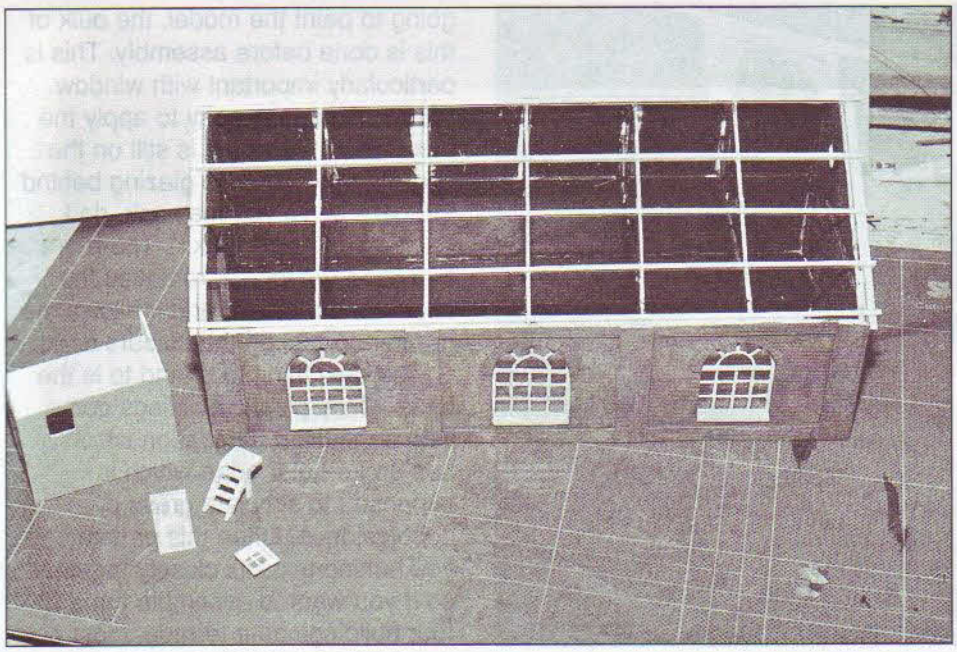
My own procedure is as follows. If, as is normally the case, I am going to paint the model, the bulk of this is done before assembly. This is particularly important with window frames. It is quite easy to apply the paint when the frame is still on the sprue and there is no glazing behind the bars. Why, you may ask, do I paint a self-coloured kit? There are two good reasons, it removes the sheen of the plastic and it allows me greater control on the colours used.

The next thing to attend to is the base. Many plastic buildings come with a moulded foundation which has an irregular edge which is supposed to simulate grass or cobblestones. Often this prevents you butting two kits closely together, so if you want to assemble three or four buildings as a terrace, most of the base gets in the way. Some drastic pruning with a saw before going any further is usually a good idea. Often it's less bother to make up a new base on a sheet of plastic card.

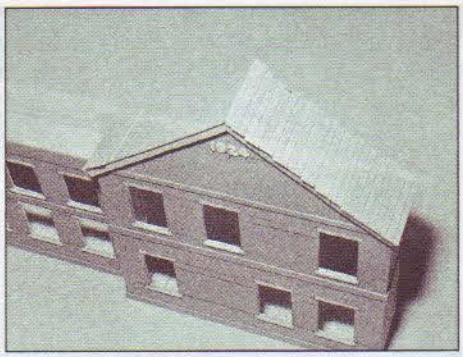
The next stage will be to fit windows and doors to the sides, add glazing and, if desired, window



The moment of truth! Although the various parts had been carefully marked out from dimensions taken from the model, it was not until this stage that it became possible to see how well the shed would fit on to the layout. I wasn't unduly worried because I could easily have slewed the track had I made a serious error, but all was well.

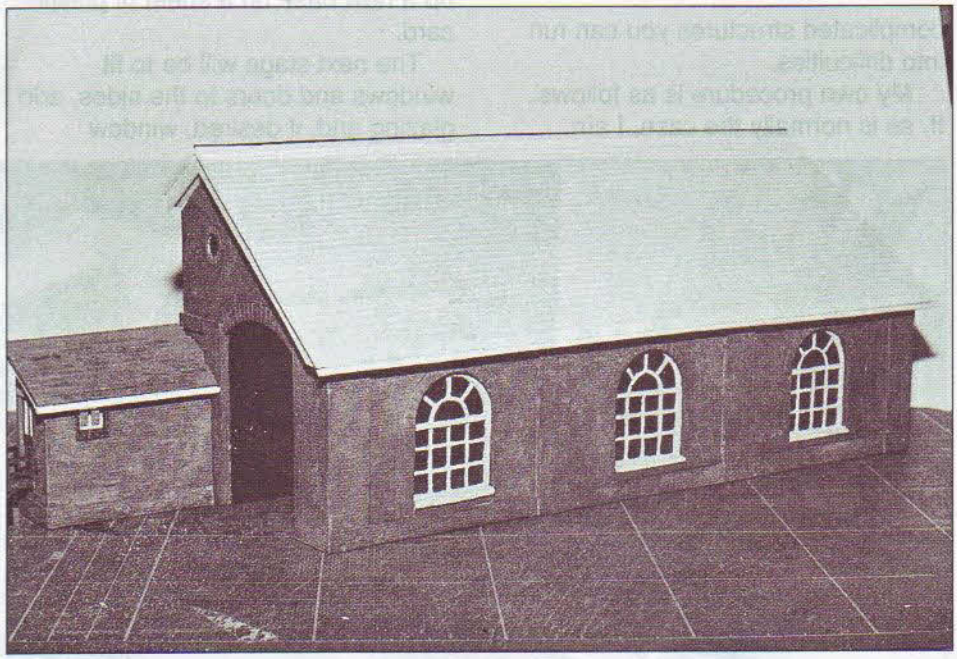


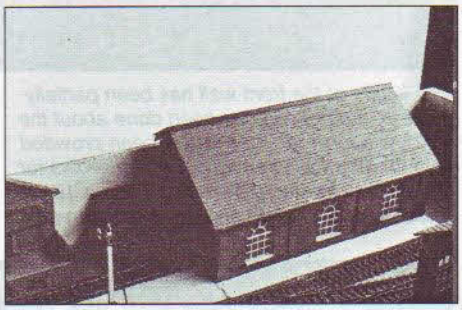
Above: *It was now time to erect the roof principals and lay the rafters. I cheated here, and put in far fewer than would have been found on the prototype. The initial stages of the office building can be seen.*



Slating is carried out using Slater's sheet of individual rows of half slates. These have to be cut into strips and overlapped on the model in the fashion of the prototype. This is a fairly tedious task, but it results in a nicely detailed roof that looks right. This can be seen on another part finished model, a low-relief factory.

Below: *The shed is now almost complete. The roof is in place and has been slated, although this doesn't show too well in this photograph. The gutters are fitted, but not the downpipes and shed doors.*





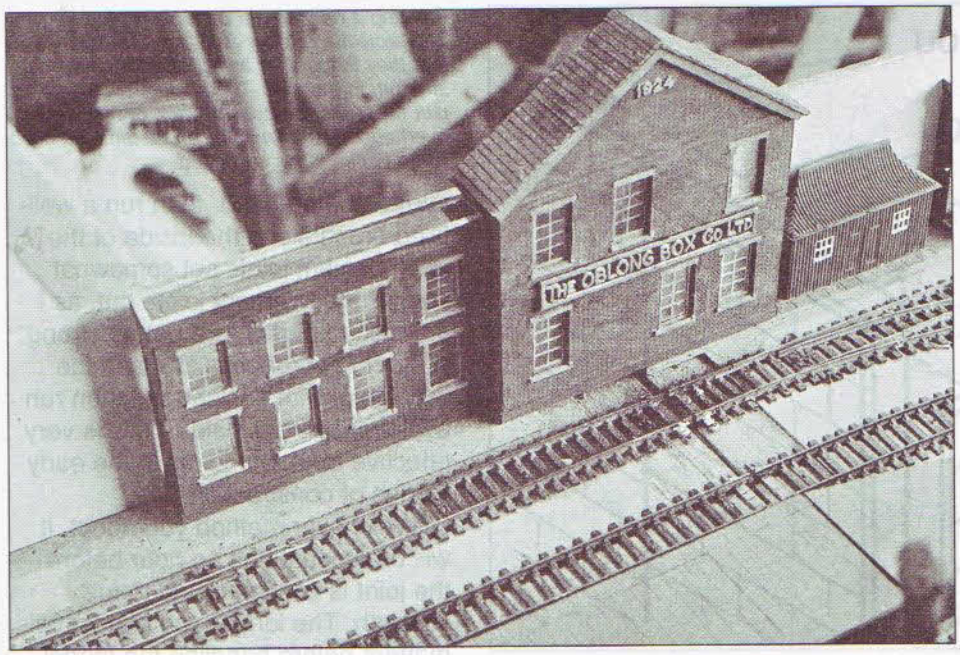
The goods shed in place on the layout.

curtains. The main exception to this rule is where large opening doors are fitted, as on a goods or locomotive shed; these usually need to be fitted in place later. At this point, ask yourself if you want any doors to be modelled in the open position. This may call for a little judicious work with razor saw and craft knife.

Before assembling the walls and roof sections, smooth the joint edges to remove any moulding pips and check corners and edges for fit before applying any cement. The walls and roof sections are normally numbered, often with two numbers at opposite ends. On a simple structure the four walls would be numbered 1-2, 2-3, 3-4, 4-1. Join the numbers together, using the base as a guide. For more complex structures you may need to give the matter some thought should the instructions not be sufficiently explicit.

During assembly, it is advisable to check right angled corners with a small square and to make sure that walls are vertical. Offer the roof to the walls before the cement has set to check for fit, but defer final assembly until the cement has hardened as you may need to do a little filing of the edges to ensure a snug fit. At all stages it is advisable to leave the assembly to harden for at least an hour before moving on to the next section.

External details can now be



The Oblong Box Co. Ltd is one of the major industries at Brill, *its products are found worldwide for there is little doubt that, as their slogan has it, 'Oblong Boxes Are Best'. Apart from the all-important matter of generating goods traffic for the branch, their impressive factory, built in 1924, neatly covers one of the hinges on the folding baseboard. This is a straightforward low-relief structure. The irregular window spacing on the main building has no especial purpose. The original drawing with equally spaced windows looked too regimented so I pushed them about until it looked, to my eyes, more interesting. The windows have scribed glazing bars.*

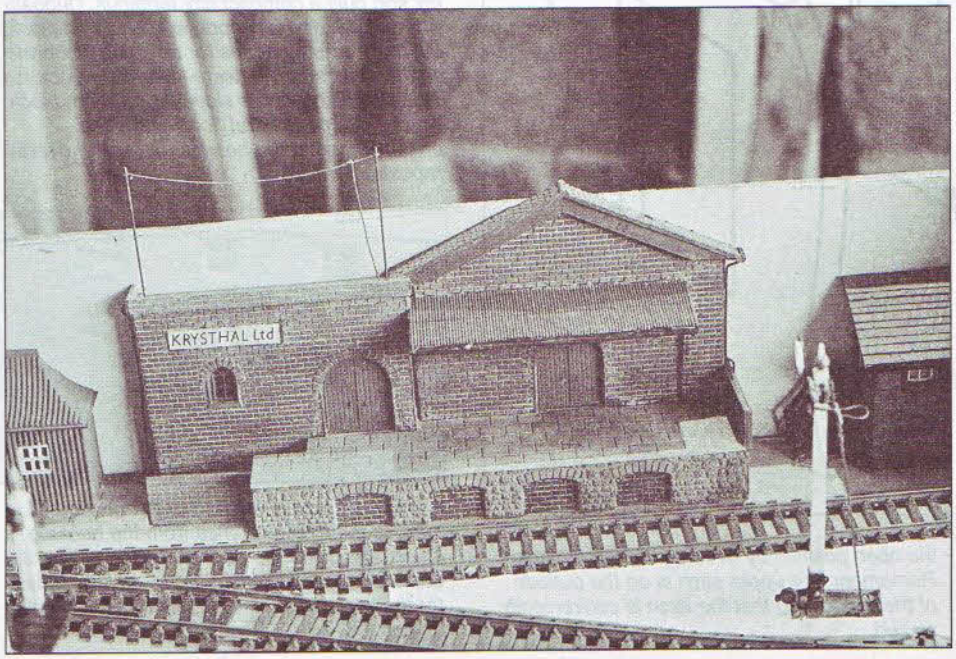
added. The most important are gutters and downpipes, signs, external lamps and suchlike trimmings can be regarded as optional extras or replaced with finer replicas.

Applying plastic adhesive

Plastic kits can be assembled with plastic cement, a plastic solvent or a liquid cement. Most modellers begin with tube cement, mainly because the dealer has sold it with the kit. A solvent applied to the joint with a brush is easier to use, but does not provide quite so strong a joint. I use both methods. In general cement is used for the main joints where maximum strength is needed and solvent for the finer details, though I do not follow any fixed rule.

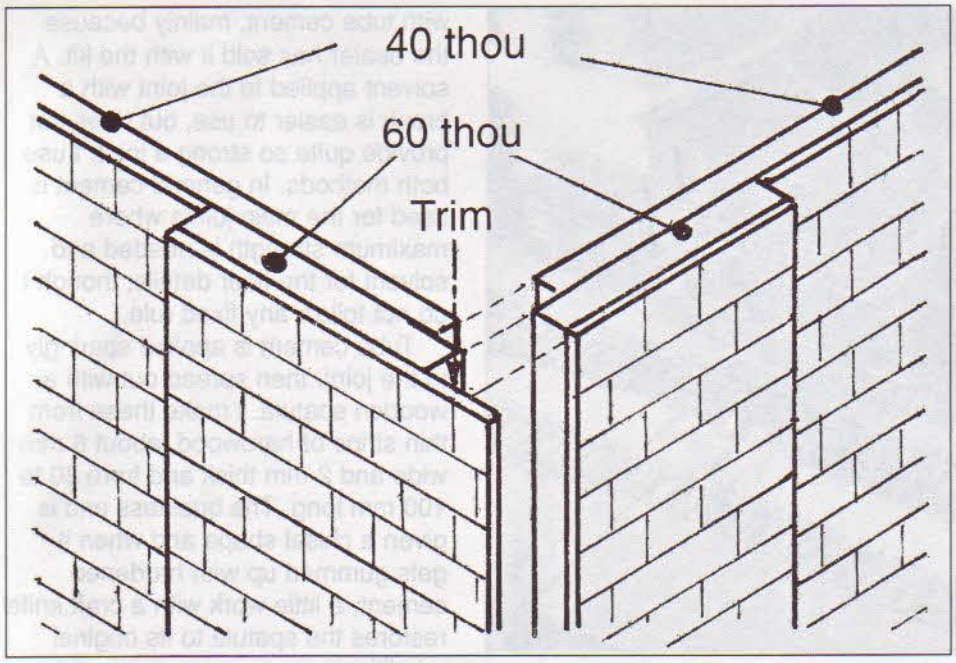
Tube cement is applied sparingly to the joint, then spread out with a wooden spatula. I make these from thin strips of hardwood, about 6 mm wide and 2 mm thick and from 80 to 100 mm long. The business end is given a chisel shape and when it gets gummed up with hardened cement, a little work with a craft knife restores the spatula to its original condition.

The object is to get a uniformly thin film along the entire length of the joint. This not only avoids the surplus squeezing out where you don't want it, but it also speeds the hardening process. It will be a good five minutes before the joint is strong enough to take any strain, but at least a quarter of an hour before it cannot be parted without risk of damage to the parts concerned. With solvent, it helps to moisten the joint



Another lineside industry is Krysthal Ltd, Brill's *own hi-tech factory. Their current output is a fine range of mains wireless sets, ranging from a very simple five valve superhet to their top of the range radiogram with auto-change mechanism, long, medium and short waveband reception and a push-pull amplifier. They have their own loading dock and dispatch regular van loads of wireless sets to London and the provinces.*

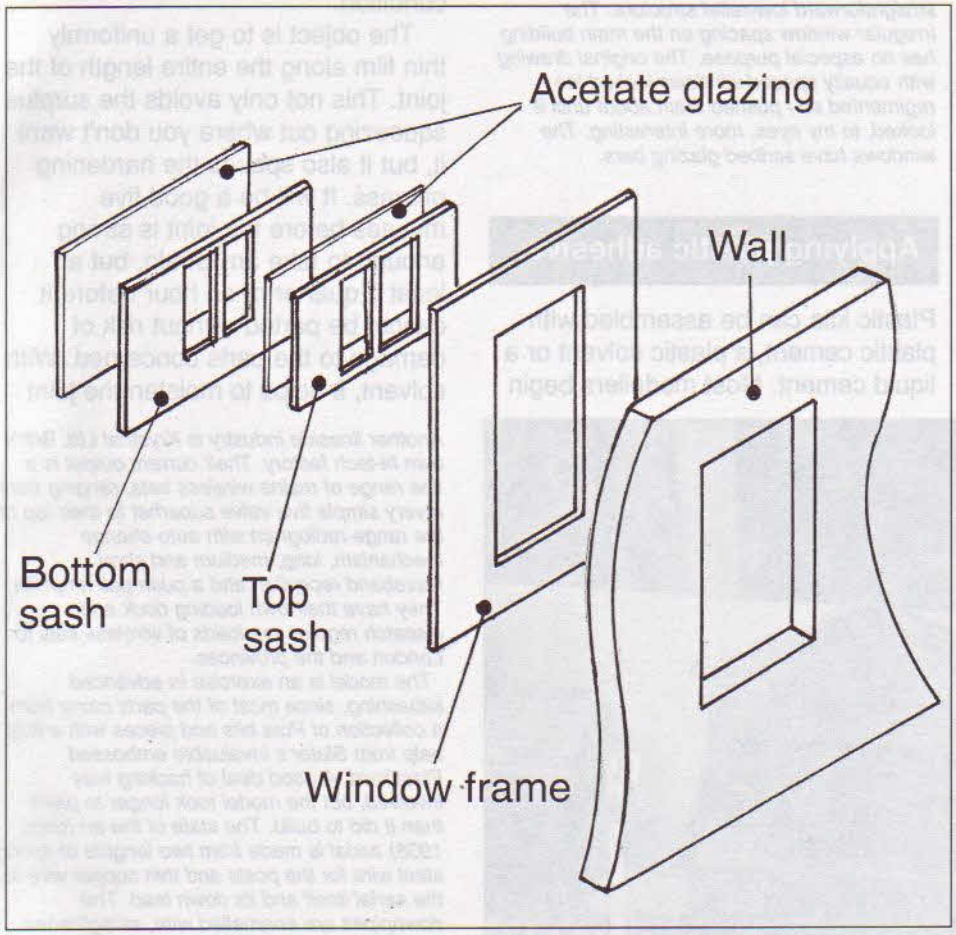
*The model is an exercise in advanced kitbashing, since most of the parts came from a collection of Pola bits and pieces with a little help from Slater's invaluable embossed Plastikard. A good deal of hacking was involved, but the model took longer to paint than it did to build. The state of the art (*circa *1938) aerial is made from two lengths of spring steel wire for the posts and thin copper wire for the aerial itself and its down lead. The downpipes are enamelled wire, straightened by gripping one end in the vice and pulling hard with a pair of pliers. Being dark brown, they need no painting and are the last detail to go in place. A smear of epoxy resin secures them to the walls.*



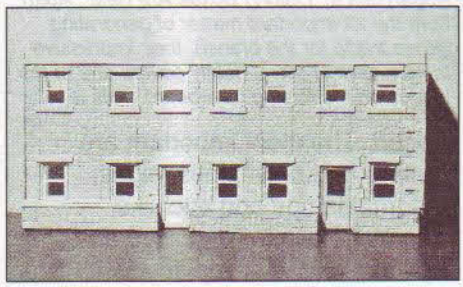
Forming a neat corner on a plastic building. The projecting corner piers are arranged so that they fit together and give additional strength to the joint. The brick overlay on one pier can either be applied later, or allowed to overhang as shown so it can be trimmed flush when the joint has hardened.

surface beforehand, then run a well-filled brush along the inside of the joint. Solvent joints set somewhat sooner than cement joints but, as I mentioned earlier, are not as strong. A hybrid approach is to make the initial joint with solvent and then run a fillet of cement inside. This is very effective for major joints in the early stages of construction.

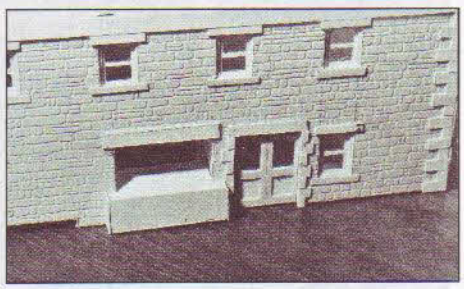
Whichever method you adopt, it will be at least half an hour before the joint is coming round to full strength. The longer you can leave matters before handling the model, the better. Having a plastic kit fall apart at this stage is a nuisance, not



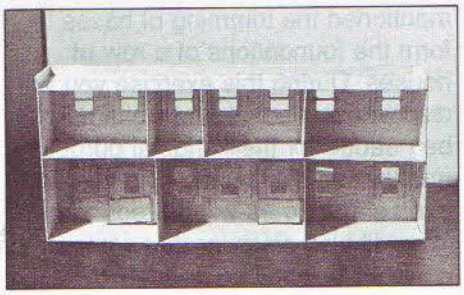
Modelling a sash window. The process is basically the same as for the door, but as most model railways are set in late spring or high summer, the window can be modelled in the open position by overlapping the sashes. Remember, the upper sash is on the outside of the window so that the latch is conveniently placed.



Here's one I made earlier. Some 20 years ago my son built a compact city terminus, Dugdale Road. *It needed an impressive station building but there was no space for anything elaborate, so the station offices were low-relief structures. This photo shows the side waiting room block with offices on the first floor. The deep projection along the base is part of the overall roof structure.*

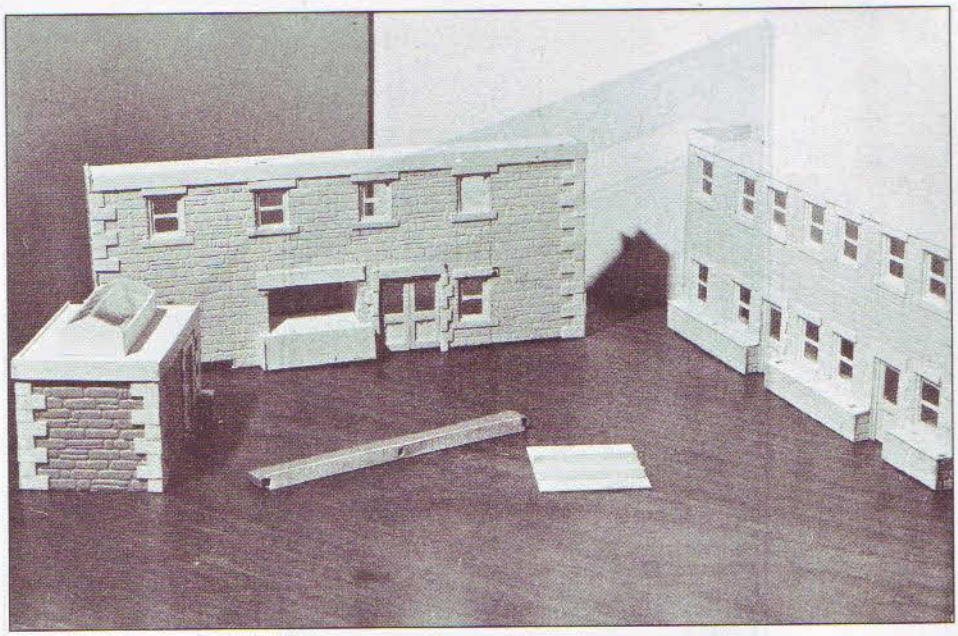


At the end, across the end of the concourse, there is the main entrance from the booking office, alongside the bookstall. The walls are Slater's coursed random stone, with overlays for the window lintels and sills and the corner quoins.



The back of the side building, showing how the body is reinforced with inner strips, laid out as if they were walls and floors. This model was built solely from 20 thou sheet, with no backing sheet. While nothing has warped, thanks to a lot of internal bracing, I now prefer a more rigid form of construction.

a disaster, but it will waste a lot of good modelling time. There are some cases where the parts refuse to remain in the right position whilst the cement is setting; this is more common with scratchbuilt structures than with kits. In such cases, a little Blu-tack can be used, with or without props, to hold the parts in their correct alignment. Alternatively, a couple of internal gussets cut from plastic sheet will often keep the parts properly aligned and add strength to the structure. As a last resort, Sellotape can be used to hold walls together,

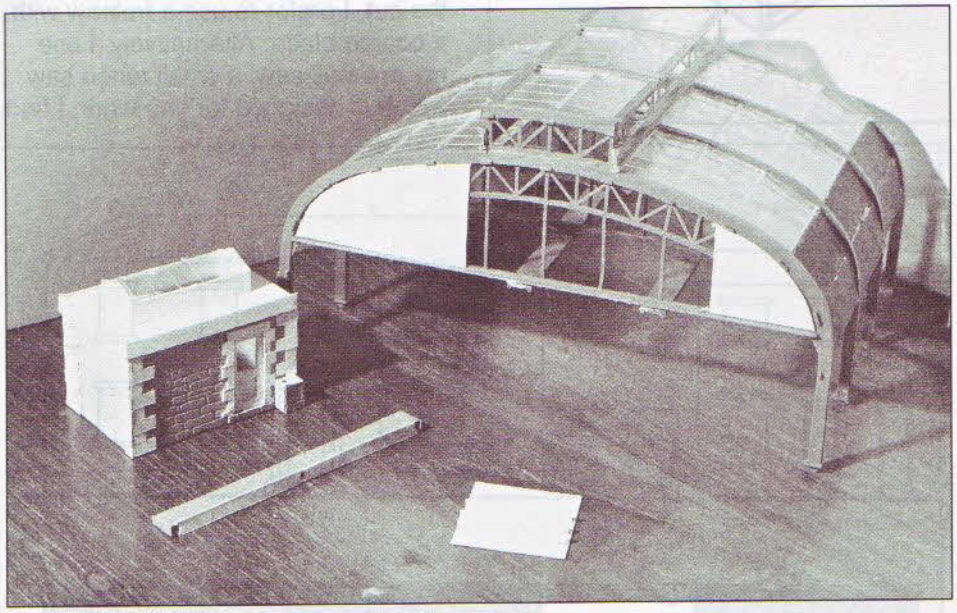


The buildings for Dugdale Road *complete, laid out roughly as they went on to the layout. The low wall and the projecting ledge along the base of the right-hand building provide support for the train shed roof. The small building on the left is the gents' toilet block.*

but the less tacky Scotch tape is less likely to leave sticky marks or lift paint.

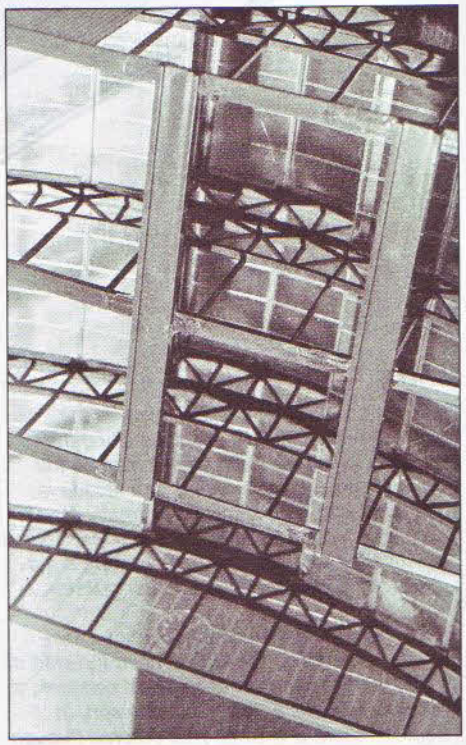
Modifying kits

I have already touched on the first stages of kit modification when I

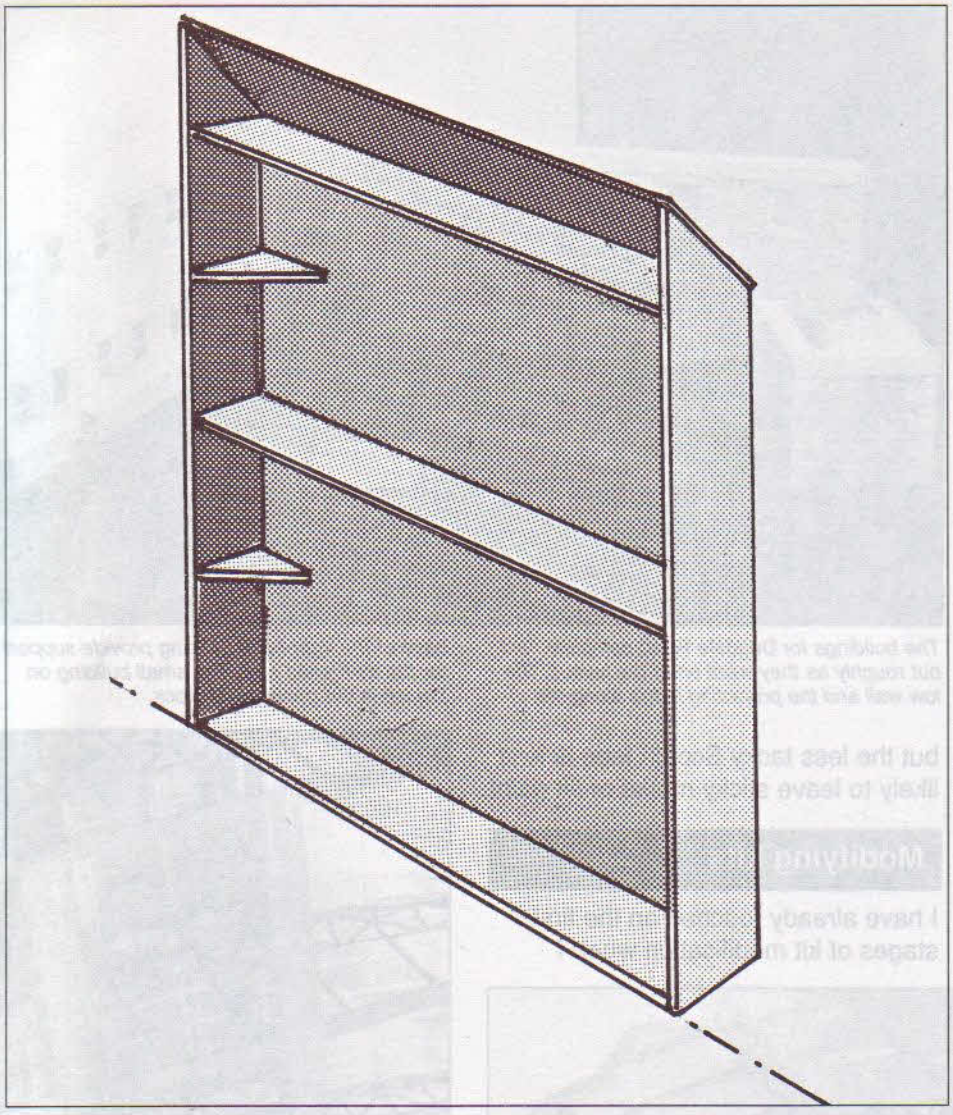


The iron and glass train shed roof is made from a couple of Pola N gauge kits. During assembly we felt that the roof looked a little uninteresting so we added a clerestory, using cut up bits of Pola kits and Plastruct girders.

The roof is quite short, and only covers the main concourse, while the platforms have umbrella awnings. The short roof allows the operator to reach the couplings of the train locomotive.



The reason for using an N gauge kit is best given by this internal view, which gives some idea of the spidery appearance of the model, fully in keeping with the prototype. Two pieces of Plastruct girder represent the smoke troughs. The glazed end faces towards the street, on the railway end there is matchboarding over the platforms, while the girders above the tracks are left bare to help let the smoke out.

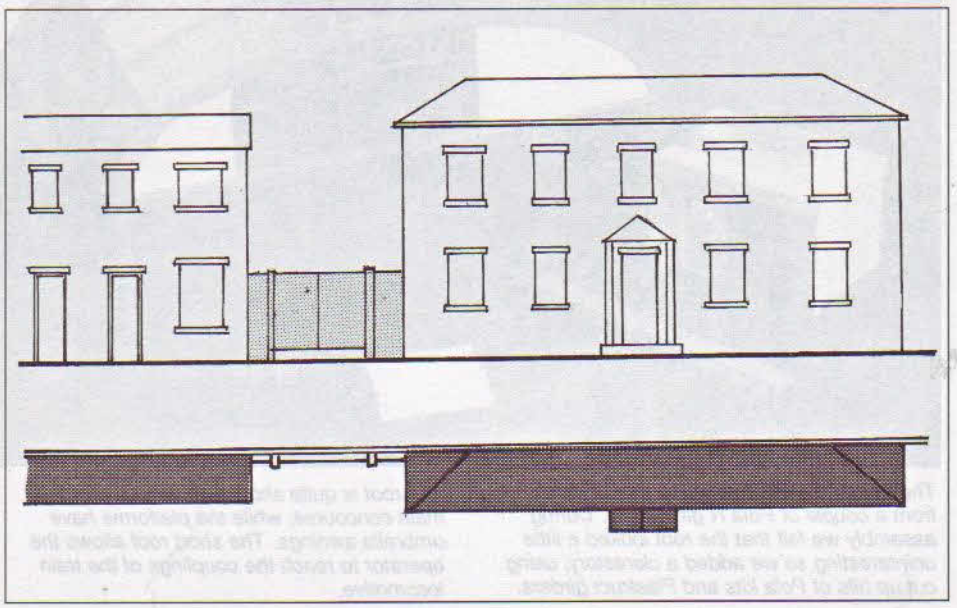


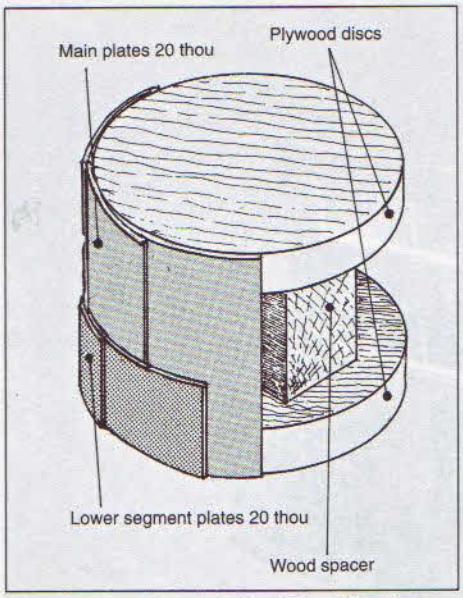
mentioned the trimming of bases to form the foundations of a row of houses. During this exercise you will discover that some end walls will not be needed for their original purpose and that several window frames and even some doors will be redundant. You will also discover that some careful fitting will be needed between the adjacent kits and that the roofs will need trimming. An even more drastic modification is to turn two kits into a row of four low-relief buildings and, going a stage further, by packing below with offcuts from the bases the buildings can be set on a gentle slope and even arranged along a curve. This will mean even more careful fitting as assembly proceeds. With a little experience you will find it better to construct your own base from plastic sheet rather than try to alter the manufacturer's offering.

While the thick plastic of moulded kits can be cut through with a Stanley knife, it does take a good deal of effort, and usually the mouldings on the kit part make it difficult to hold a straightedge firmly along the side of the cut. I prefer to use a fretsaw with a coarse blade. Alternatively, I use my dovetail saw, a small tenon saw which is designed for fine work. I find

Above: *Low-relief modelling involves the construction of shallow buildings along the backscene; indeed such models can be the whole of the backscene. Only the facade is fully modelled. The sides are normally plain and often hidden by adjacent buildings. Behind the detailed frontage one finds nothing but a few strategic stiffeners and corner gussets.*

Right: *Outline elevation and plan of a low-relief backdrop. To the left we have the start of a late Victorian terrace of artisans' cottages, to the right a public building of some sort. In between there is a small yard entered through a pair of timber gates. This is representative of the sort of buildings commonly found flanking a railway, particularly where the main shopping street crosses the line at right angles. For a 1990s scene, those cottages should be gentrified, with double glazing, the occasional Georgian bow window and, of course, panelled and glazed hardwood front doors. You might find a couple of elaborate porches, and, in the 1980s, a Porsche or two outside.*





Construction of a gasholder. Two thick ply discs held apart with a block of wood form the basic core. The tank plates are made from curved 20 thou plastic sheet. The domed top is most easily made up with two-part car body filler over suitable formers - a couple of thick card discs would be ideal.

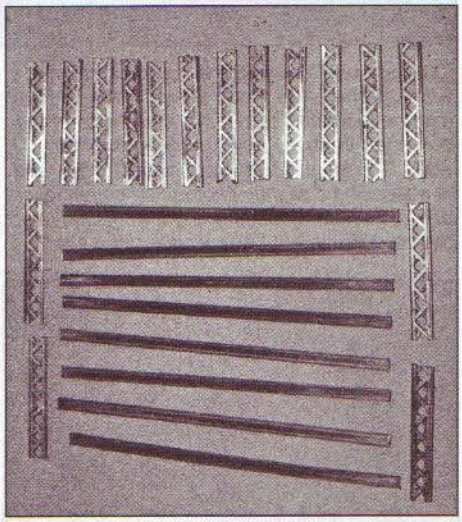
this preferable to the razor saw or pin-ended hacksaw, because a coarser tooth is needed to get through the thicker material. Where possible, I make a deep scribe mark across the cutting line beforehand.

Kits can be further modified either by cutting parts from redundant walls or from textured plastic sheets. These useful materials are available in a variety of surface finishes. The oldest is Slater's embossed Plastikard. Here the surface finish is embossed into a 20 thou sheet of their well known Plastikard, giving a sheet measuring approximately 200 x 300 mm; the exact sizes vary slightly. A more recent range by Wills is moulded and measures 130 x 75 mm and is a shade over 1 mm thick. Both offer a good range of wall and roof finishes as well as paving stones and cobblestones.

Although invaluable for modifying kits, these textured plastic sheets are primarily intended for scratchbuilding, together with plastic sheet and moulded fittings. Slater, Wills and Ratio, in addition to a growing range of railway and industrial building kits, provide a selection of accessory packs using parts of their basic kits.

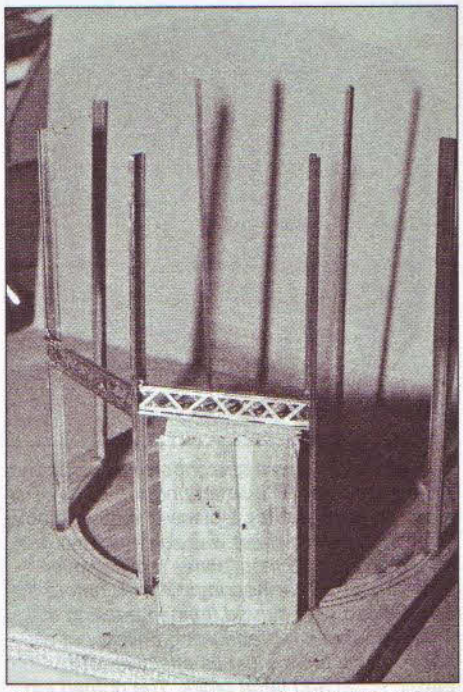
Basic cutting techniques

Whether you make buildings from plastic or card, the fundamental approach is the same. The various parts are marked out on the sheet and then cut out with a craft knife. This is done on a cutting board. At one time this was any handy expendable piece of scrap sheet material, but today the plastic cutting board is the rule because the inevitable cuts close up and do not deflect the knife blade. Don't attempt to cut through anything but the thinnest of materials with a single cut. The best technique is to take a very light initial cut, doing no more than lightly score the surface, providing a guide for subsequent heavier cuts.

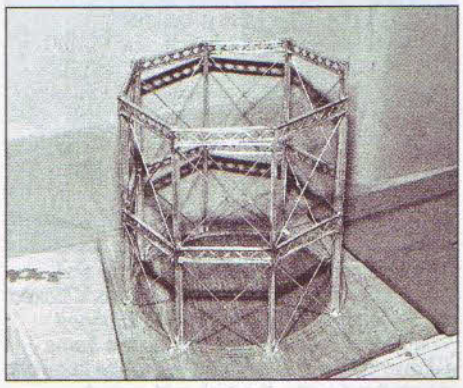


The gasworks was to be the centrepiece of the coalyard diorama and a gasworks isn't a gasworks without a gasholder. There is a German-made kit, by Vollmer I believe, but I passed over a chance to buy one and only had a large supply of brass angle and channel in stock. So the key parts of the gasholder were fabricated from these and some Scale Link etched bracing.

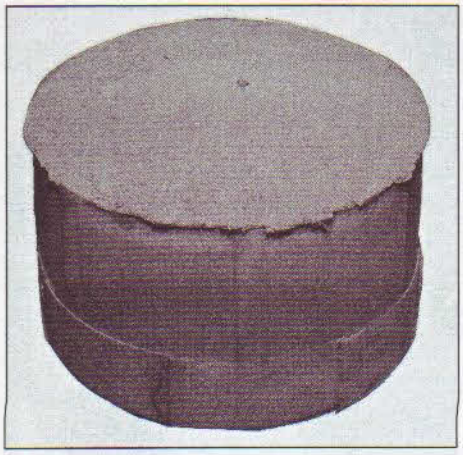
Straight cuts are made alongside a metal straightedge, normally a steel rule, but where right-angle cuts are to be made, an engineer's square is



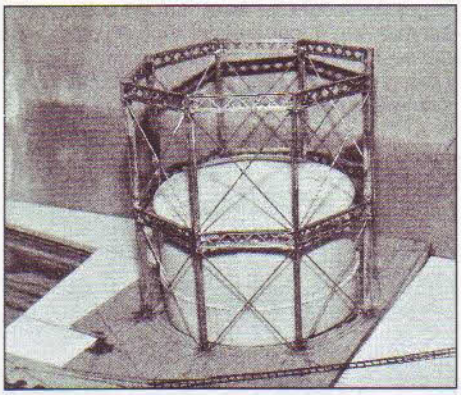
Having made the various parts, I had then to assemble them. The vertical channel girders were simple, a force fit in drilled holes, subsequently secured with epoxy resin. Soldering the cross-girders in place proved to be a trifle more troublesome than I'd expected. I used a simple spacing jig – a piece of wood – to get the middle tier level. It didn't quite work out that way, it took several cups of coffee and the best part of a day to get the joints to agree. I thought I'd won early on, only to find that one side was a good 2 mm lower than the other.



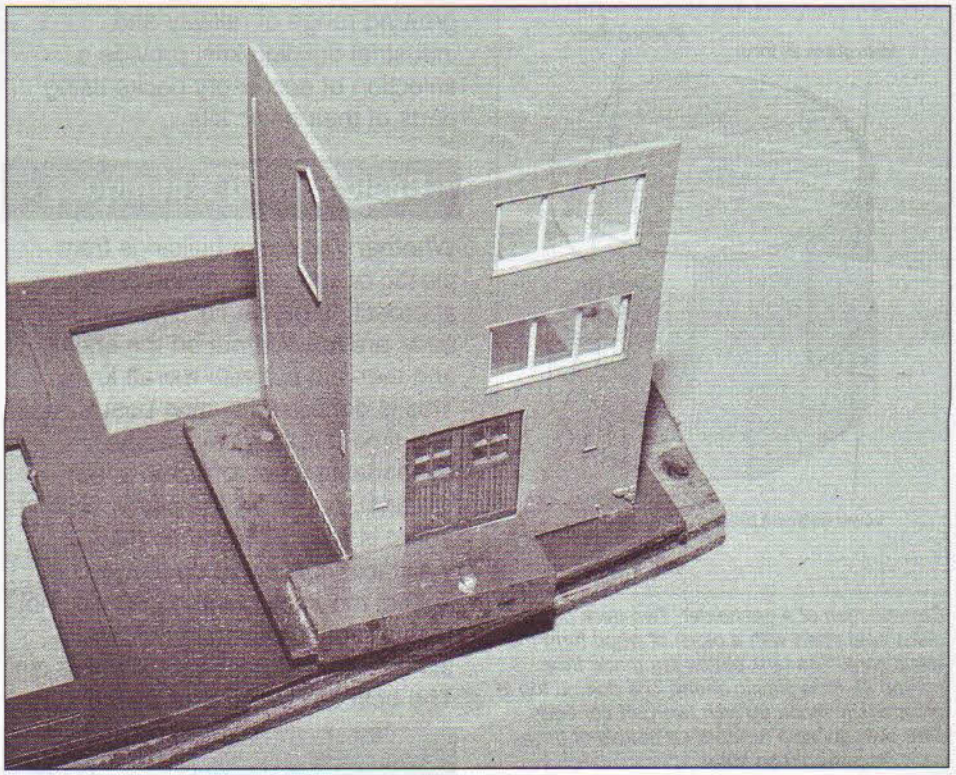
Eventually I got the girders level and installed the top row. This was easier as I'd already got the tops of the girders level and it was just a matter of aligning them with this. The next stage was the cross-bracing. After my struggle with the girders I simplified the design to a pair of crossed wires. There ought to be a central straining ring, not to mention turnbuckles. Once I had got all 32 wires in place, the whole caboodle was thoroughly washed under the kitchen tap to remove all traces of flux. It was then left to dry while I got on with the gasholder proper.



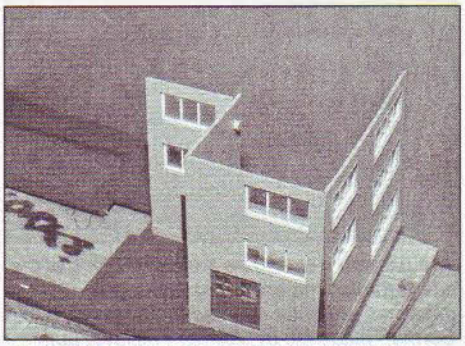
The gasholder was a straightforward modelling project. The tank is built around two discs of plywood separated by a piece of timber. A strip of 10 thou plastic sheet was stuck around both edges and the 20 thou 'plates' applied over this. To prevent their springing apart before the cement had set I curved them in a rolling mill. This is intended for fabricating boilers out of sheet metal, but it's just as effective with plastic sheet and large tanks. The domed top was built up over a Faller moulding that was intended for some sort of kiosk. I applied tapered plastic sheet plates to this, but as it didn't look right I ended up coating the lot with two-part car body filler, which was left to set overnight and then smoothed with a file.



The tank slipped into its hole and the end result of best part of a three days' work looked much better than at one time I had hoped. The access ladder was added to the frame – I'd overlooked it at the start – and the ironwork painted red oxide, the tank mid grey. A coating of epoxy resin on the bottom of the tank secured it in place.



The gasworks building is a Vau-pe factory kit with just one small modification to allow it to fit into the tapering site. This involved cutting the corner off the base and modifying the rear walls. The kit is for an unspecified factory, and is a pleasing if slightly improbable combination of three units. I doubt if any gasworks looks in the least like it, but I was working to a tight schedule and put the kit together without painting or prettifying with the idea that it would be eventually replaced by more authentic structures. The trimmed base was pinned to the ply infill and work began erecting the walls, into which I'd already fitted the doors and windows.



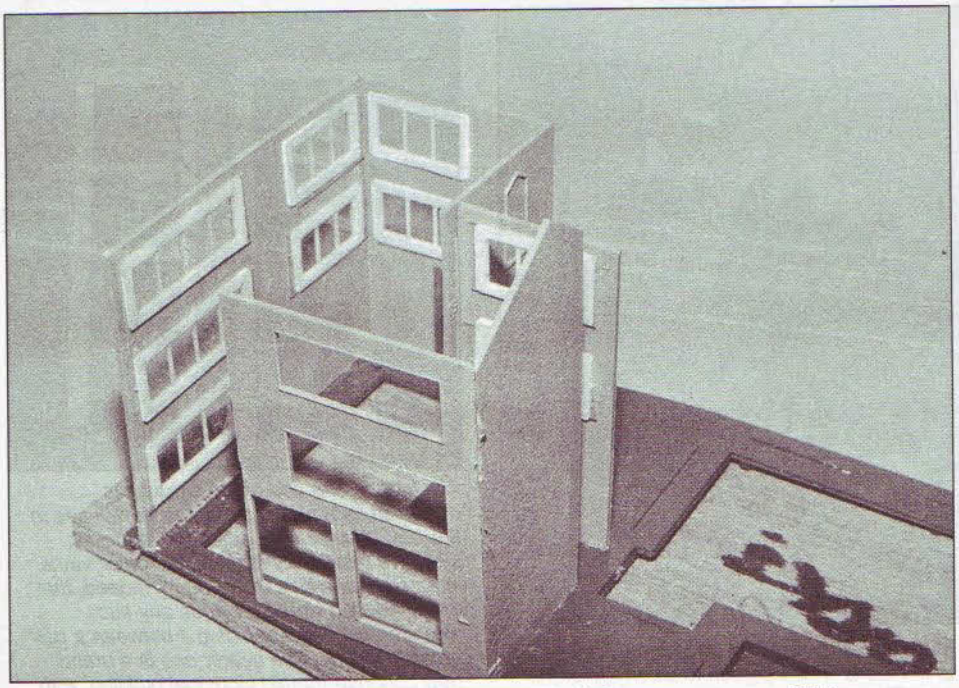
The next step was to adjust the walls where they touched the backscene. The side wall almost went in without modification, and all that was needed was a little work with a file on the taper.

advisable. Do not use wood or plastic rules, let alone plastic set squares, their edges will be permanently ruined by the first cut. Curved cuts are normally made freehand, but with plastic sheet a true arc can be made using engineer's dividers. These have screw adjustment and so do not open out or close in during the cutting process.

An important difference between card and plastic sheet is that whereas the former material has to be cut completely through, plastic sheet, up to 40 thou in thickness, can be snapped cleanly when partly cut through. While the thinner sheets can be easily cut with a light craft knife or scalpel. I prefer to use the heavier Stanley knife when dealing with anything above 30 thou in thickness.

Walls

A full size building begins with its foundations, the walls are erected on this and the roof is added last of all. We follow much the same sequence on a model, though a true foundation is not needed. I prefer an inner base so that there is nothing projecting outside the walls. This is carefully cut to size, deducting the planned thickness of the walls from the external size of the proposed building.

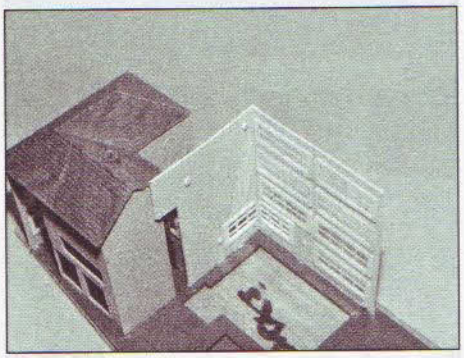


The rear wall needed more drastic modification. It was cut not at the interference point but on a line between the openings in the moulding. No windows or doors are fitted. It is completely hidden and is only there to hold up the roof and steady the side wall.

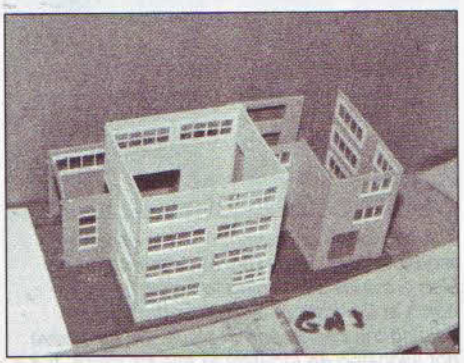
Walls have an appreciable thickness. A house brick is roughly 8½ in long, 2½ in high and 4 in deep (216 x 64 x 100 mm), giving 9 x 3 x 4½ in (229 x 76 x 114 mm) when the mortar is added by a craftsman.

Bricks are laid in one of three basic bonds, stretcher or garden wall, Flemish and English. The first is only one brick thick, and is used for garden walls (surprise), outhouses (in which case there must be piers, usually at 9 ft (2.7 m) intervals), as a brick infill on frame structures, or for an ornamental cladding, and as the outer face of a cavity house wall. Flemish and English bond is at least two bricks thick, and the headers are used to bond the layers together. It will be seen that a brick wall will be at least 4 in (100 mm) thick, a standard cavity wall is usually 12 in (300 mm) thick, and a large railway or industrial building will often have walls three or four bricks deep. Slater's 20 thou thick embossed Plastikard is a shade over 1½ in (38 mm) in 4 mm scale.

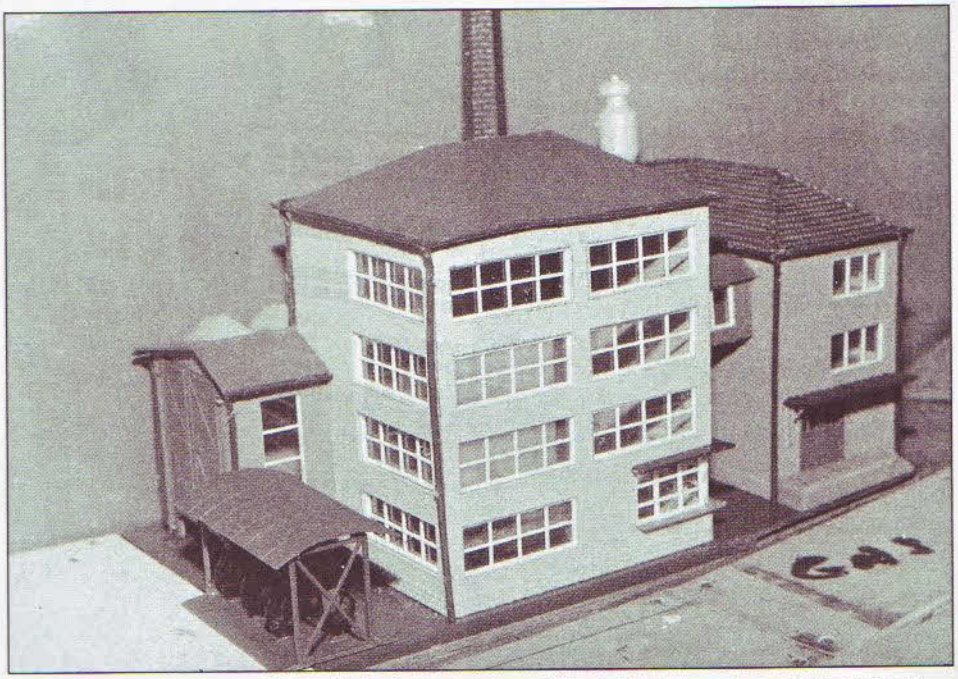
Although some architectural modellers take the trouble to make their walls full scale thickness, it is only necessary to model the depth of the window recess. As window and door frames are set inside the walls,



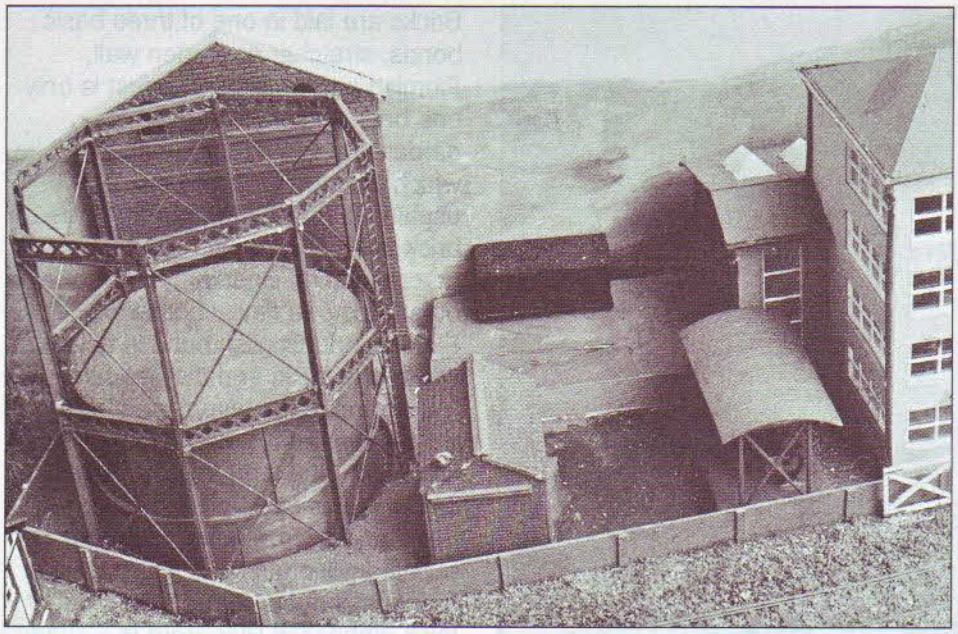
The other main building is now being erected, while the L-shaped roof on the first is offered up to see where it too must be trimmed.



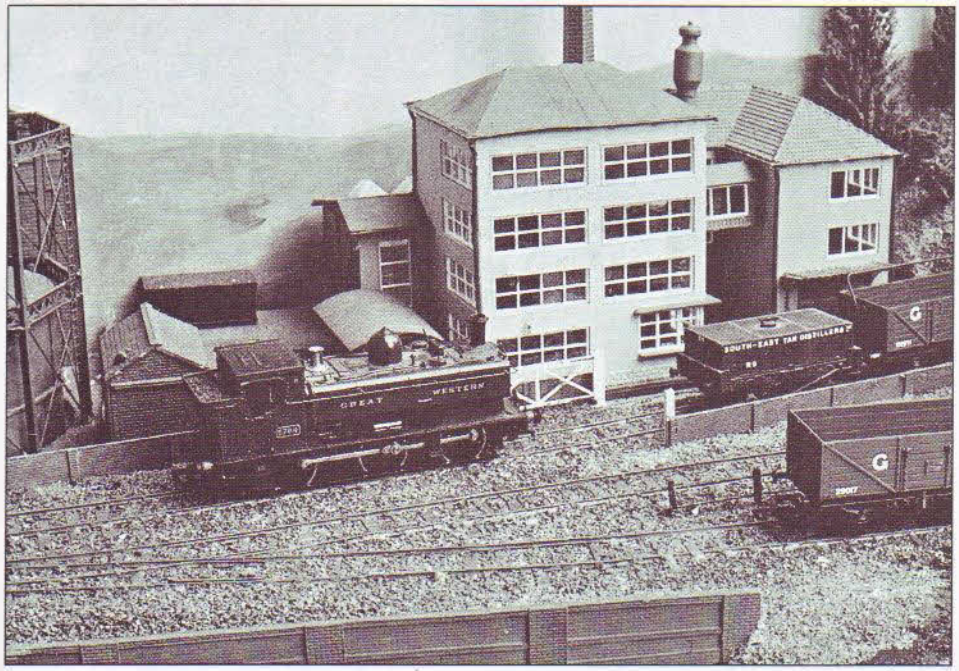
The walls are now fully erected, awaiting the addition of the roofs and external details.



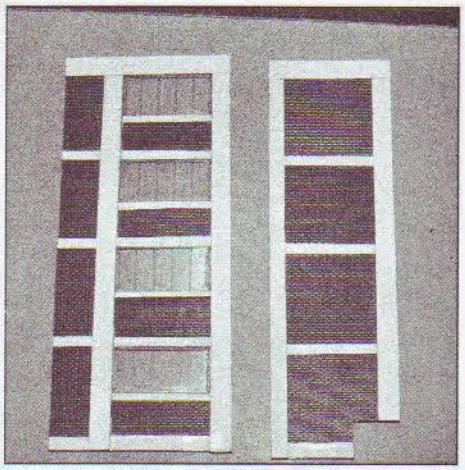
The kit is now fully assembled, with the front loading bank in place and a couple of canopies. The small building at the rear was supposed to take a wagon and has a pair of opening doors, with a large cut-out which will clear Märklin tinplate based track, the limiting condition in its designed usage. I had other ideas. A Ratio cycle rack has been stuck in the corner. It doesn't look out of proportion, although it is 4 mm scale and the probable scale of the building is nearer 3 mm to the foot.



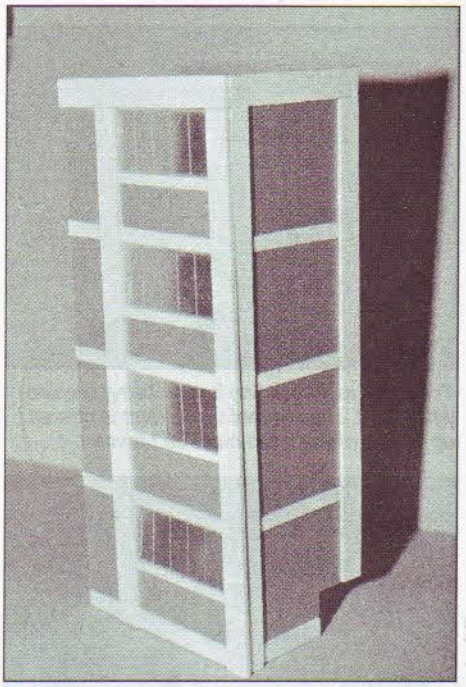
The high gap under the door was quickly disguised by building a raised section in front. A scratchbuilt rectangular tank is stuck there to fill a gap; it was thickly painted with dirty black paint and has a nice tarred look. The ridge roof building began life as a Wills weighbridge hut, and is the meter house, which measures the flow of gas in and out of the holder. It is about the right size, but it did boast a chimney. You don't have fires in a gas meter building, so I had an unsightly hole, until I found a cast pigeon to sit on top of the gap. The gasworks now has a perimeter wall. It's more usual to have the piers on the inside of a boundary wall, but the odd exceptions exist and this arrangement looks more interesting. The flat structure behind the gasholder is supposed to be the end of the retort house. It's another quick fix using parts from the scrapbox.



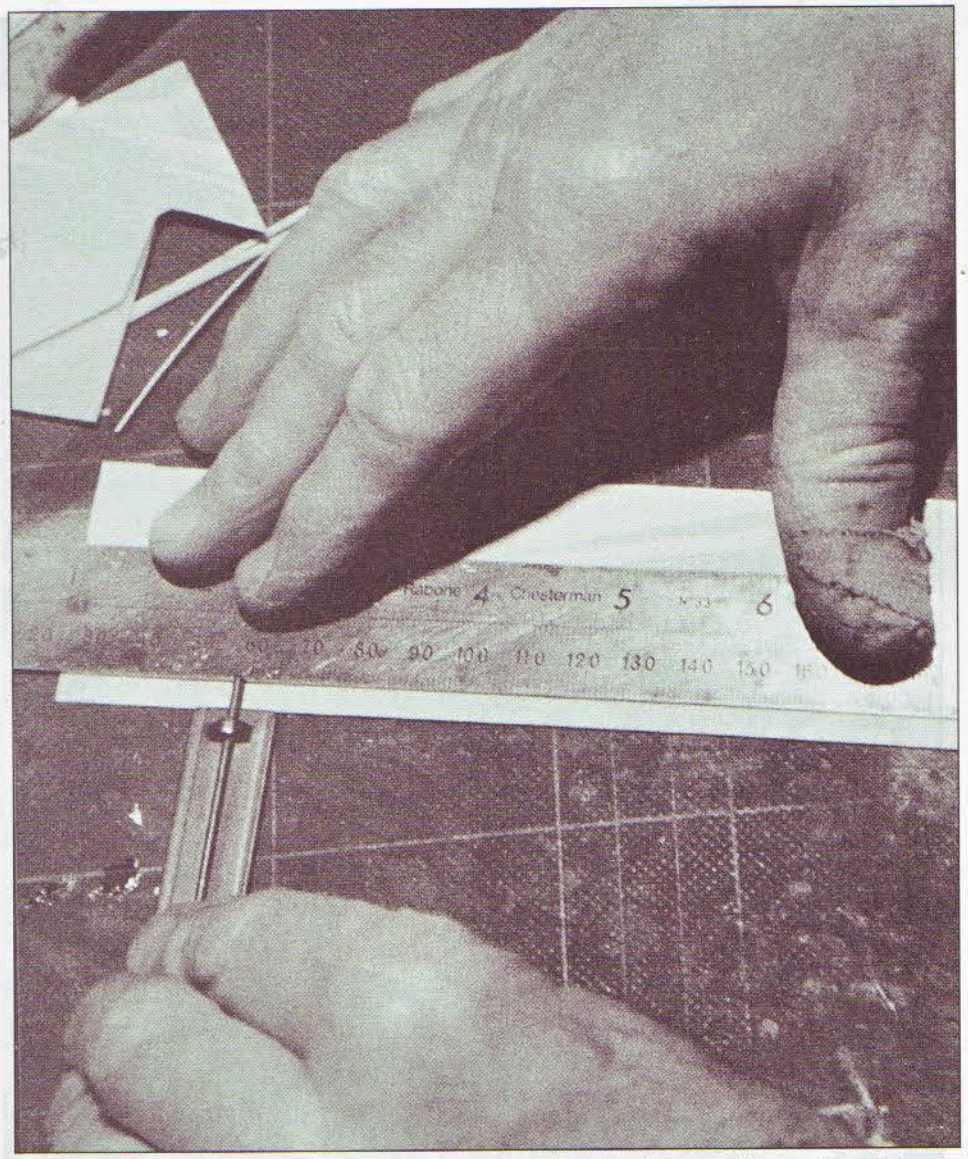
A general view of the gasworks buildings. Even in monochrome they look as if they have a purpose, though their exact function is open to criticism. Agreed, gasworks have general offices, but they don't usually face this way round. The gate into the gasworks siding is cut down from a Hornby level crossing, and the posts came from the same source. It is permanently open. How does the coal get from the siding to the retort house, and how does the coal tar get loaded into the tank wagon? Eh? You aren't supposed to ask that!



The hole at one end of the diorama is disguised by a tunnel portal, as we will see in the next chapter. The other end is trickier, since we can hardly introduce another tunnel in a space of a little over 100 m. Indeed, that low-level road would preclude any such arrangement. We are hiding it between a pair of tall buildings. The nearer one is a brand new concrete-framed industrial building, with brick infill. Only two sides are actually modelled; the one facing the railway is completely blank, while the road side has windows. These began life as glazing for a Pola N gauge station roof.

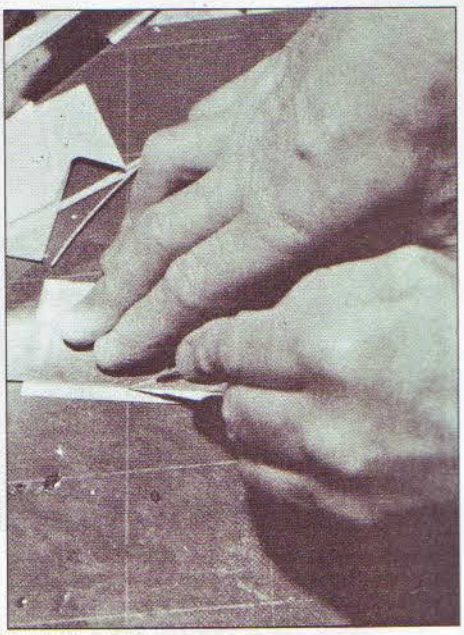


The two sides go together neatly enough around a ply frame. This adds strength and also provides something to screw into. The notch at the bottom is to clear the batten holding the backscene in place. So far I have not allocated an industry to this structure, but it might become Basil Industries, makers of the world famous Daphtasa Brush.



The best definition of a scratchbuilt model is a kit where you start by marking out and cutting the parts for yourself. Marking out is the most exacting task, since if the cutting lines aren't accurate everything else will be wrong. One of the more difficult tasks is marking out relatively thin strips, and most projects call for a fair quantity of these. A simple way of doing this is to set the depth gauge on a calliper gauge to the required dimension and use this to align the straightedge, in this instance a steel rule.

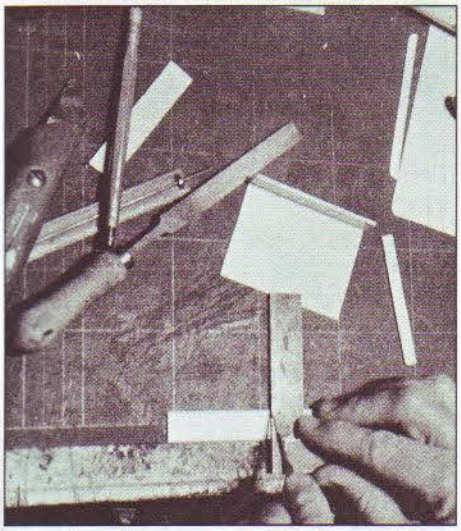
this is usually a matter of 3 to 4 in (75 to 100 mm) on most buildings, though in some large structures the frames are set further back. My walls are now made from medium thickness plastic sheet, with embossed Plastikard overlay. The two sheets are cemented together by liberally coating each inner face with solvent. I normally use Slater's Mek Pak, which is sold in small screw-top bottles and larger containers. The latter are preferable, not merely on grounds of economy, but of convenience. You can get through a lot of solvent in a serious modelling session. I decant a small quantity into a conical bottle that once held film cement, using a small home-made brass funnel. It is practically impossible to knock this bottle over by accident and so ruin any plastic parts on the workbench. A further tip: I wrap a piece of yellow tape around



Cutting looks an obvious process, but for accuracy (and safety) the following points should be observed. First, you must work on a firm, level, clear surface; this will involve frequent removal of scrap offcuts from the work area. Second, you must hold the straightedge firmly with your spare hand, pressing down to prevent any movement of rule or workpiece. Third, the initial cut should be a light one, so that you have maximum control over the blade. It is sufficient merely to score the surface, then the second and subsequent cuts can be made with greater force. A sharp blade is essential.

the brushes I use to apply Mek Pak. This makes them easy to spot and prevents them getting mixed up with those I use for painting.

Frequently the walls of larger industrial buildings are broken up with vertical brick piers, and further enlivened with raised brick courses. These are extremely easy to model. Piers are made by cementing the brick embossed sheet to a plain sheet of appropriate thickness, cut to the required height. When the two sheets are fully bonded, piers can be cut off from the sheet, using an engineer's square to ensure a vertical line coinciding with a course line. Remember that all brick piers are made to an exact number of bricks or half bricks. Raised horizontal courses are always a whole number of brick rows deep.



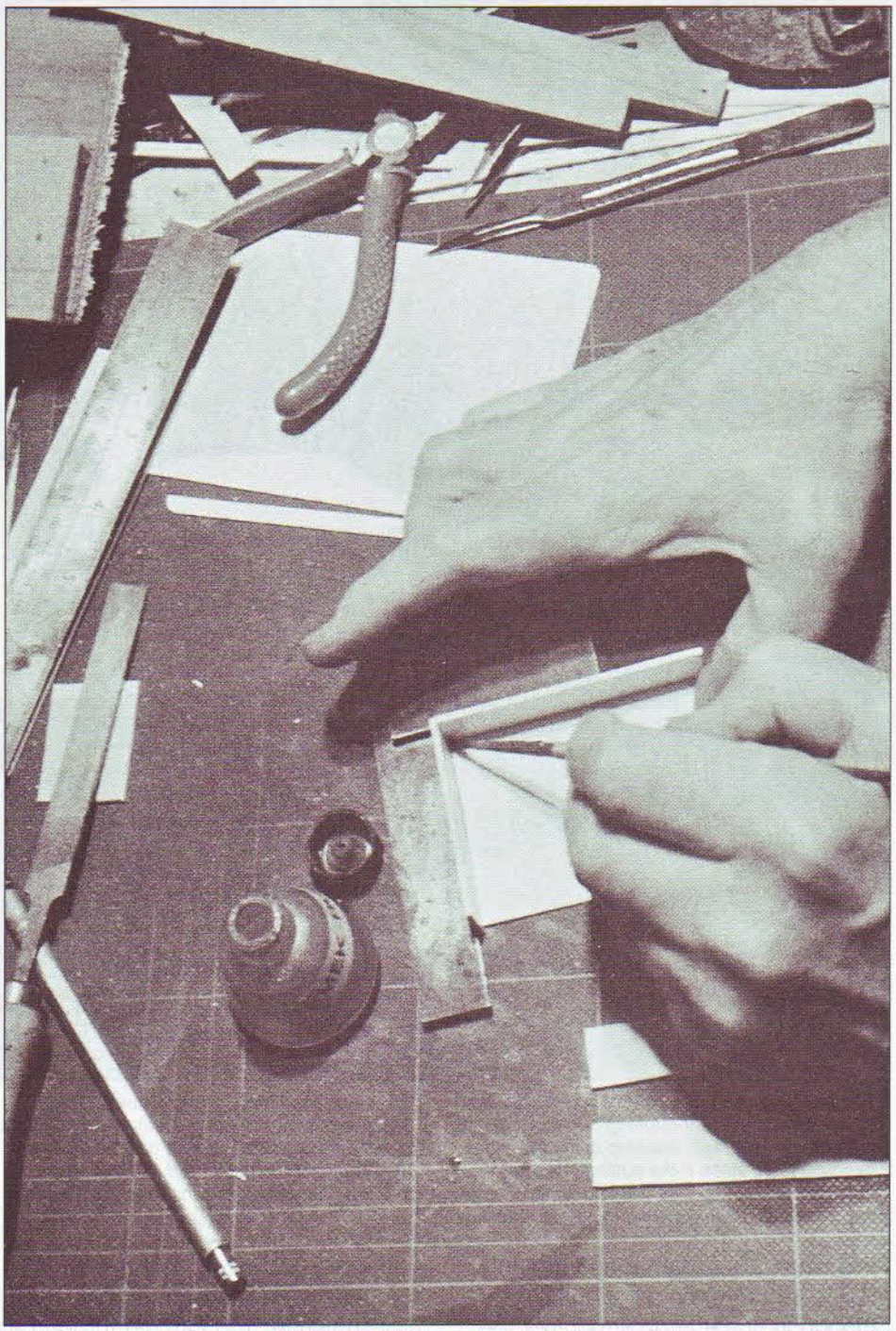
Wherever possible, vertical cuts should be made using a square. Here the square and workpiece are lined up with the edge of the cutting board. The photograph also shows some of the tools: a Stanley knife, small file (for trimming edges and general smoothing), clutch pencil and, partially hidden, a calliper gauge. Some parts of the model are visible, but it will be seen that the working space is clear of clutter.

Mostly the thickness of the sheet suffices.

Windows

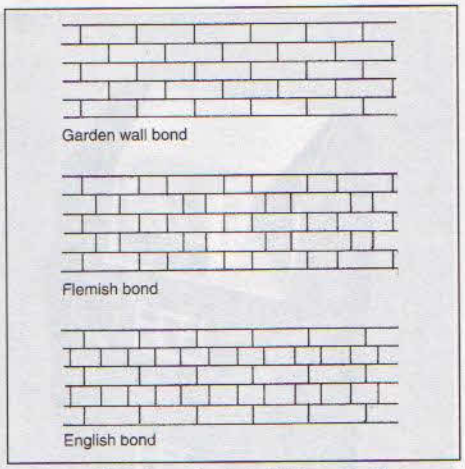
Window openings in thick plastic sheet are most readily made by carefully cutting down each edge, then cutting diagonally across. These diagonals get the heavier cutting since a little sideways error is unimportant. The easiest way to remove the four waste triangles is to place the opening over the open jaws of the vice and tap the centre of the cross sharply with a metal rod. It is of course, vital to ensure that all window openings line up horizontally and, where appropriate, vertically as well. The embossed sheet is cemented over the prepared base and then the openings are carefully pierced from behind with a scalpel. A little trimming is usually needed to produce a clean edge, then a lintel and sill are added.

Window frames are cut from 10 or 20 thou sheet. Glazing bars can be pierced from a sheet, but this is a slow, tedious business. Should one bar be broken it is usually possible to effect a repair with a little solvent.

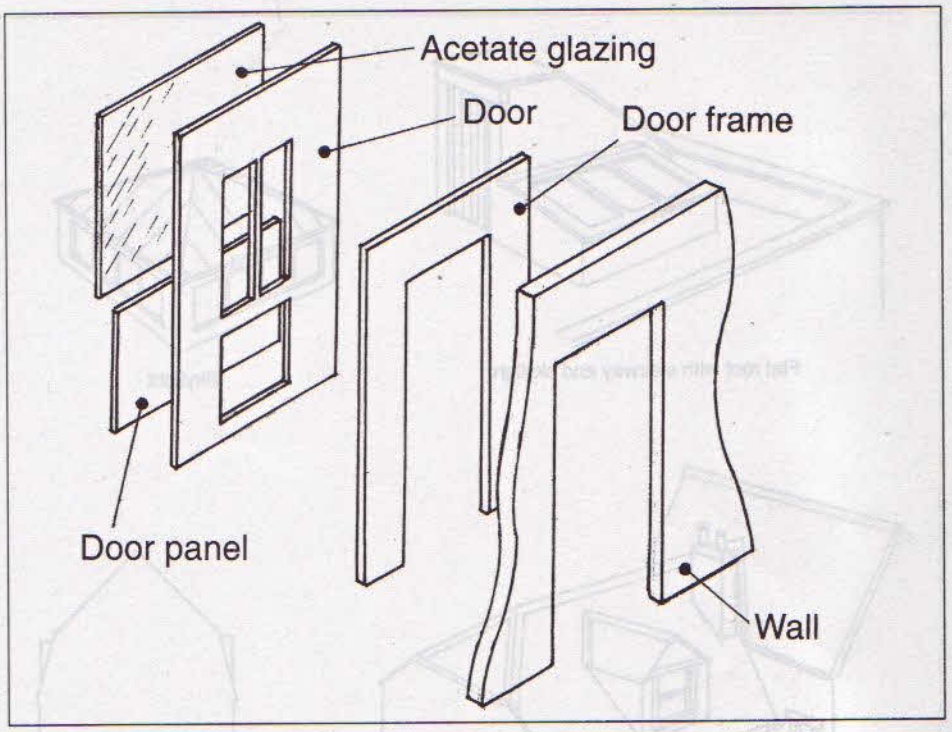


Assembly of hand-cut parts calls for a little care since it is unusual for there to be any alignment aids. Here I am using a square to ensure that the side is at right angles to the edge, although the base could be taken as a reasonable guide. The open ready-use bottle of Mek-Pak is handy for me to dip the brush in before running a generous supply of solvent along the joint line. Provided the parts are a good fit (as indeed they should be), the solvent flows into the joint by capillary action.

The repaired frame needs to be set aside to harden before further piercing is attempted. It is a good idea to mark out and cut an extra



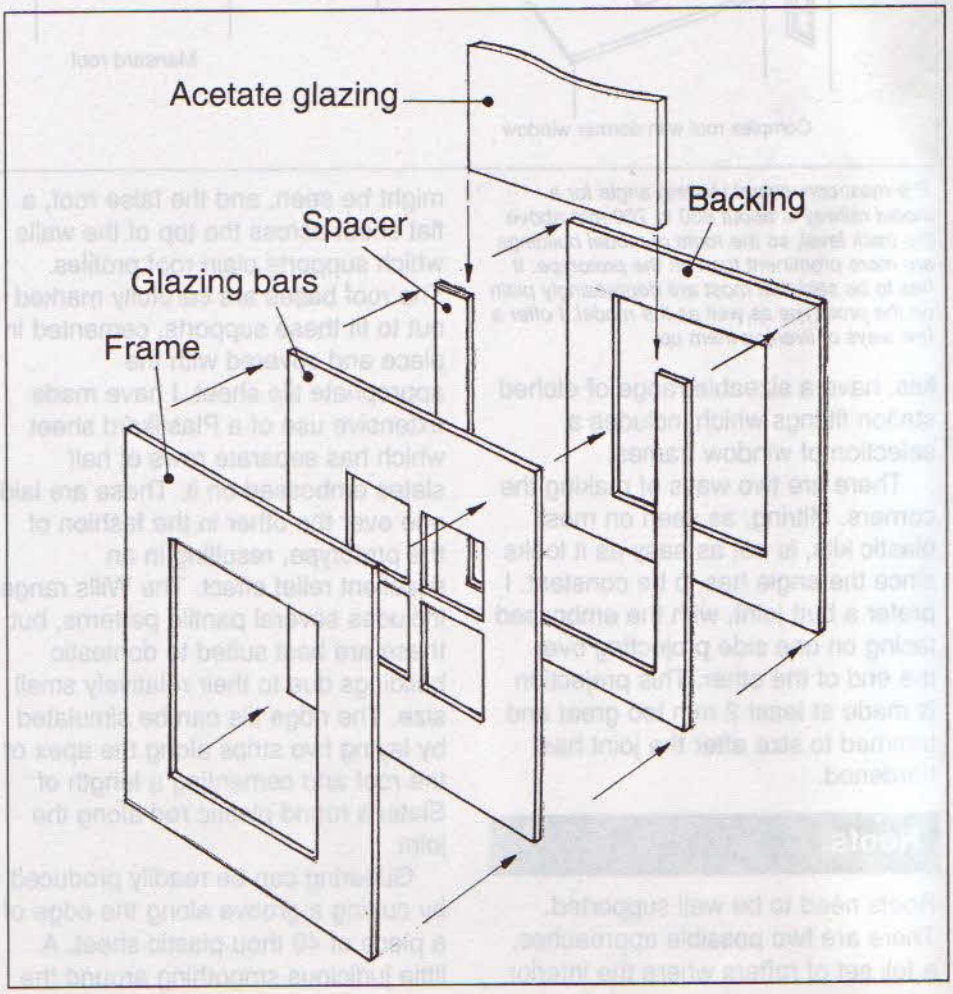
Above: *The three basic brick bonds. The simple garden wall bond is one brick thick and when used for walls or outhouses, requires the inclusion of frequent strengthening piers. It is also used for the outer skin of domestic cavity walls, and as an infill or cladding on many modern buildings. Flemish bond is normally two bricks deep and is more common on industrial structures. English bond is favoured where three or more thicknesses of brick are required. It is to be found in many Victorian railway structures.*



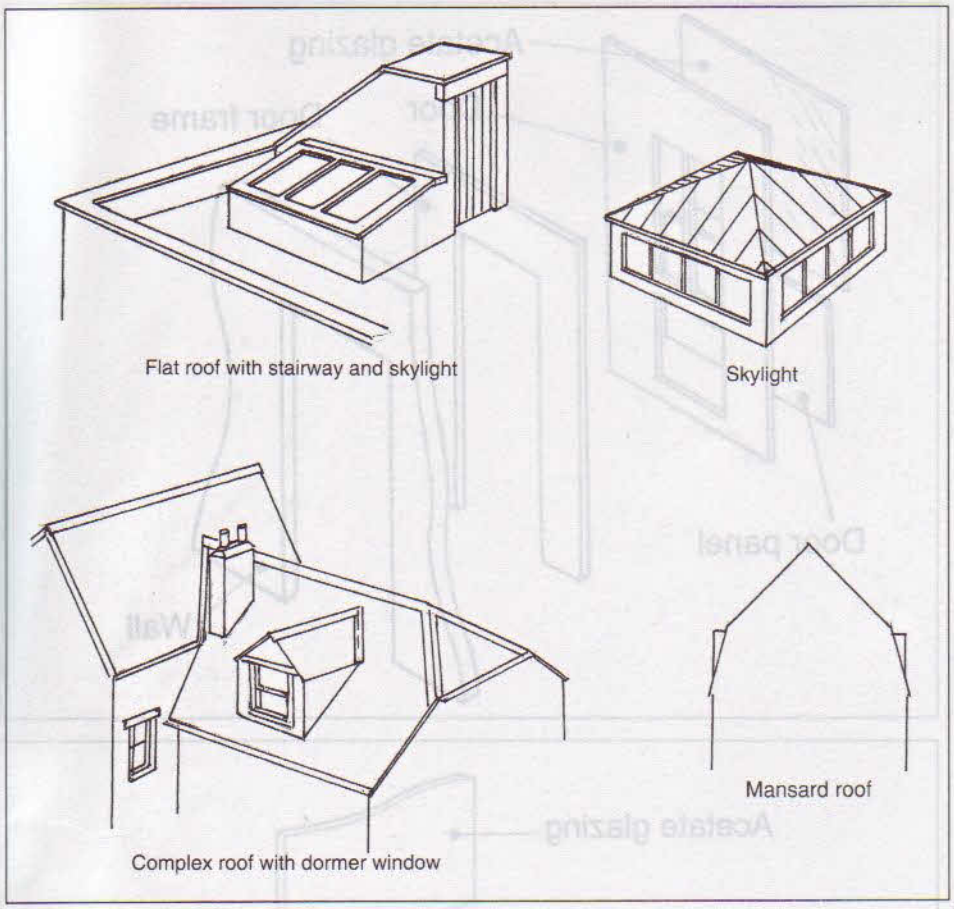
Top right: *Every building has a door of some sort. They can be modelled by assembling the various layers as shown in this diagram. This shows the arrangement for a half-glazed door. While it might seem that cutting out the openings in the door is the trickiest part of the process, in practice getting the various layers in proper alignment seems to be the major stumbling block. Take care!*

frame just in case of accidents. While you may never need it, marking out an identical frame afresh is none too easy. As an alternative, glazing bars can be scribed into the acetate glazing sheet, and the grooves filled with paint or coloured ink, any surplus being wiped off before it dries.

A small selection of moulded and etched window frames is available, and the etched frames are particularly nice. D&S Models, mainly known for their wagon and coach



Right: *It is usual to cement the acetate sheet glazing behind the window frame. This is simple and, providing just the right amount of cement is used, reliable. It is only a little more troublesome to make a frame into which a precisely cut piece of acetate can be slipped in from above. This type of construction is particularly useful in low-relief modelling, where the glazing can be inserted after the model is finished and painted.*



The most convenient viewing angle for a model railway is about 600 to 700 mm above the track level, so the roofs of model buildings are more prominent than on the prototype. It has to be said that most are depressingly plain on the prototype as well as the model. I offer a few ways of livening them up.

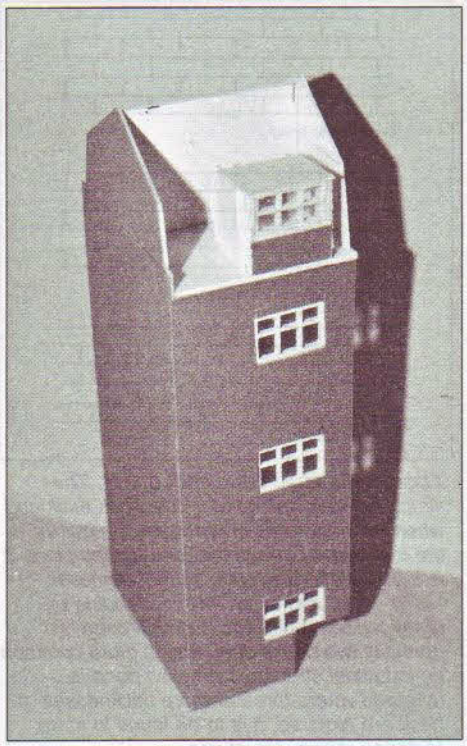
kits, have a sizeable range of etched station fittings which includes a selection of window frames.

There are two ways of making the corners. Mitring, as seen on most plastic kits, is not as easy as it looks since the angle has to be constant. I prefer a butt joint, with the embossed facing on one side projecting over the end of the other. This projection is made at least 2 mm too great and trimmed to size after the joint has hardened.

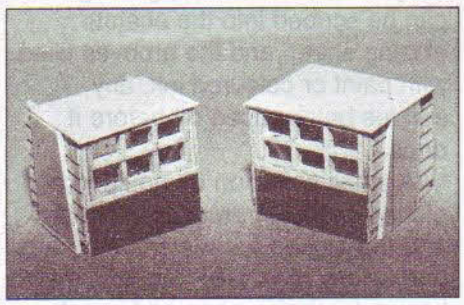
Roofs

Roofs need to be well supported. There are two possible approaches, a full set of rafters where the interior might be seen, and the false roof, a flat sheet across the top of the walls which supports plain roof profiles. The roof bases are carefully marked out to fit these supports, cemented in place and covered with the appropriate tile sheet. I have made extensive use of a Plastikard sheet which has separate rows of half slates embossed on it. These are laid one over the other in the fashion of the prototype, resulting in an excellent relief effect. The Wills range includes several pantile patterns, but these are best suited to domestic buildings due to their relatively small size. The ridge tile can be simulated by laying two strips along the apex of the roof and cementing a length of Slater's round plastic rod along the joint.

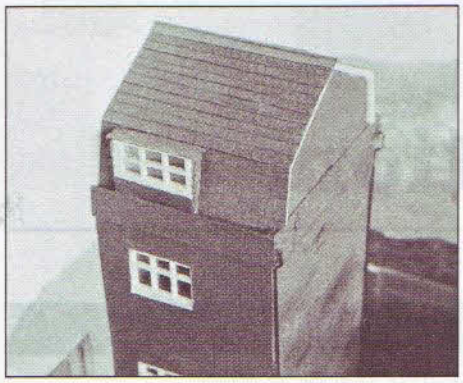
Guttering can be readily produced by cutting a groove along the edge of a piece of 40 thou plastic sheet. A little judicious smoothing around the front and ends produces a realistic gutter which is cemented under the eaves. The downpipes are made from enamelled copper wire, which



The building on the far side of the track is an older structure with a mansard roof, to add interest to the skyline. This is the far side, and although those windows will not be visible from the normal viewing angle, I felt constrained to put them in. They came from a now discontinued Faller pack of accessories and only needed to have the holes cut for them in the side. Again, the bottom is notched to fit over the batten. This picture shows the basic construction of the mansard roof, with its dormer windows already in place. A centre ridge piece helps strengthen the assembly. I envisage this as being a warehouse, but its main function is to cover a point motor.



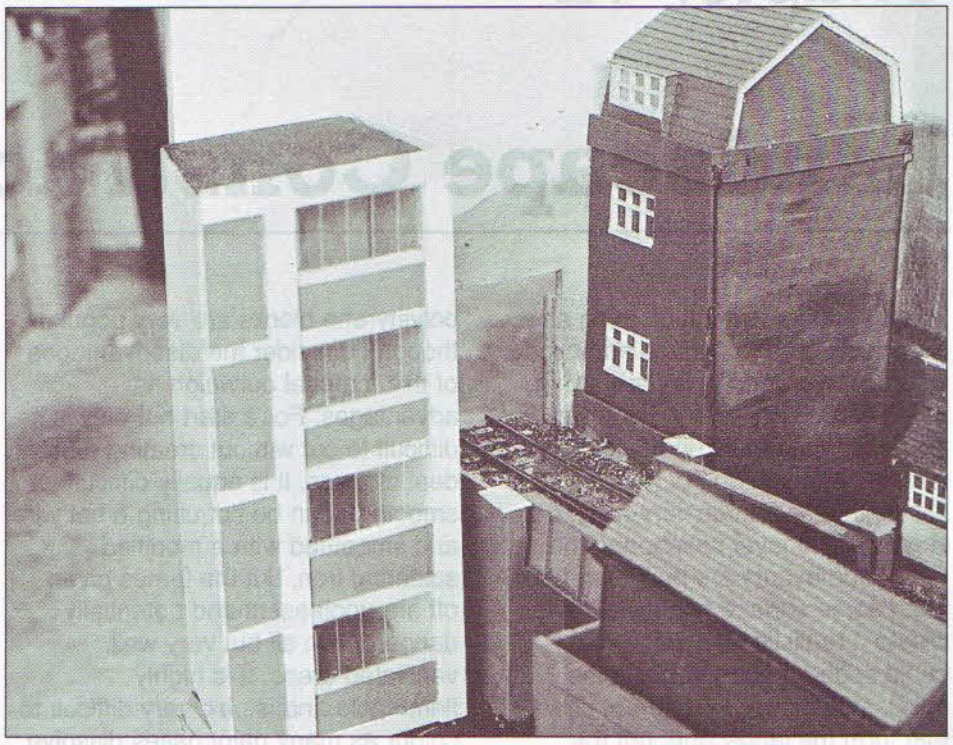
The two dormer windows are sub-assemblies which were built around the Faller window frame, much as the prototype would have been had a prototype existed. The slabs along the sides will support the roof.



The mansard roof complete. It has a slated roof, produced from Slater's embossed Plastikard. The enamelled wire down pipes are quite prominent.

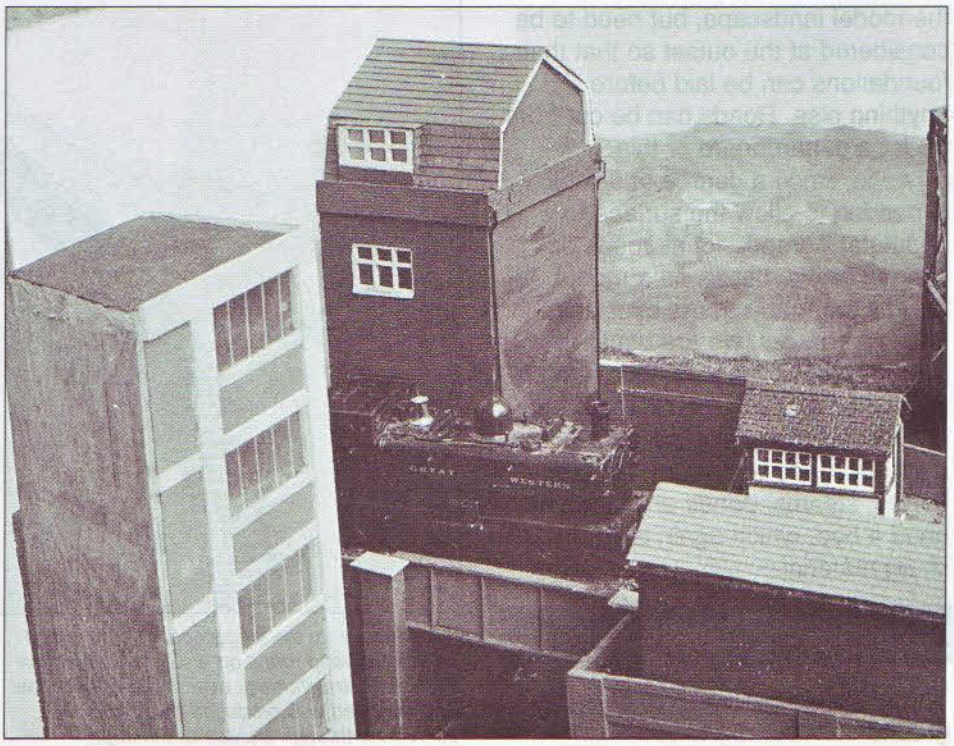
needs no painting unless you are being very fussy. The wire is straightened as mentioned previously by gripping one end in the vice and pulling hard at the other end with a pair of pliers.

All my recent buildings have a wooden insert in the base, or are built on a plastic base fixed to a piece of plywood. This allows me to screw them to the baseboard with No. 1 countersunk woodscrews. Wherever possible, these are inserted from underneath. Several small buildings can be built on a ply base to form an interesting group.



Seen from this angle, the hole in the backscene is visible, though in practice there is enough interest, with the low level road, to draw the eye away. The ground frame hut, a Wills kit, and the indeterminate store that covers a point motor also help to draw the eye away, even if the gasholder isn't doing its stuff. What is much more to the point, the area has plenty of scope for further detailing.

The blank end wall of the warehouse is an obvious site for a hoarding, and the Wills kit will do nicely with just a little modification. Then I intend adding a suspended gantry on the modern block with a couple of men cleaning the windows. Add some road vehicles and you have enough going on to allow the viewer to suspend disbelief over that hole.



This more conventional view shows that the hole is reasonably well covered from most angles. The side wall of the modern factory is a piece of plywood which, in due course, will get painted.

Chapter 12

Landscape Construction

In nature there is no such thing as a dead level ground surface as anyone who has ever tried to lay a bowling green will readily testify. Even flat plains have a gently undulating surface, and you do not have to go to the Alps to find some very rugged scenery. The level baseboards on which our layouts are built therefore need some surface manipulation to create a realistic landscape. We could spend a good deal of time discussing the many different strata that form the landscape, but the amount of space available on most layouts for earthworks of any description is limited. Within these narrow confines we find ourselves faced with two general conditions, earth or rock.

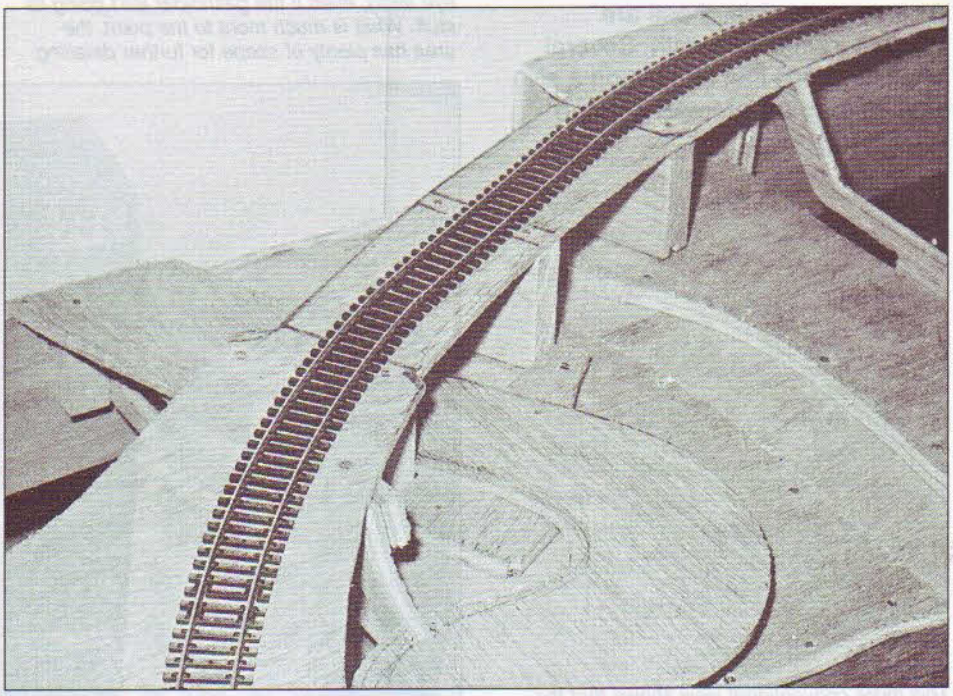
Roads, rivers and lakes are part of the model landscape, but need to be considered at the outset so that their foundations can be laid before anything else. Roads can be cut from thick card, hardboard or thin plywood, since a degree of flexibility is needed to allow the surface to undulate. Agreed, not all roads do change levels, but as on a model railway the road passes over or under the tracks, we are usually concerned with inclines. One thing we should avoid is a sudden change in level. Changes in gradient are normally made with a smooth curve. Rivers, steams, ponds and lakes also need a bed, which again is cut from sheet material.

Expanded polystyrene

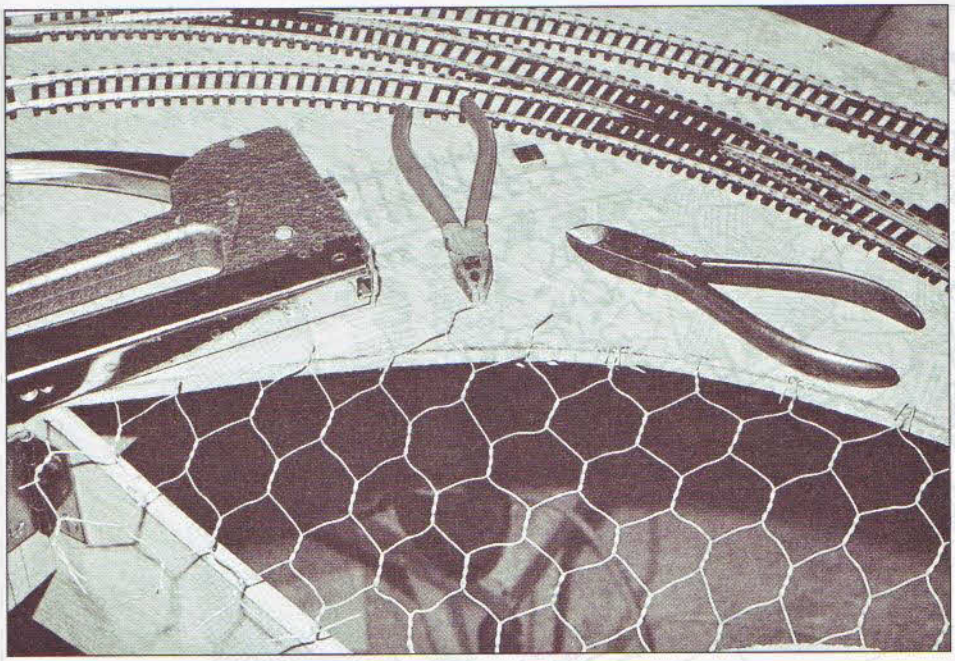
There are several ways of creating a ground surface. Expanded polystyrene blocks are very popular, though I consider the disadvantages of this material outweigh its advantages. For a start not only is it difficult to cut without creating a great deal of mess, it is equally difficult to smooth. It can be cut using a hot wire and smoothed with a modified soldering iron, but the fumes given off are unpleasant and potentially dangerous in all but very well ventilated areas. It is highly flammable and is also very difficult to colour as many paint bases dissolve the material. One popular solution is to coat it with plaster, but as we shall see there are simpler bases for a plaster shell.

Papier mâché

Papier mâché is often recommended, but frequently the instructions given reveal that the writer does not know anything about this material. True papier mâché is made by pounding torn up paper in size until it is reduced to a pulp; the name translates as 'mashed paper'. This material is then used to produce trays, boxes and similar trinkets by pressing it on formers to squeeze out most of the water and speed drying. The result is an extremely hard board which, when lacquered, has a very attractive finish. Unless the paper is very thoroughly pounded



Foundations for the landscape. The track and trackbed sweep round on a curve, with a short section of straight track over the road and river. The river bed was produced by making a curved cut through a piece of 6 mm ply, separating the sections and screwing them to a larger piece of 4 mm ply. The road was cut out of 4 mm ply and screwed down at one end, then packing strips were put underneath to create the desired slopes.



Next chicken wire netting was stretched across the openings. Three tools are needed, a pair of wire-cutters to trim the netting, a small pair of pliers to twist the wires as required, and a staple gun. The netting on the right has been stapled down to the ply trackbed and the ends of wire twisted neatly back.

into a pulp you get a rather lumpy material, and without a good deal of pressure the resulting material takes weeks, not days, to dry out completely. As a basis for a model landscape it is tolerably useless.

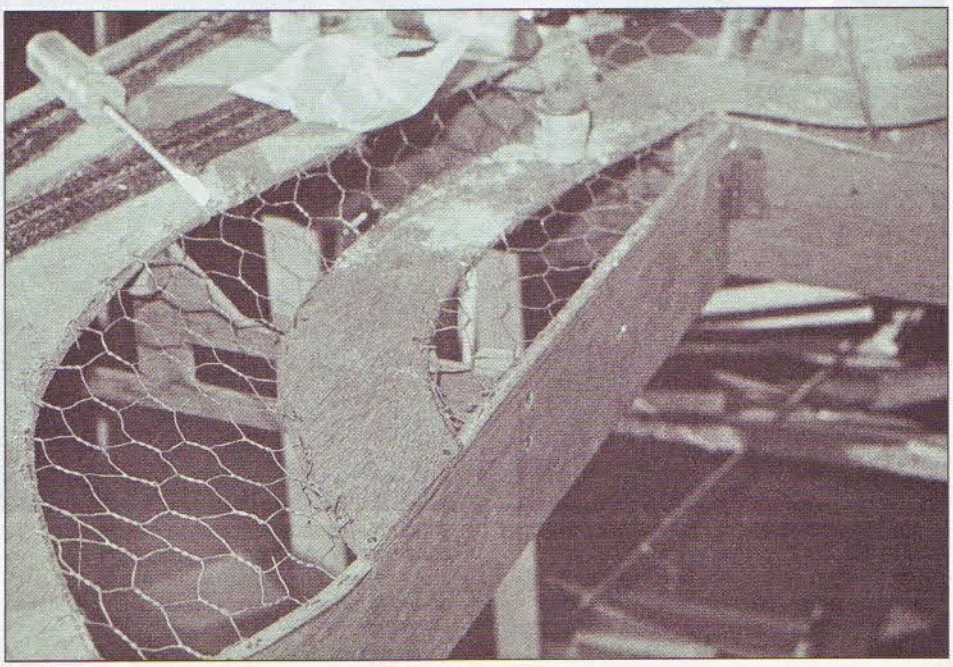
The usual method described to make model terrain from paper is to paste small pieces over a former using common wallpaper paste. This is fairly simple, not too messy and has just one disadvantage, you can only apply three or four layers of paper before the whole thing gets too soggy.

The base is dry, crumpled newspaper, poked into shape. If it needs to be held in place, sticky tape is quick, clean and dry. Where large open areas have to be covered, a sheet or two of newspaper taped over the hole will provide support. The fact that it is loose and insecure is of no importance whatsoever, it is only needed until the top surface dries out, after that it has no further value and can be torn away.

The system is at its best where large areas need to be covered, because it is extremely cheap. Where a fair-sized expanse is involved, the number of layers you can apply in a given time is limited so that the first application has time to dry overnight before the second goes on. You will need to apply anything from six to twelve layers of paper to produce a self-supporting surface. The result is a sort of loose cardboard.

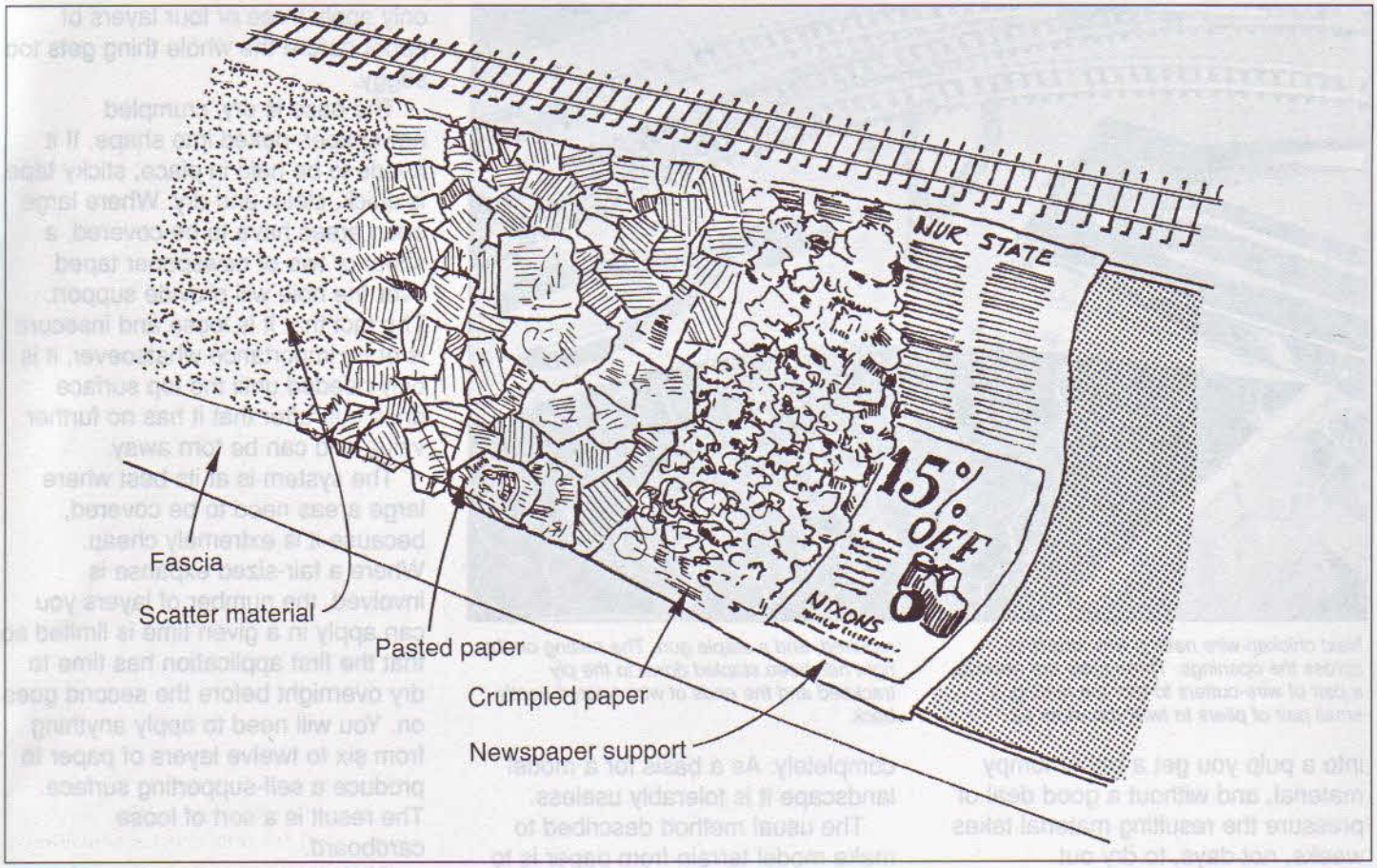
When preparing the paste, the instructions on the packet are no guide to mixing, since you most definitely do not require a bucketful. Empty the paste into a screw-top glass jar, then use a tablespoonful of paste to a jam jar full of water. Allow this to gel, stirring from time to time, then apply with a cheap paintbrush. A piece of scrap board about 8 to 12 in (200-300 mm) square will make a good pasting board. Don't forget to wash both it and the brush thoroughly at the end of the session.

The wire netting is now fixed in place over the gaps in the sub-structure. All is ready to start landscaping. Some plaster has been spilt on the roadway.



Plaster

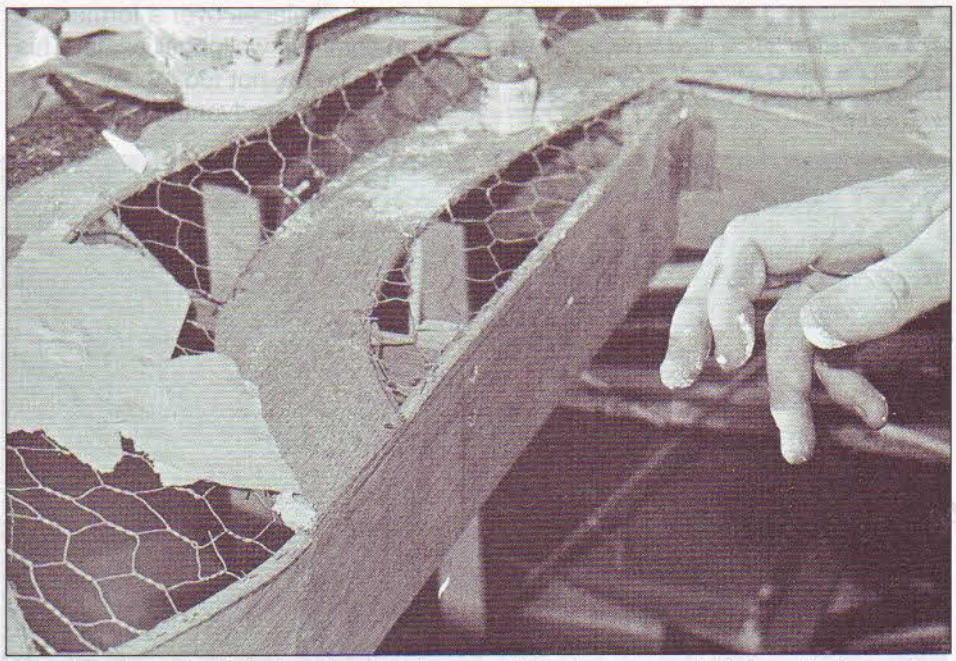
Plaster is a popular material for landscape construction, because it is reasonably priced, readily available and delightful to use. It is also extremely versatile, since it can be moulded and carved to form a rock face or spread out evenly to form the base for a field. Its two main



Modelling landscape with a pasted newspaper base.

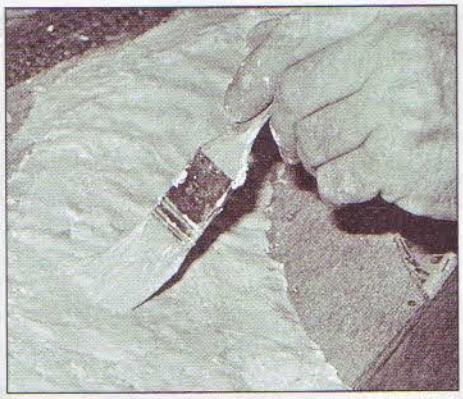
disadvantages are the messy nature of wet plaster and the liability of set plaster to crack under stress. It needs to be applied over a former, of which there are two popular versions.

One is chicken wire, which is usually to be found in garden centres. This has two virtues; it is self-supporting over wide spaces, and it can be readily pushed and poked into any desired shape. It has three snags; it is very easy to scratch your hands while using it, it is difficult to cut neat holes in the landscape, and if you are not careful you end up with a hexagonal pattern over your fields. If you wear gardening gloves whilst cutting and fitting it in place and take the trouble to apply a smooth finishing coat to the initial surface snags one and three are dealt with. The best way I've found to

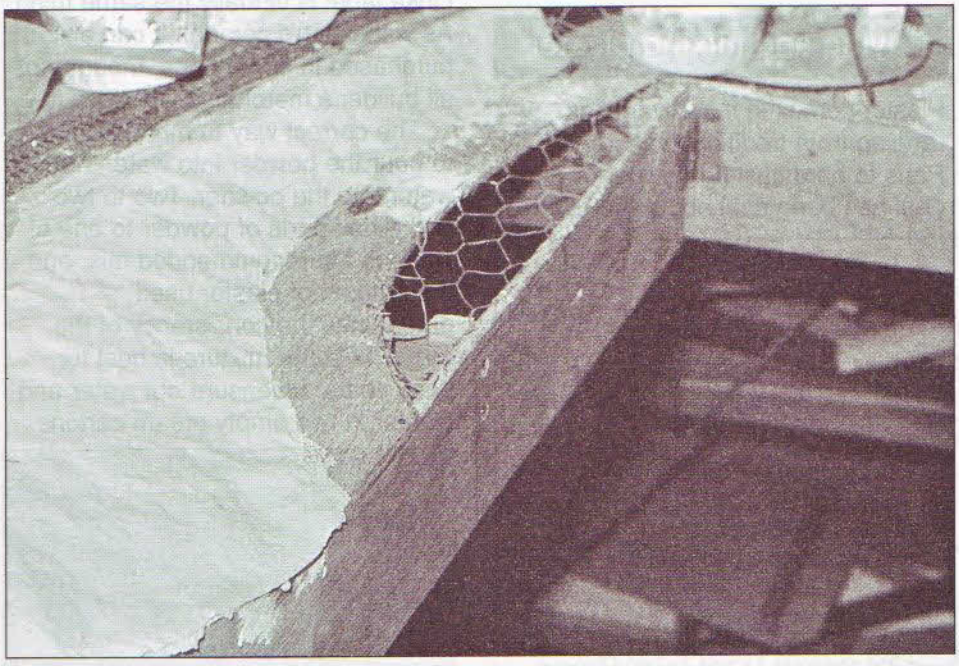


Once the wire netting is in place the plastering can begin. Because the mesh has a fairly large opening, it is more convenient to apply scraps of paper coated in plaster over the wire. In this instance paper towels were used, although newspaper is just as effective and considerably cheaper. It's rather a messy process, so some warm water in a bucket and an old towel will prove invaluable for cleaning the hands.

Above: *The plastered paper is smoothed down with a broad flat brush which helps spread the plaster more evenly over the support. Once the whole area is covered, it will be left to harden.*



When the bottom coat of plaster has set overnight, the top finishing surface can be applied. Here it is being smoothed down with a dampened brush. The hexagons in the foreground are covered, but there are still plenty to be seen further along the embankment.



Below: *This photograph shows all too clearly the hexagonal pattern produced by the underlying wire mesh. This happens because the plaster-coated paper inevitably settles down under gravity during the setting period.*

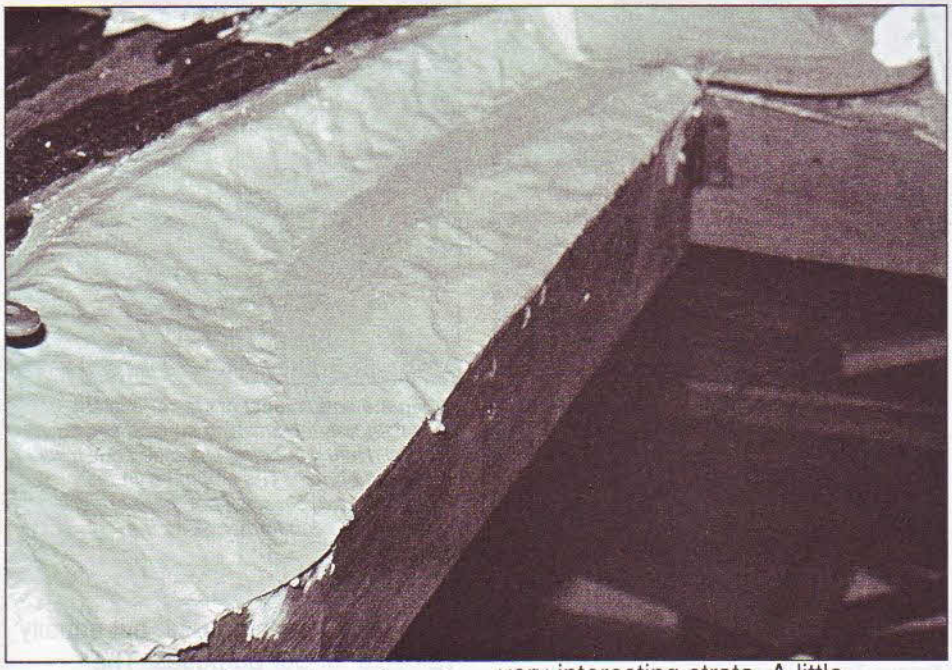
cut a hole is to carve down to the wires with a Stanley knife, then snip through the metal with a pair of wire-cutters.

The alternative method of support is to weave a mesh with strips of cardboard, usually cut from cereal cartons. This is much easier than it sounds, but it does mean that you need rather more supporting profiles. Both methods are illustrated in detail.

As an alternative, the base can be made from plaster-impregnated bandage, a method originally intended for medical use, but equally valuable for our purposes. The bandage adds strength to the shell, which even in thin layers is self-supporting. It does, however, need a further coat of plaster to hide the texture. A significant advantage is that it can be built over a crumpled newspaper support, which can be removed when the shell has set.

A similar approach to the bandage is the 'hard shell' technique. The method originally described in *Model Railroader* was to dip pieces of torn paper towel into a creamy mix of hard casting plaster. I discovered that ordinary newsprint is just as good as towels, and that if you can't get the hard casting plaster ordinary crack filler (Polyfilla) will do the job. Again, a crumpled newspaper base will support the shell whilst it is hardening overnight.

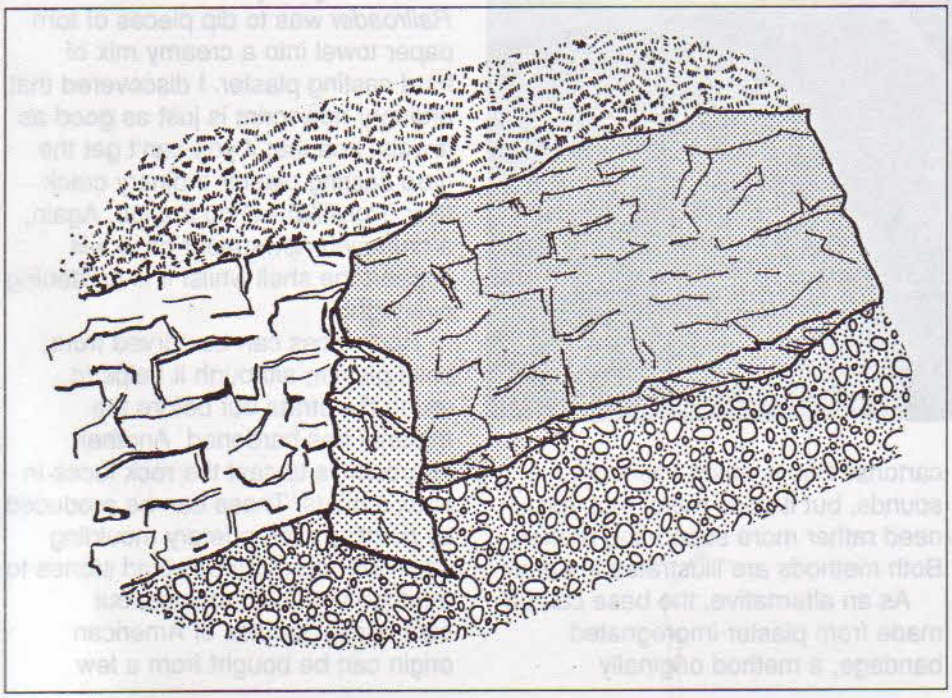
Rock faces can be carved from solid plaster, although it helps to rough the strata out before the material has hardened. Another approach is to cast the rock faces in latex moulds. These can be produced by painting a proprietary moulding latex over carefully selected stones to produce your own moulds, but commercial moulds of American origin can be bought from a few



Plastering is now complete, and even the road has received a thin coat to fill the grain. The landscape, looking decidedly wintry, is ready for the finishing cover of 'grass'.

specialist retailers. There is a very simple alternative, namely crumpled aluminium kitchen foil, which when applied to wet plaster produces some very interesting strata. A little judicious carving with a craft knife afterwards will soon produce a reasonably realistic rock face.

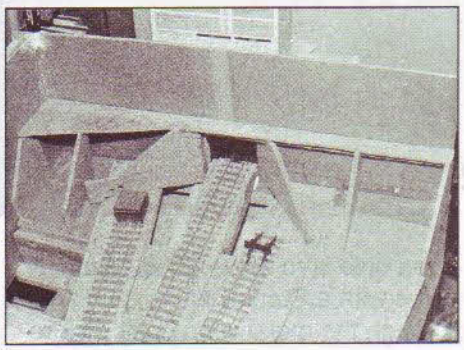
Casting 'rocks' with crumpled aluminium kitchen foil.



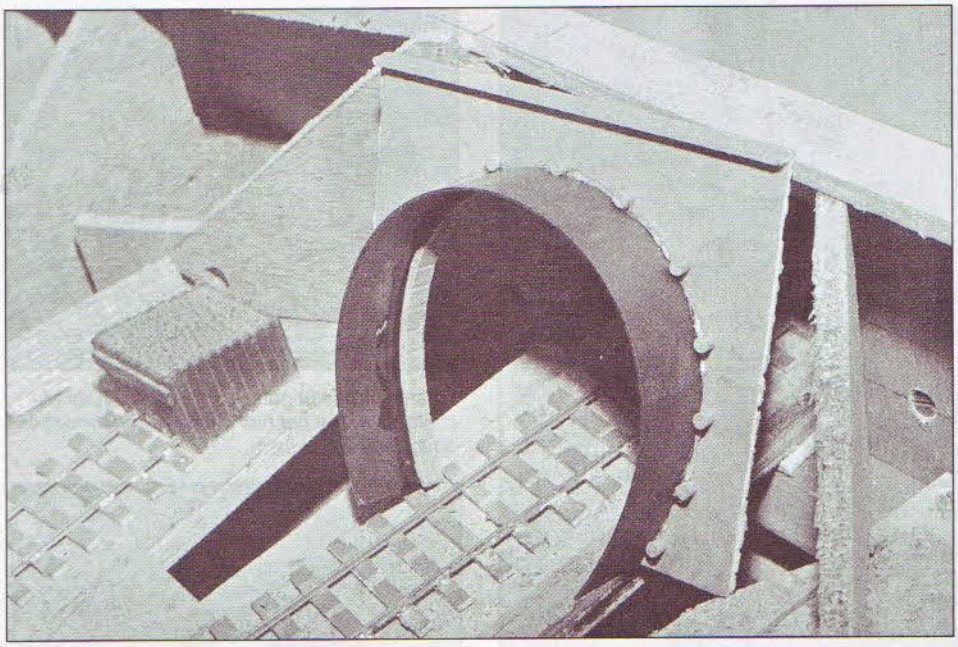
Buying and mixing plaster

Plaster comes in many varieties, ranging from traditional plaster of Paris to hard casting powder. A good deal has been said about the relative virtues of different brands, but in my experience, apart from the matter of speed of setting, the most important factor is ease of supply in the right quantities. Unless you are contemplating covering a very large area in a short time there is no point in getting a 50 kg bag of Kean's cement from your local builder's merchant. For the average project, 1 kg is more than enough, and the usual packets of filling plasters sold by every DIY store in the land are just about right. These are fairly slow setting, which for many purposes is highly convenient, but in my opinion the virtues of slow drying times can be exaggerated. Dental plaster, both hard and quick drying has been used with considerable success, though it is not too easy to obtain. Hard casting plaster sold by artist's suppliers for pouring into latex moulds, or by model shops under the Linka label is virtually the same thing. As with Kean's cement, it can also be purchased in 50 kg bags, though not all builder's merchants will stock it.

The correct way to mix plaster is to pour the powder into water, not water into the powder. Two to two and a half parts of powder to one of water is the recommended mix, and the amount of plaster used determines the consistency of the mix. The stiffer mixture is best for base coats. I measure out water and plaster in two empty cream cartons

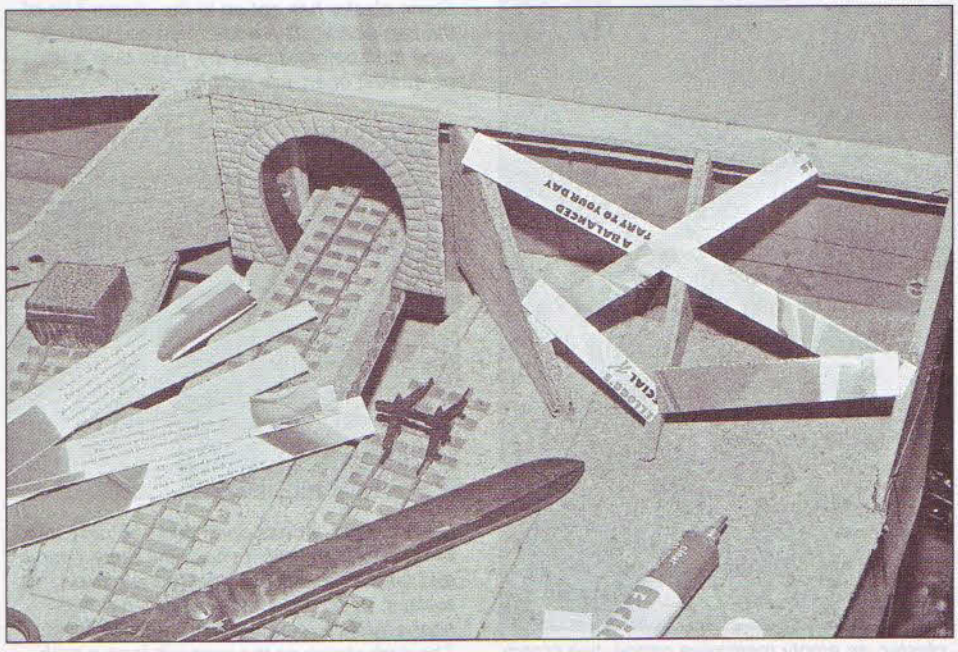


The exit from the coalyard diorama to the fiddle yard is through a tunnel. Here we have the basic ply framing for this section. Two ply formers are backing for the tunnel wing walls, and the portal itself fits snugly between them.



Before the tunnel mouth was fitted, the wing walls were separated from the portal, since they refused to bend cleanly at this point. The embossed lining provided in the Pola kit also proved obdurate, so after a couple of attempts to get it to curve correctly I chickened out and substituted a strip of black plastic sheet. This is secured in place with a generous fillet of plastic cement.

and mix in empty margarine cartons. The 500 g size of margarine container is just right for mixing two and a half cartons of plaster. For a top coat, a 2:1 mix can be used, and a similar proportion is needed for hard shell construction. Experience, rather than measurement should be your guide.



The foundation for the plaster landscape was then made from strips of card cut from a cereal carton and stuck in place with acetate cement. They were applied pattern side up so that they would come out more clearly in the photograph; they work equally well whichever way you lay them.

Grass

A grass effect can be produced by mixing fine cork dust or sand with the top coating of plaster and painting it when dry. Alternatively, the surface can be covered with a commercial scenic scatter material. These range from dyed sawdust to finer flocks and come in a variety of colours. Unless you're producing a bowling green or sports stadium, mix dark and light green and throw in odd pinches of other colours.

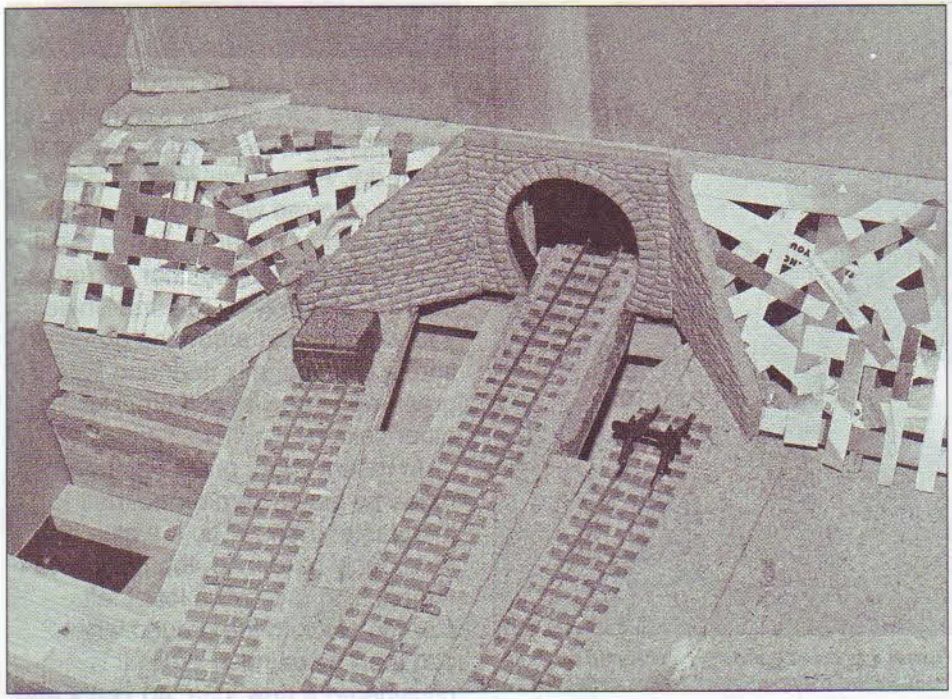
In recent years grass has been made by gluing carpet underfelt to the plaster then, when the glue has thoroughly hardened, the ripping off the backing to leave a lot of felt strands stuck to the ground which can then be painted. While it is considered a new idea, 40 years ago the same technique was used with medical lint and winceyette. These materials produce a finer grass.

Water

Various methods have been used to reproduce water. The least effective is to use actual water, since any movement is in the real and not the model world. At our scales the difference is noticeable and so in the main water is only used where boats are to move around. A very old idea is to use crumpled cellophane to represent flowing water. It is still effective, but cellophane is not so common as it once was and while florists make considerable use of it, they now use printed sheets.

For still, dark water, as found in a canal or dock, a layer of varnish over a painted surface takes a lot of beating. For pools and limpid streams, where the bottom should be visible, a layer of transparent acetate sheet is placed over the modelled base and the top land surface carefully matched to the bed.

As an alternative, the water can be made from a two-part transparent

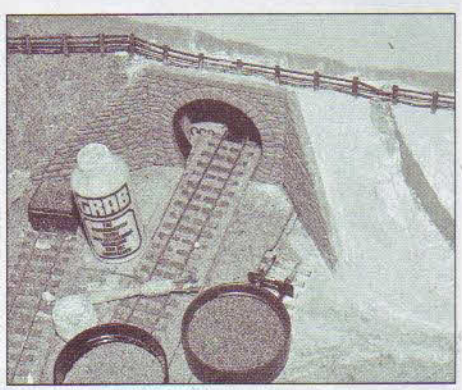


The next step was to secure the tunnel portal and wing walls in place, using standard epoxy resin, which I find the best adhesive for sticking plastic to wood. The long-setting pattern is best since you have some time to make the final adjustments, whereas the 'five minute' variety sets so quickly you have to rush things. This is not good. As the natural slope of the cutting would have clashed with the gasworks building, a small toe wall cut from Wills moulded plastic stone walling was added.

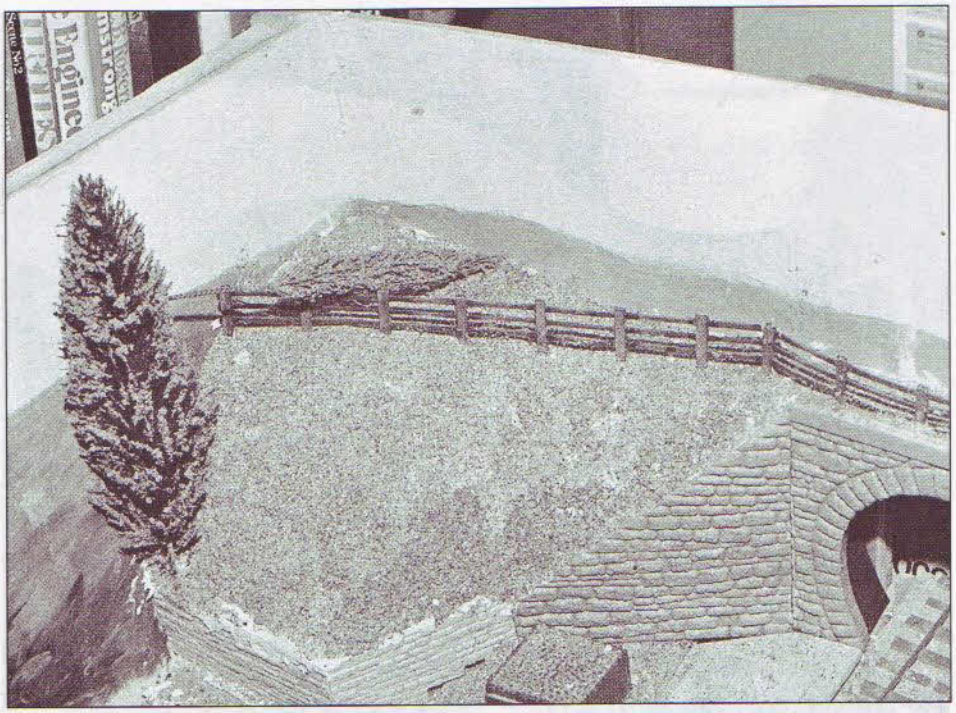
Before plastering began I covered all the track and its surrounds with cut up plastic bags, held down with Sellotape. It will also be seen that the backscene has been painted. All the requirements are laid out – the packet of plaster, an empty margarine carton, two cream cartons, a small trowel, two sculptor's moulding tools and the water bottle (which the sharp-eyed may notice once held vodka).

Plastering has begun. A small quantity of the contents of the pot has been roughly trowelled on to the card strips.

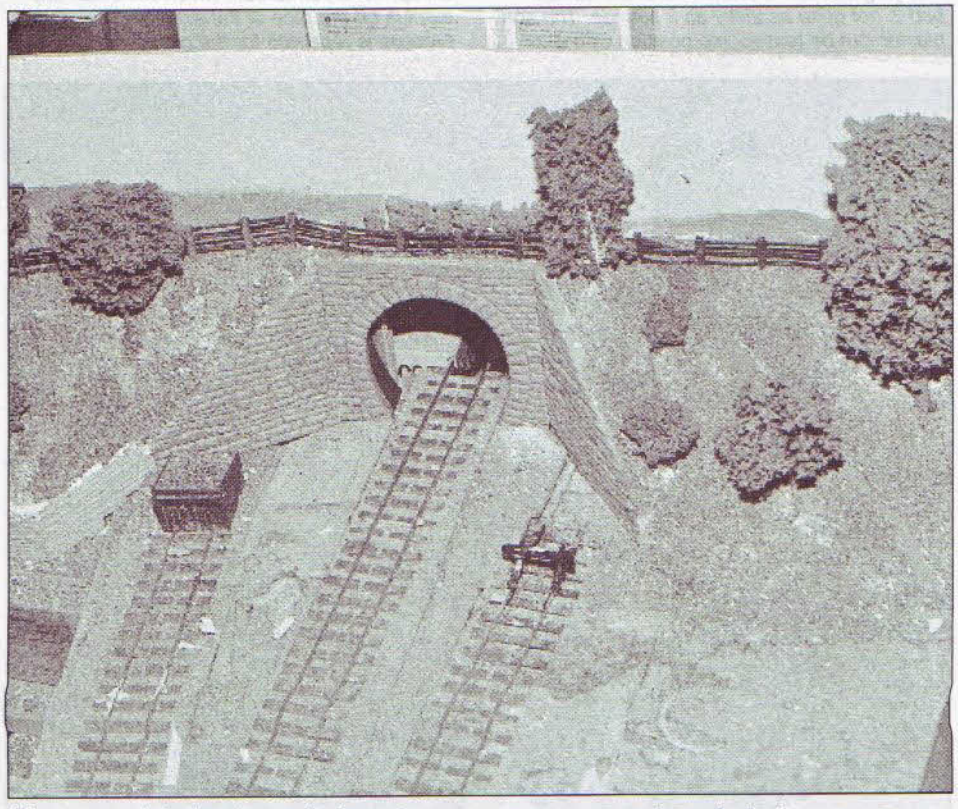
Plastering is complete and the surface smoothed. Before it has set, the boundary fence has been pushed into the soft ground; this is a lot easier than drilling holes for it later. Some plaster has got on to the distant hills of the backscene. There are three possibilities; wipe it off before it gets dry, paint over it later, or, easiest of all, just hide it.



Once the plaster has hardened, the next step is to apply the grass. I chose the quick course and applied scatter material to the glued surface, using two shades of green mixed haphazardly to create a more natural effect. The dark streak on the right will form a path, leading to a broken section of fence. The glossy appearance of the surface is due to the glue, which has been liberally applied over the plaster.

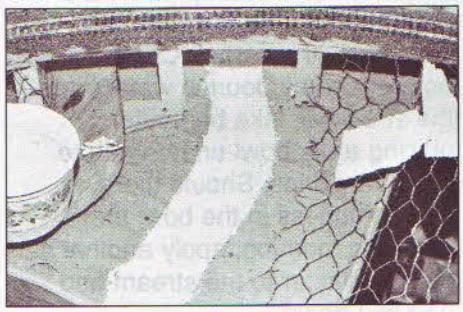


After the grass was down and the fence had been painted an indeterminate dark brown, it was time to add the vegetation. We'll look into this in detail in the next chapter. I used selected trees and bushes from my collection of commercial products. One poplar has already been planted and a sapling is lying on the fence, waiting its turn.



The trees and shrubs are now in place, so except for a little touching in that will be needed on the grass the rural bit is finished. The plaster marks on the backscene are now behind a clump of bushes. I much prefer the easy way out.

Where relatively small areas of 'ground' need to be fitted in between track bases and around buildings, mixing a tub of plaster is both bothersome and messy. Proprietary ready-mixed plaster can be used here to great effect. In this picture I am filling in between the main track base and the plywood back for the retaining wall. The gap has been covered with a scrap of ply, but card is just as effective. The ready-mix is applied with a sculptor's modelling tool. As with normal plaster, smoothing is aided by lightly dampening the surface. It will be seen that this took place before tracklaying began.



Early stages in modelling a stream. The bed has been filled with plaster up to the top of the ply base. The adjacent wire mesh is not yet covered.

The stream bed has now been painted dark green/brown. There is a little plaster sticking up above the wood base, which will have to be cut away before the next stage in the proceedings.

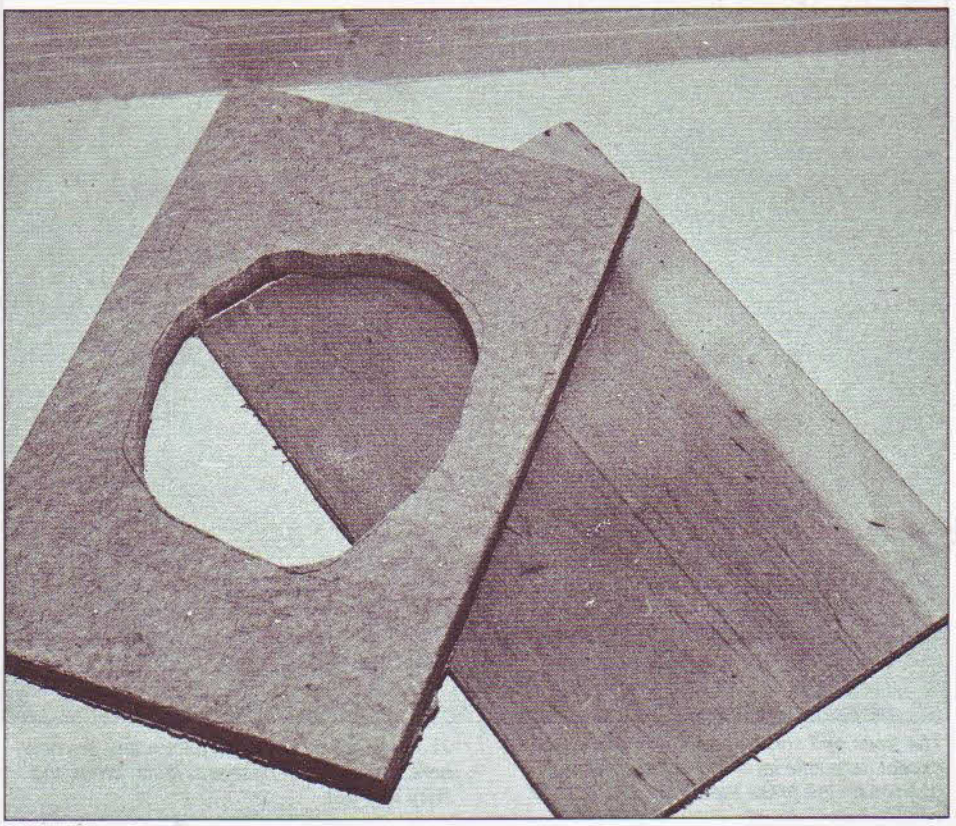
A sheet of clear acetate is laid over the bed to represent water, with a few green streaks of paint along the underside help create the illusion of flow. The plaster is now brought over the acetate to form the banks.

encapsulating resin, sold by many artist's suppliers. This demands an absolutely waterproof base since the stuff will seep through even a small hole and end up as a hard irregular block on the floor or, worse still, the carpet. Check beforehand by pouring water into the stream or lake bed, after placing a dry bowl underneath to catch any drips. Should there be any dampness in the bowl the following morning, apply another coat of plaster to the stream bed and test again.

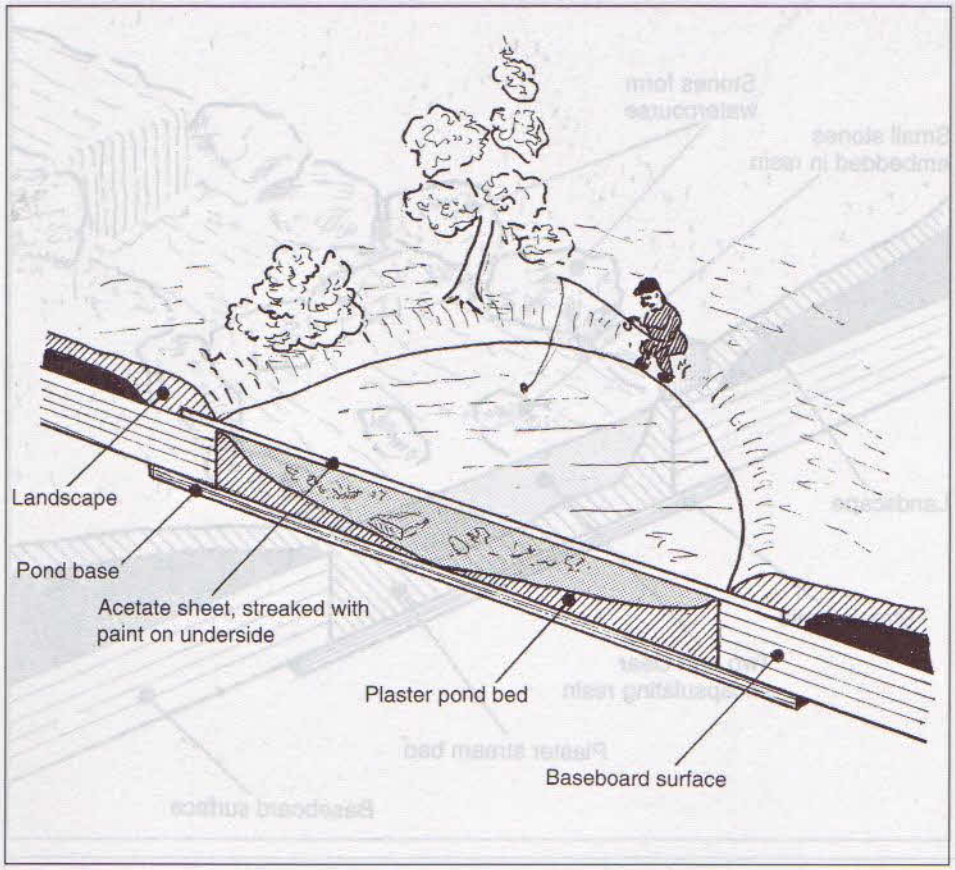
Fast-flowing water is very difficult to model effectively. Some of the best results I have seen were achieved by modelling the 'water' surface with plaster, which was then artistically painted and heavily varnished. Alternatively, the river bed is modelled in considerable detail and the 'water' produced by successive layers of clear casting resin or varnish.

Waterfalls are even more difficult. Here the rock face has first to be modelled with complete fidelity and that is the easy bit. There are two ways of reproducing the falls. One is to stick thin slivers of cellophane from the lip of the falls, which has the advantage that

Marrying the banks to the line of the stream bed is not quite as tricky as it sounds. The soft plaster can be teased into position with a cheap No. 3 paintbrush, which will clean any surplus off the face of the acetate. The process is repeated for the other bank.



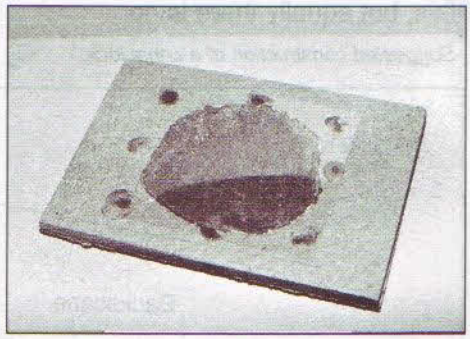
The first stage in modelling a pond. A suitably shaped hole is cut from a thick board – in this instance 9 mm insulation board – and a thin backing sheet provided.



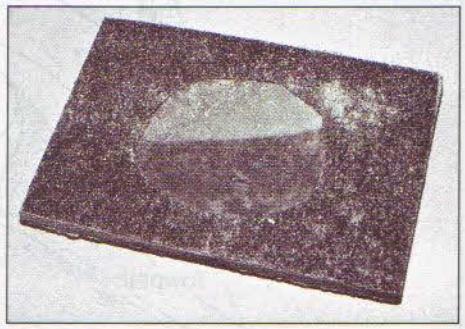
Below: *The two sheets are pinned together and the pond's bed is formed with plaster. Ready-mix was used for this small job. The modelling tool is proving very useful for forming the contours, while the fret saw bench is also proving its value as a slightly higher working surface.*

Left: *Modelling a lake with acetate sheet water.*

With the pond bed finished to my satisfaction it was set aside to harden for a short while and then painted with a very dilute wash of brown and green whilst still damp. This is the old established process of fresco painting, but I don't claim any links with the Renaissance masters. It does show that it helps to know most of the tricks in the book, since most craft techniques can be applied to railway modelling, one way or another.

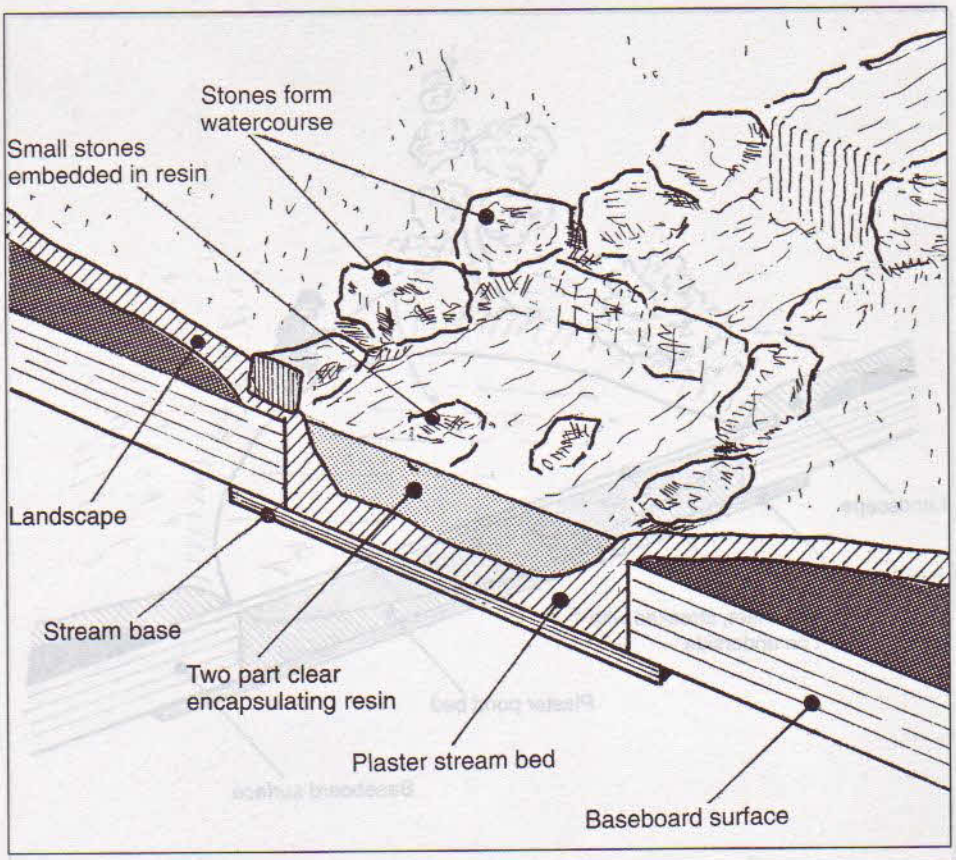


The acetate 'water' is now placed over the pond and held in place with dabs of cement.



The pond has now acquired a grassy surround, cut from a grass mat. This is a useful material for a spot of rapid scenic coverage and in skilled hands can be very effective. Its main fault is a tendency to acquire highly improbable fold lines, particularly when covering a well rounded area of ground. However, it is adequate for this demonstration.

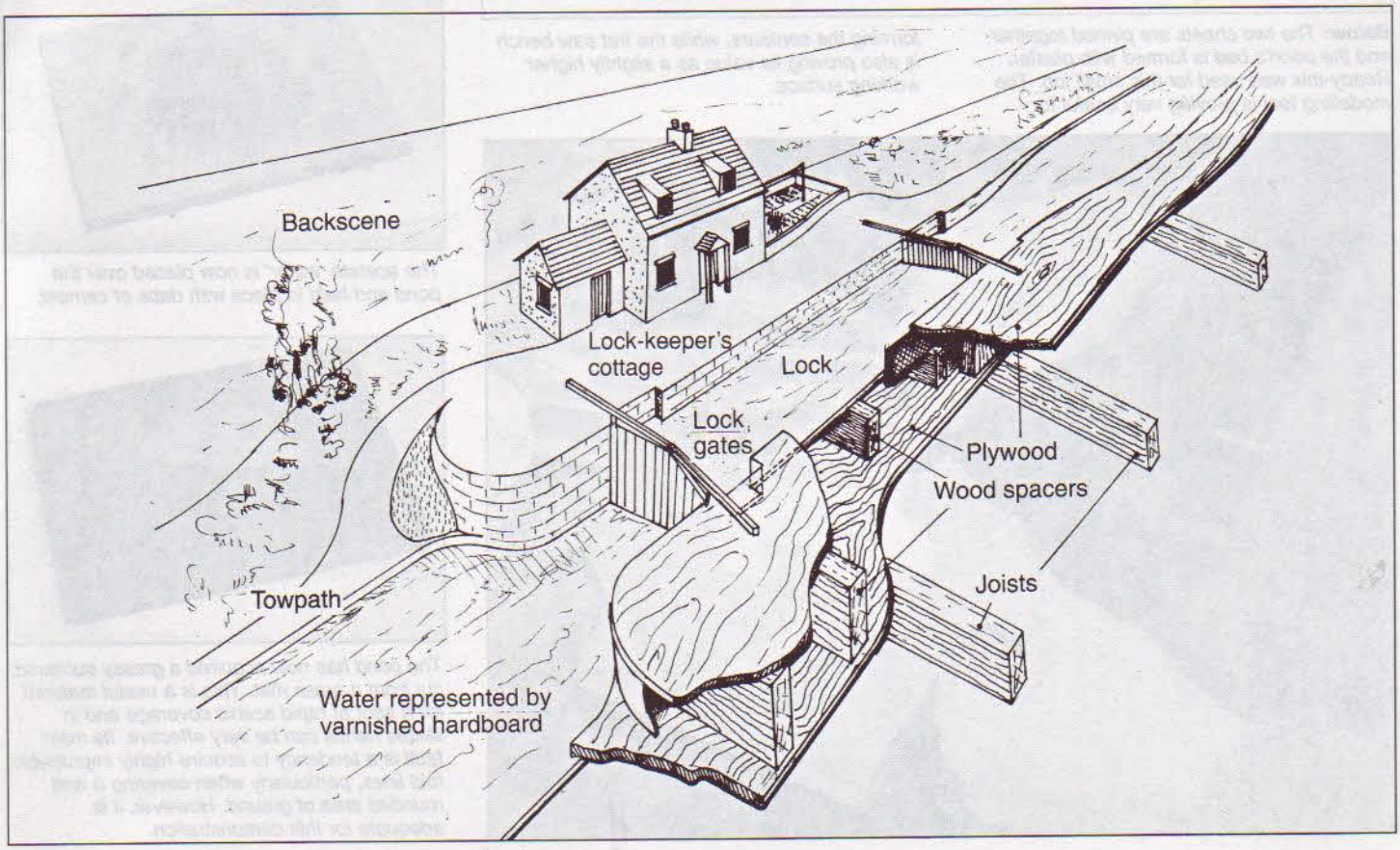
Modelling a stream with clear encapsulating resin.

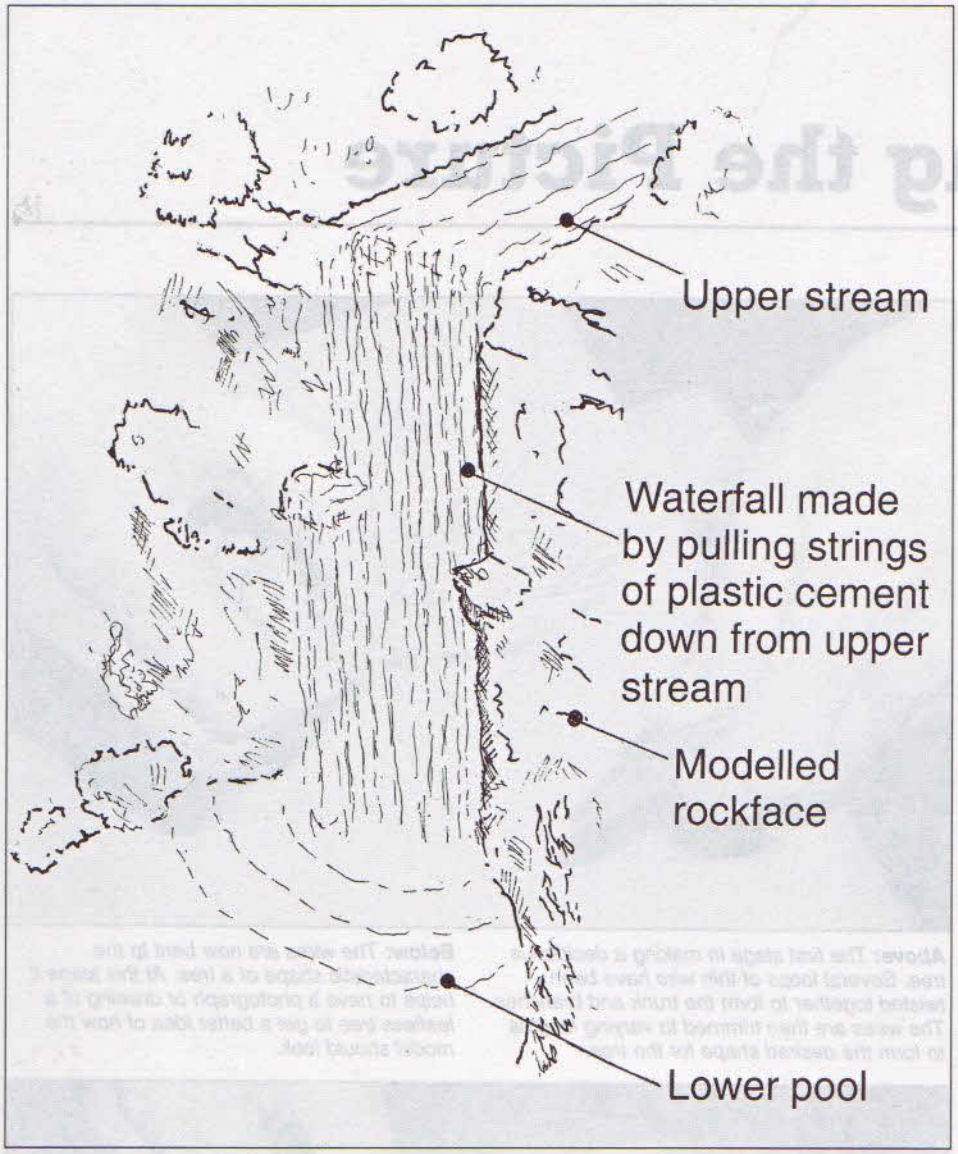


the filaments move slightly in any air currents. The other is to drop strings of plastic cement from the lip. This is easier said than done. Although the stuff is only too ready to string when you are using it to assemble a kit, it can be very unobliging when you want to produce filaments.

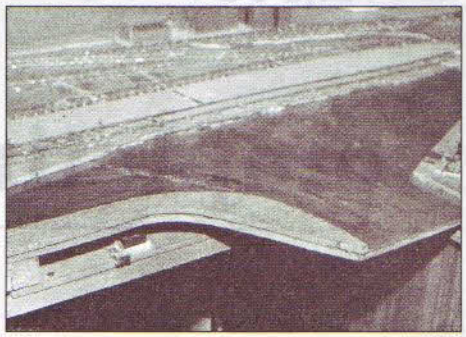
This is a good point to stress that landscape modelling is the most artistic side of our hobby. While techniques are important, the whole business can best be summed up in the words of the song, 'It ain't what you do, it's the way that you do it'. Not everyone has either the special skill or the more important artistic eye to be able to create a wholly convincing landscape. There is no disgrace in this, but equally there is no

Suggested construction of a canal lock.



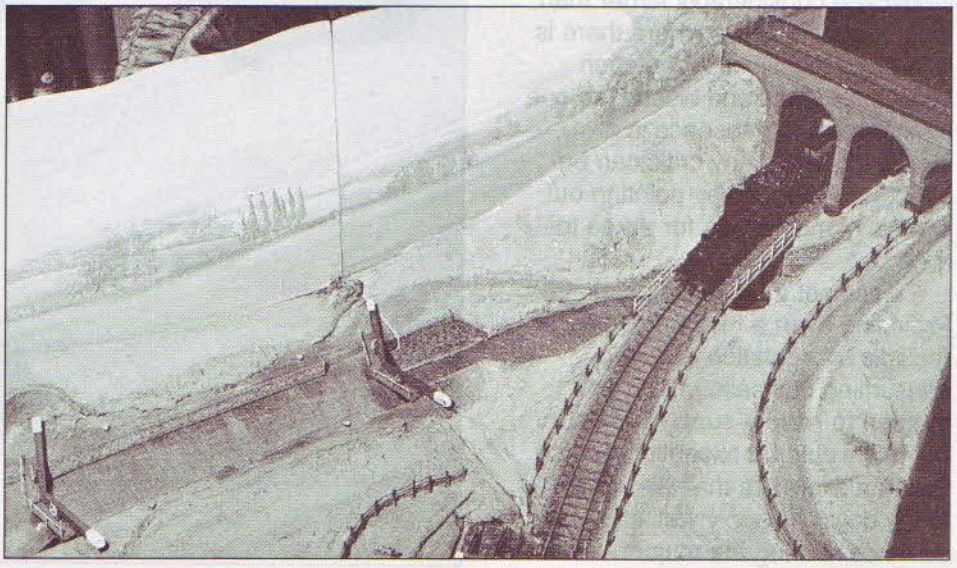


Construction of a model waterfall, using plastic cement for the cascade.



A little project in my den incorporated a small canal, but fell victim to my new computer which had greater need of the space. The canal was made from plywood, well filled with plaster and smoothed before painting, then thickly coated with polyurethane varnish. The idea was that the brush strokes would represent ripples in the water and, at the outset, all was fine. The varnish took a week to harden, during which time my den was all but uninhabitable. My family were very forbearing since, although the door was kept shut, the smell permeated the whole house. Next time this process will take place in the garage. The sad part of this tale is that the varnish dried out with a marvellously smooth coat. Now had I been dealing with a table . . .

compulsion to demonstrate one's inability. So if you find your abilities in this direction are less than convincing, opt for an urban/industrial setting and fill the vacant space with buildings and roads instead.



One of the best known model canals is located on Peter Denny's Buckingham. *This shows it in its earliest incarnation as a pleasing corner filler on the Mk II version of the railway, way back in the 1950s. Apart from the canal, note the effective arrangement of the cutting and the way the canal and railway occupy adjacent arches of the LNWR's short viaduct.*

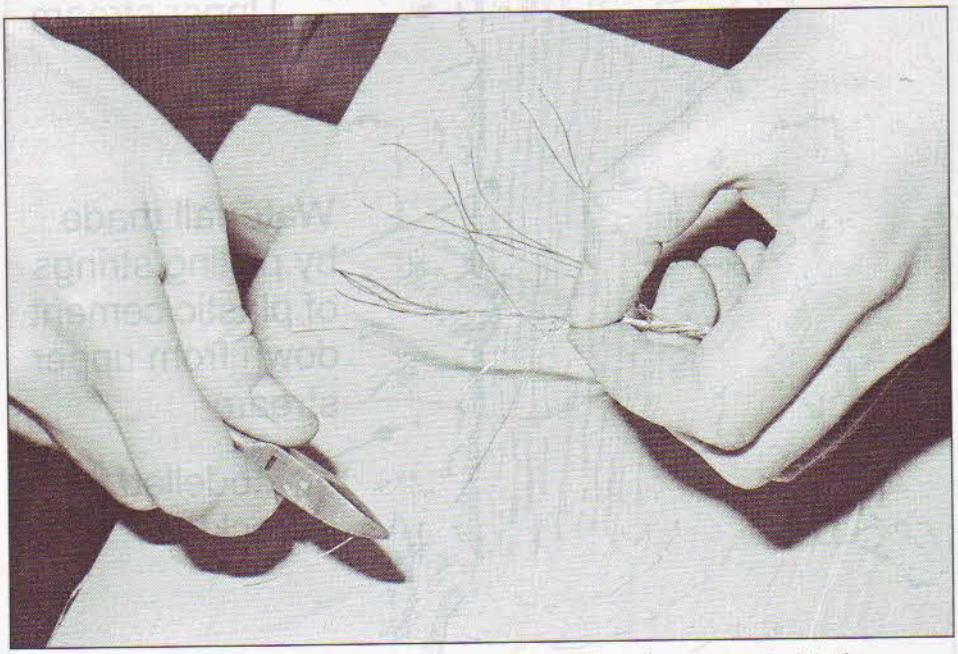
Chapter 13

Completing the Picture

When all the various parts of a model railway we have discussed have been put together, we will have a model which gives to the casual viewer an overall impression of realism. A closer, more deliberate study may well give a different impression, a feeling that there is something not quite right, that something is missing. That something is the fine detail, the small additions to the bare overall picture that brings the model to life.

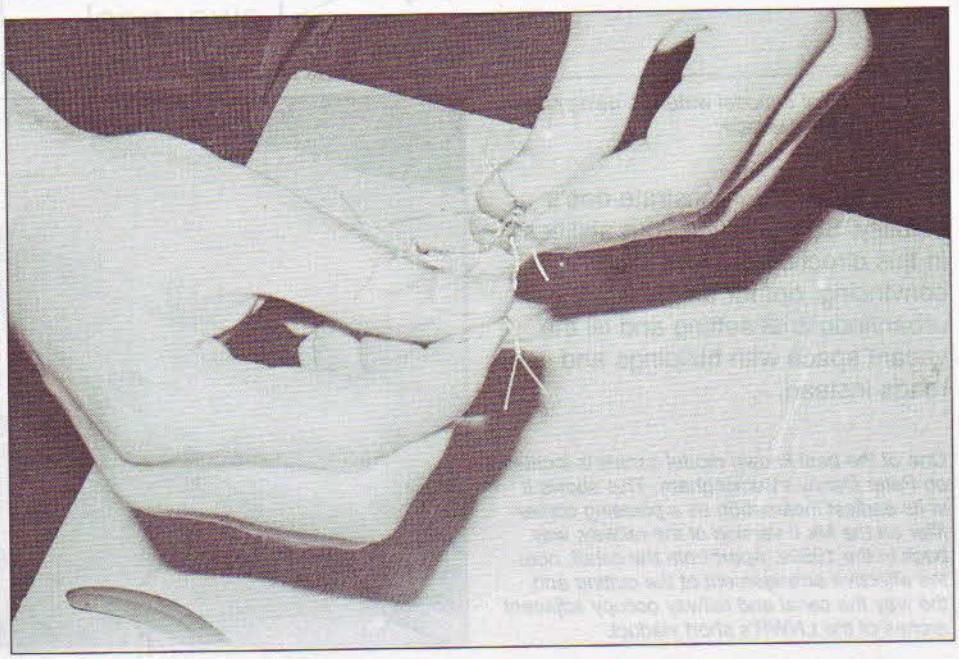
Except where the model represents a completely built-up area, the most important addition to the overall picture is vegetation, plants, hedges and above all trees. By strict logic these ought to be regarded as an integral part of the landscape, but there are sound practical reasons for treating them as detail accessories. For a start the railway will function just as well whether they are present or not. There are many slices of the British landscape considerably larger than most model railways where there is little or no significant vegetation other than grass and weeds, so one cannot say their absence is a significant error. Any critic can be effectively silenced by pointing out just how long it takes for a tree to grow.

This is not a facetious point. Providing even a modest degree of realistic afforestation is a time-consuming business unless you happen to have a supply to hand, but this would be exceptional since few modellers are that far-sighted as to lay down a supply well in advance. During the major



Above: *The first stage in making a deciduous tree. Several loops of thin wire have been twisted together to form the trunk and branches. The wires are then trimmed to varying lengths to form the desired shape for the tree.*

Below: *The wires are now bent to the characteristic shape of a tree. At this stage it helps to have a photograph or drawing of a leafless tree to get a better idea of how the model should look.*



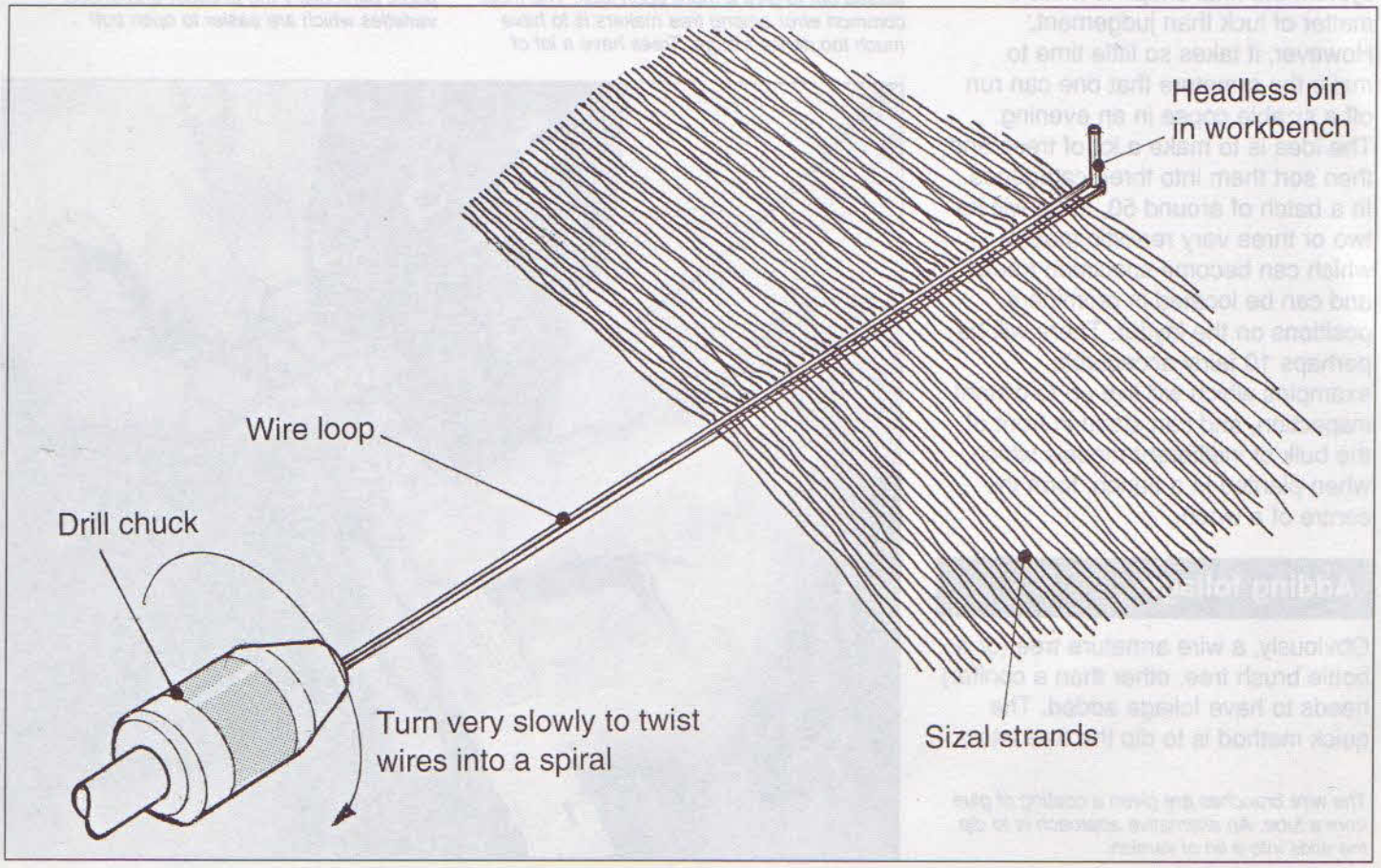
construction period, there are more important calls on one's time and money.

Modelling trees

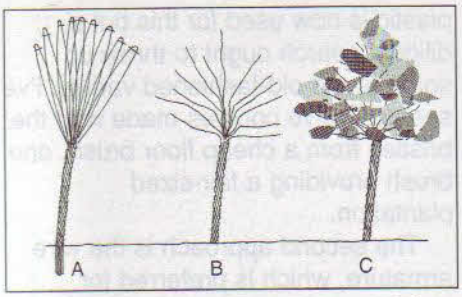
The quickest way to get model trees is to buy them ready-made, though even this is far from straightforward. Several German firms produce ready-made trees which are available through selected model shops, and there have been attempts by British cottage industries to break into the market. The quality is variable, and the cost of even a tiny coppice is considerable.

It is not unduly difficult to make a tree of sorts. There are two approaches. The first is the bottle brush method. This involves making a long narrow loop of wire, sandwiching a large quantity of strands of fibre between the two sides and twisting the wire tightly. This is done by gripping the top end in a vice and the other in the chuck of a hand drill, which is slowly rotated to tighten the wire. The fibres are stroked into the required shape and trimmed with a sharp pair of scissors. This is the most straightforward way of making conifers, but it can also be used to create deciduous trees. Jack Kine, who describes the process in some detail in his book, *Miniature Scenic Modelling* (Argus, 1979) advocates sisal, which was once widely used for coarse packing string. Unfortunately, plastic is now used for this but a diligent search ought to throw up some of the old-fashioned variety. I've seen effective conifers made with the bristles from a cheap floor brush, one brush providing a fair-sized plantation.

The second approach is the wire armature, which is preferred for deciduous trees. There are two radically opposed approaches to this mode of construction. One is to construct each armature individually, carefully shaping the wires into the characteristic formation of the specific species you are modelling. For this you will require a book showing trees in summer and winter form, and most general bookshops can offer a range of modestly priced pocketbooks intended for budding naturalists. Clearly, this takes time, not only to make each tree, but also to acquire the expertise needed to do this in the first place.



Making 'bottle brush' trees. The main requirements are a length of soft wire, a large collection of fibres, preferably sisal, a wheel brace and a nail driven into the workbench. The wire is bent into a thin loop and the open end is gripped in the wheelbrace chuck. The loop is slipped over the nail and the fibres sandwiched in the loop. The wire is then slowly twisted with the handbrace until it is a tight spiral with the fibres radiating outwards. The top of the twisted wire is cut off, the fibres clipped and shaped and the tree painted with a spray. The tree is dipped in varnish, then rolled in foliage material.



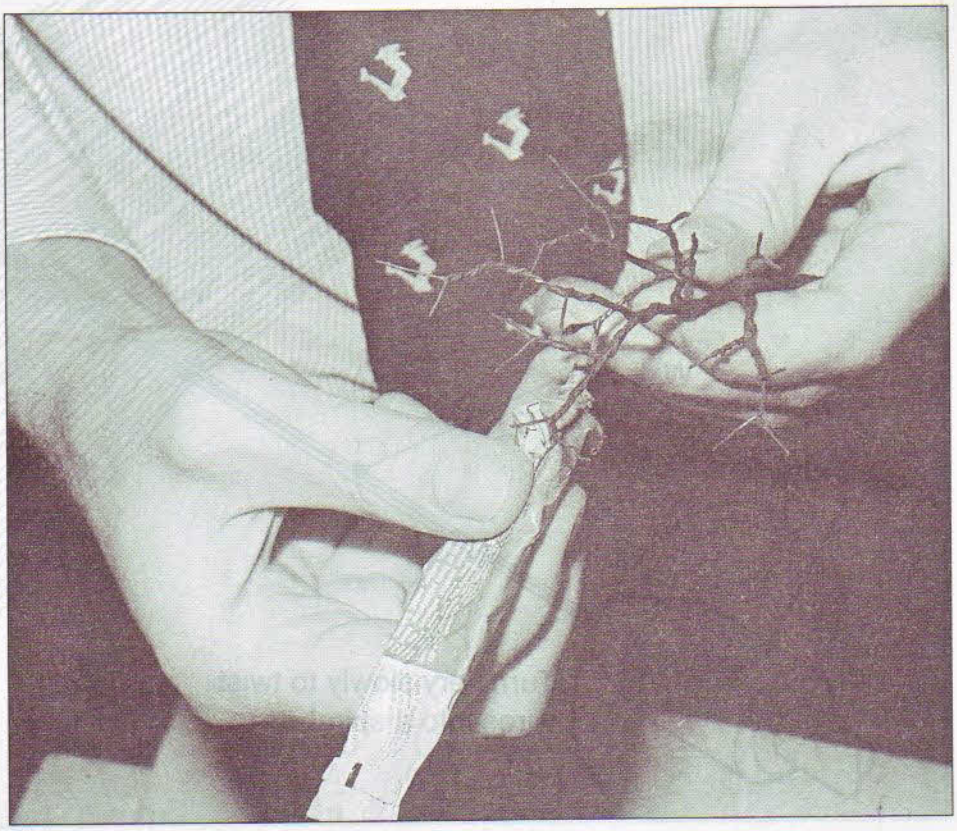
Making a wire armature tree. A: loops of wire are twisted to form a rough trunk, and the ends cut. B: The wires are then shaped, twisted further and trimmed to form the branches. C: Foliage is stuck on to the branches.

The alternative, quick and cheerful method is illustrated in the accompanying photo sequence. The armature is produced rapidly from a bunched up length of wire. As a matter of interest, I found a great quantity of suitable wire wrapped round the picture tube of a broken TV set, enough to create a small-scale forest. Clearly, with this haphazard system the final shape is more a matter of luck than judgement. However, it takes so little time to make the armature that one can run off a sizable copse in an evening. The idea is to make a lot of trees and then sort them into three categories. In a batch of around 50, there will be two or three very realistic models which can become specimen trees and can be located in prominent positions on the layout. There will be perhaps 10 fairly acceptable examples which will live up to distant inspection, and can stand in front of the bulk of indifferent models which, when planted in a bunch, form the centre of a wood.

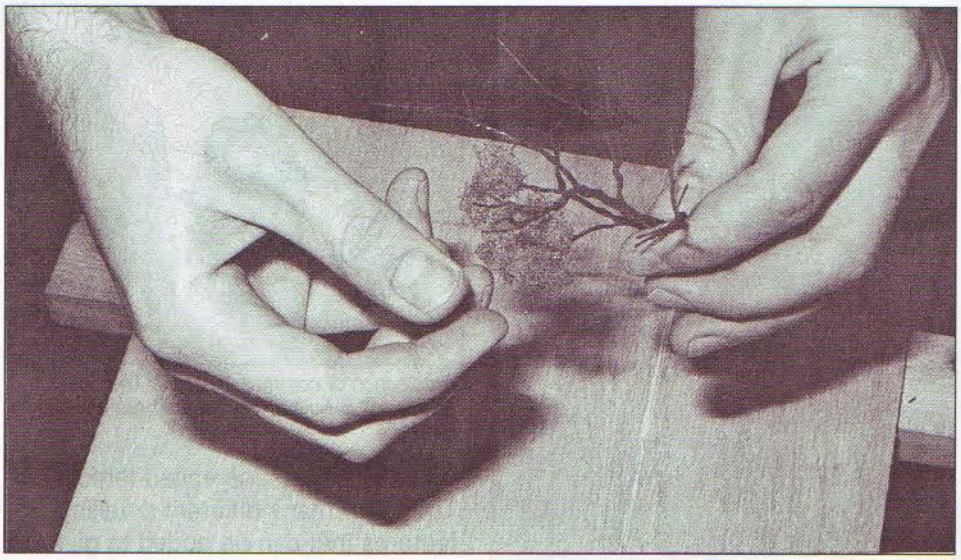
Adding foliage

Obviously, a wire armature tree (or a bottle brush tree, other than a conifer) needs to have foliage added. The quick method is to dip the tree into a

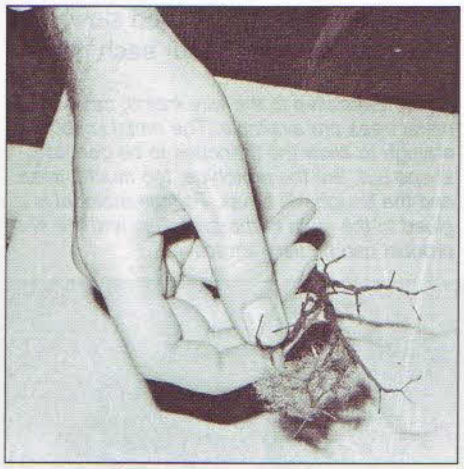
Here we see some commercial foliage material from the Woodlands Scenic series being gently teased out to give a more open look. The most common error among tree makers is to have much too dense foliage. Trees have a lot of empty space within them. I have seen excellent work done with teased out scouring pads, particularly the cheaper unbranded varieties which are easier to open out!



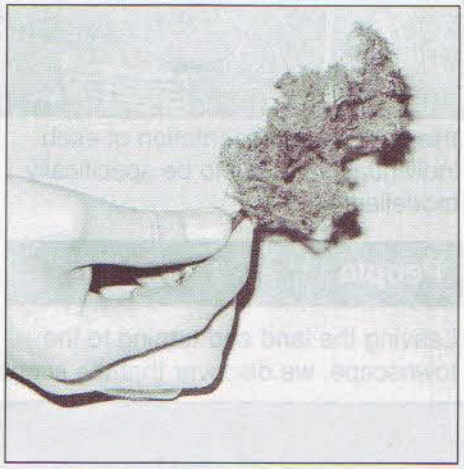
The wire branches are given a coating of glue from a tube. An alternative approach is to dip the ends into a tin of varnish.



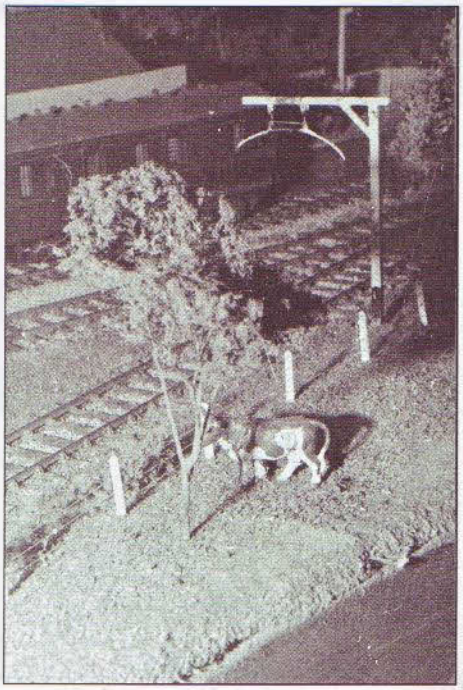
The teased out foliage is now attached to the glued branches. An alternative is to use a 'leaf mix' kept in a wide topped container, into which the glued tree is dipped.



The first few clumps of foliage have been put into place. The process will be repeated until the tree is complete.



Sufficient clumps of model foliage have been added to the tree, which is now complete and is put aside for the glue to harden thoroughly.



With this fast process, some trees are better than others, so the poorer examples are grouped as woodland, and the better ones given a more prominent position. A little judicious touching in will greatly improve the effect.

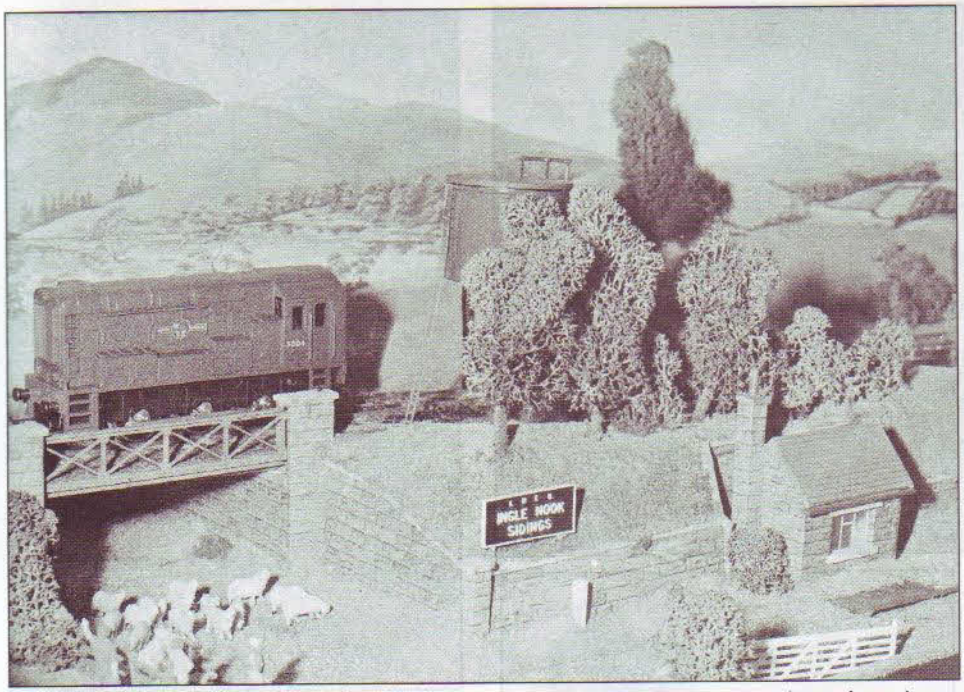
pot of matt varnish, or alternatively, give it a thorough coating with a sticky spray . Cheap hairsprays have been used; these are gummier than the better varieties and the smell soon wears off. The sticky base is then rolled in a pile of foliage material, the surplus is shaken off, and the tree planted in a block of expanded polystyrene to dry.

A wide range of excellent foliage material, in varying natural shades, is available from good model shops. Alternatively, used tea leaves, dried in the oven and, if desired, dyed in bulk, are extremely effective natural foliage. You obviously need the small leafed brands, so if your taste is for Darjeeling you will have to use the commercial types. The end result is greatly improved if an airbrush is available to spray the foliage.

Another foliage material with considerable value is lichen. This has been used for trees, though I feel it is more suited for bushes and open hedging. Close hedging can be made from horsehair stuffing or the denser foam replacements for this form of upholstery. Another useful material is a scouring pad. Again, the cheap varieties are best because they are easier to break up. Most of these materials need to be opened up, using a pair of fine tweezers to tease out the material. Speaking of teasing, don't be tempted to put foam plastic into the domestic blender in the hopes of producing foliage. It not only is next door to impossible to get out, it places a heavy strain on the mechanism. Either way, you'll be in trouble.

There are many dense fibrous materials to be found around the home or in kitchenware suppliers and street markets, and most are cheap enough to buy for a trial. Remember, the value of all the materials I've mentioned was only discovered when someone had the initiative to find out if a particular item was suitable or not.

Cultivated vegetation, whether in a garden or allotment, is not so amenable to short cuts, though the traditional overcrowded cottage garden can be produced by filling the

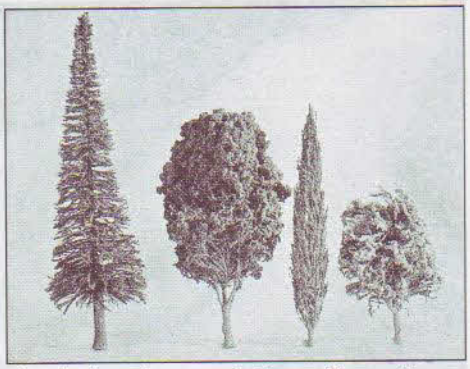


An even faster method of tree manufacture is to glue dyed lichen to selected twigs. The resulting model will not stand close scrutiny but when used in a clump or, as in this instance on Alan Wright's Inglenook Sidings, *as a lineside row, the effect is quite pleasing.*

area with a lichen or teased out foam plastic, then daubing bright 'flowers'" on this with a small brush. Other than this, a close representation of each individual plant has to be specifically modelled.

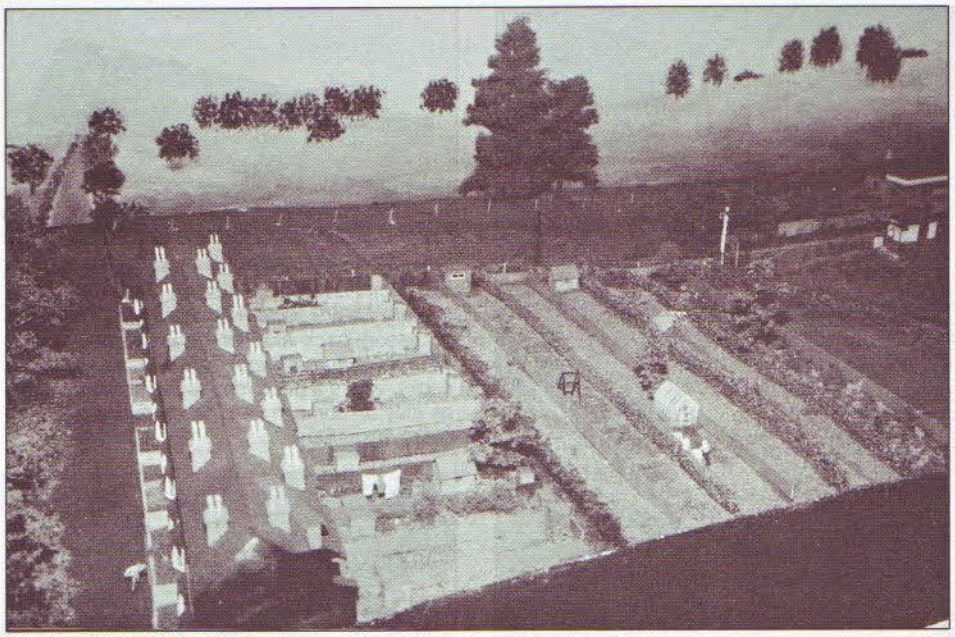
People

Leaving the land and turning to the townscape, we discover that the scope for detailing has increased tenfold. There are many different detailing features that can be added to give life and character to the scene. This can take a good deal of time, not merely because there is so much that can be added, but also because it is a good idea to proceed slowly and think carefully about each item.

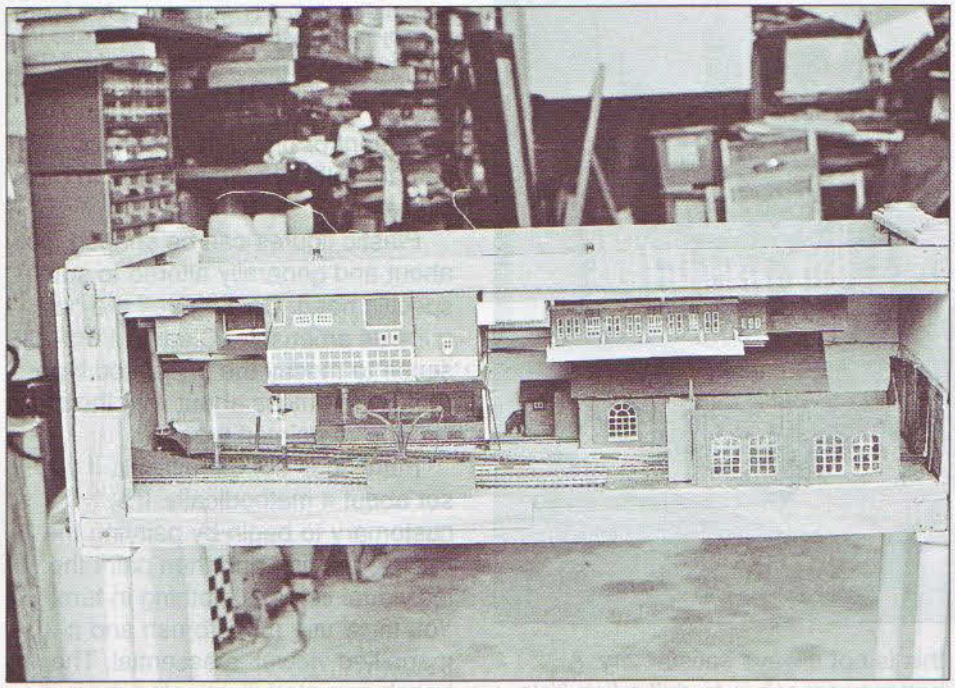


A selection of commercial trees. The conifer on the left is built on the 'bottle brush' principle.

As an alternative to the wire frame, cast white metal trees are available. The metal is soft enough to allow the branches to be bent to shape but, like the prototype, too much stress and the bough will break. Foliage material is glued to the ends of the branches and the end product can be very attractive.

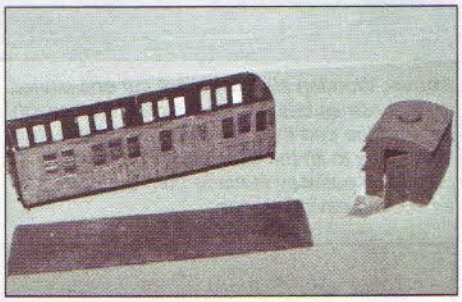


Model gardens and allotments are an interesting part of the model scene, but there is no gainsaying that they involve a great deal of painstaking work. As a result, they are generally a fairly small part of the whole, but this example, a terraced row of houses complete with gardens and allotments, occupies a good deal of space, even in 2 mm scale. The photograph does not do justice to the amount of detail in this remarkable model, but it does emphasise how it draws attention away from the railway, which is hidden at the back of the model. Whether looked at as an exercise in inspired model making or as an equally ingenious way to draw the viewer's eye away from the exit through the backscene into the fiddle yard, there is no doubt that it is a complete success.



This picture might seem to have little relevance to detailing, but it is here to show how on a folding baseboard the various elements of the model have to fit in with one another. The locomotive shed is missing its roof: this is removable to give access to the track for cleaning. This shed is due for renewal; I'm not satisfied with its appearance and a Ratio kit is on hand to replace it. A signal box will go on the lower left-hand side, but at present the factory chimney is in the way. It will be shortened to fit.

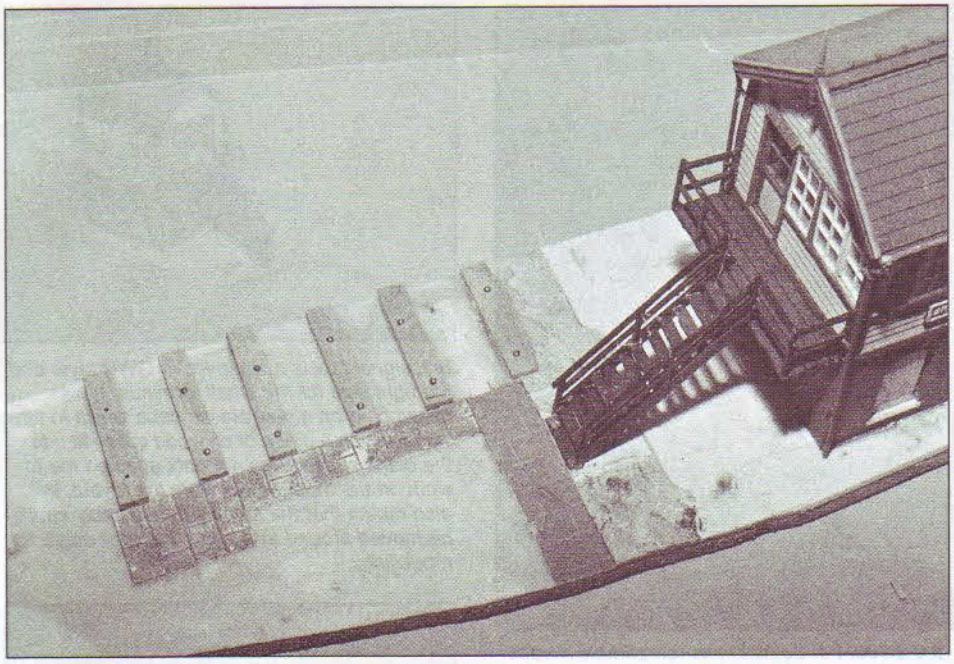
Brill signal box is a Ratio kit, in GWR style and the right size for the small terminus. It was assembled on a new plastic base which in turn was fixed to a piece of plywood cut to fit into the blank space. This not only enabled me to work on the model away from the layout, but also meant that the small sub-assembly could be moved around to present the best angle for modelling.



Two other elements are incorporated into this model, a lamp hut (one of a pair in a Wills kit) and a Ratio grounded coach body. The hut is complete on a small plastic sheet base. The door was carefully cut out of the moulded side and re-fixed in part open position. The coach body has been very severely modified. Most of the moulded grab irons and door handles were removed with a craft knife, and some windows were filled in, others boarded over. Several panels had a 10 thou plastic overlay applied to represent later plywood replacements. All roof mouldings were filed off and a piece of fine linen stretched over and cemented in place to represent the prototype tarred canvas.

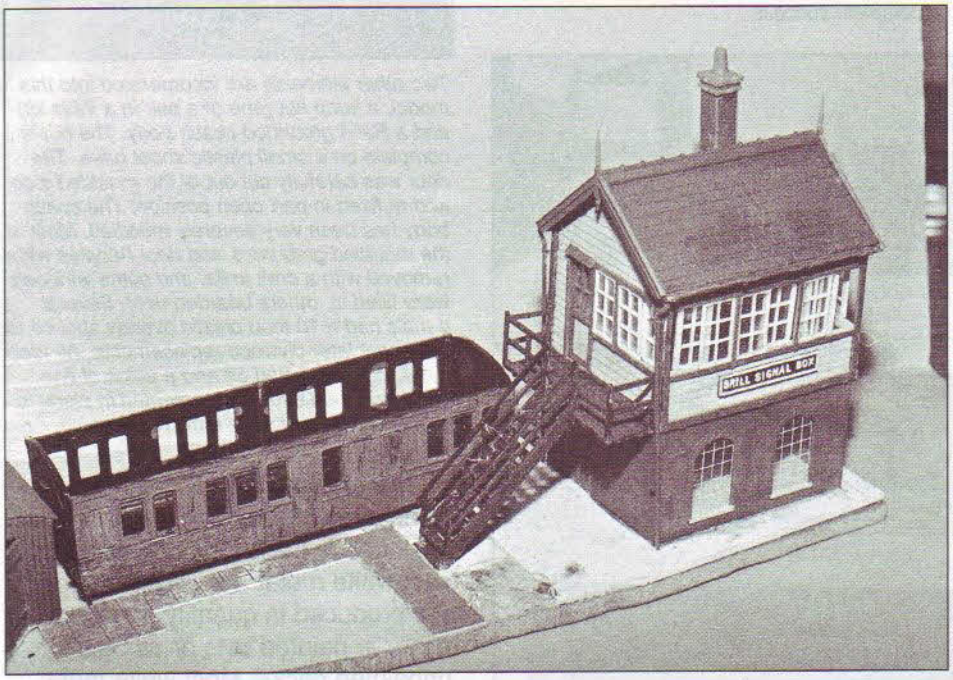
The most important detail is, without doubt, human figures. These fall into two basic types, plastic and cast white metal. The plastic types are produced in quantity and sold either in painted sets or as bulk unpainted packs. Most white metal figures are sold unpainted, only a few of the firms producing these provide the painted versions. Animals, mostly farm stock and pets, are offered by many of the firms who provide figures.

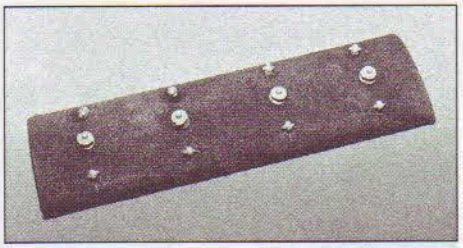
A lot of plastic figures come



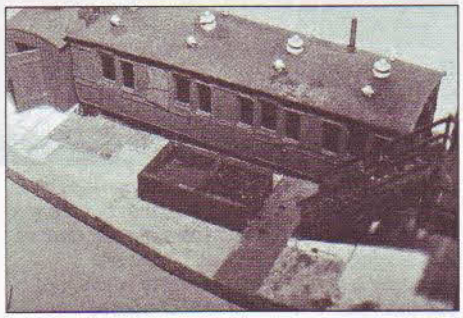
Above: *Wooden sleepers were cut and pinned to the base as bearers for the grounded coach body. In the end they are virtually invisible, but they serve to lift the coach body off the ground. A pathway is made from Slater's embossed paving stones.*

Below: *The coach body and hut are now in place. This is their second location. The original arrangement was scrapped when I checked the clearances and found that whilst a locomotive could run past, a coach just fouled the lamp hut.*





The coach roof looked bare so I added lamp housings and shell ventilators. They are actually LNWR pattern fittings from a Ratio accessory pack. Most of the British structure kit manufacturers supply useful mouldings as packs, so it's a good idea to put some in stock as they do come in very handy during a creative spell.

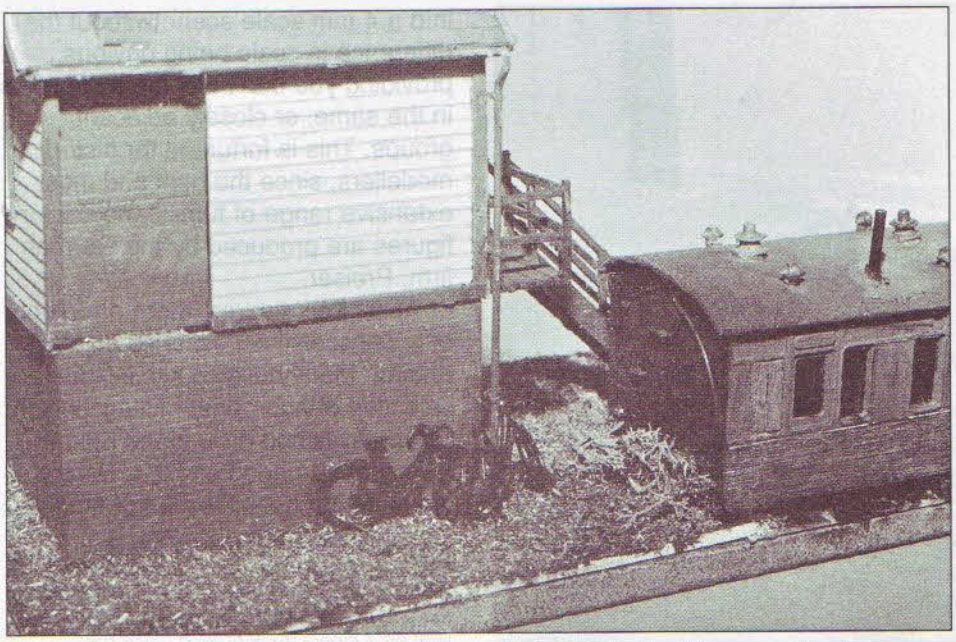


The next addition was the coal and ash bin, a very common feature alongside signal cabins. This photo also shows how only one door still has its grab iron and handle, all others having been nailed shut. A broken window has been fixed by nailing two tea-chest sides across the gap. Some extra paving has been added. The model is now ready for detailing.

complete with integral stands; these are generally more in the nature of paving slabs and, for the best effect, need to be cut away before the figure is placed in position. While it is possible to cement the feet in place, this is not always satisfactory. A better approach is to drill a fine hole in one foot – a No. 70 drill seems about right – insert a cut-down pin, with the sharp end outwards, and push this into the model road, pavement or platform. A spot of cement will still be necessary in most cases.

Plastic figures can be shaped, cut about and generally altered to suit a specific need. Cast figures are not quite as amenable. Clearly, it makes sense to modify the unpainted type rather than mess about with the more expensive painted types.

Painting is not too difficult, if you set about it methodically. It's customary to begin by painting the flesh tones first and then paint the individual items of clothing in turn. You must use a fine brush and a magnified viewer is essential. The bench-mounted illuminated magnifier or the headband magnifier are ideal for this purpose, I have used both and find little difference in ease of use or effectiveness. While in the



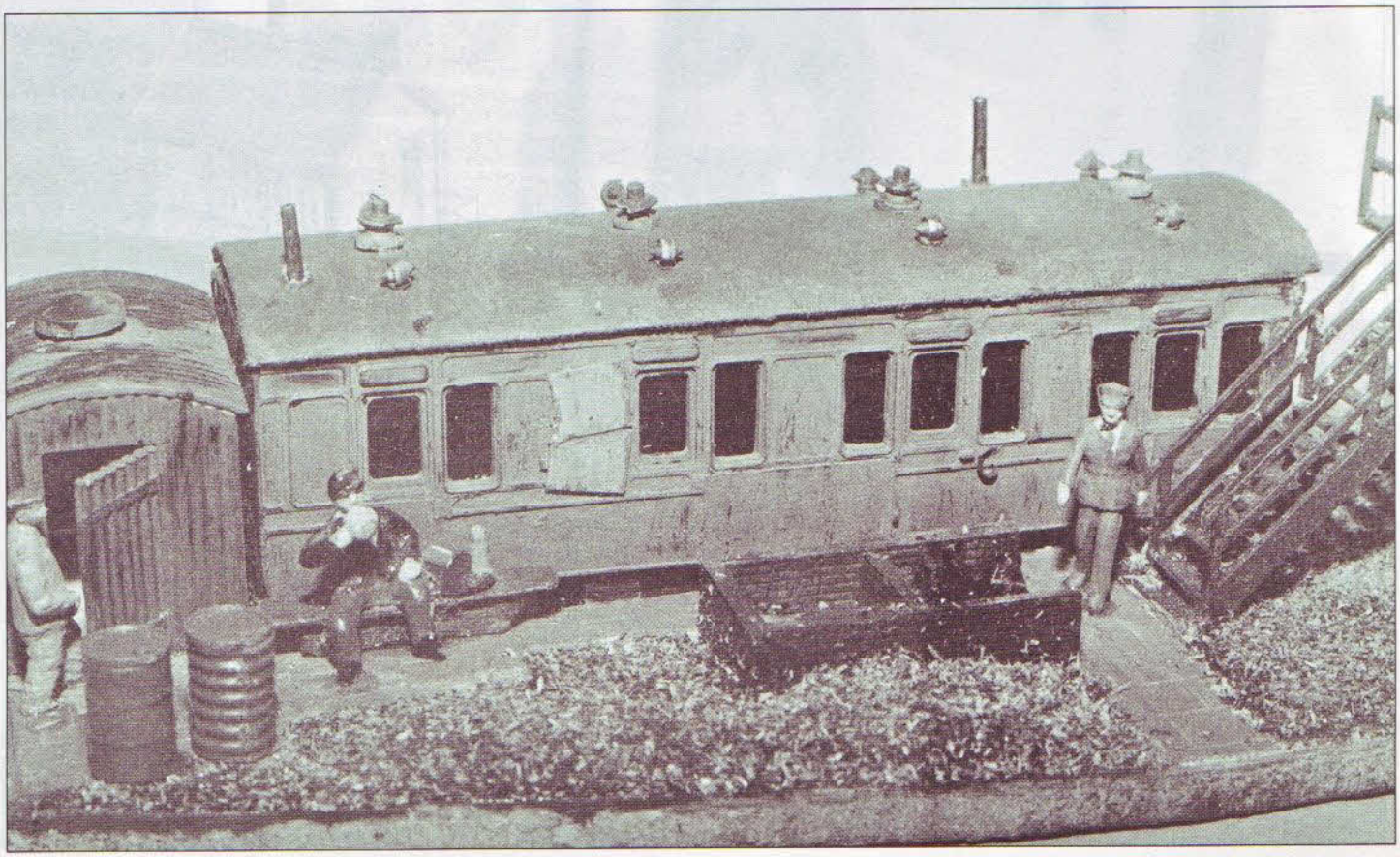
Above: *In the 1930s many railwaymen cycled to work, so round the back of the signal cabin we find a couple of bikes. These came from the Wills bike shed kit. The bottom end of the coach side has been badly damaged and replaced by wooden planks, while a little lichen 'shrubbery' has grown up against the coach.*

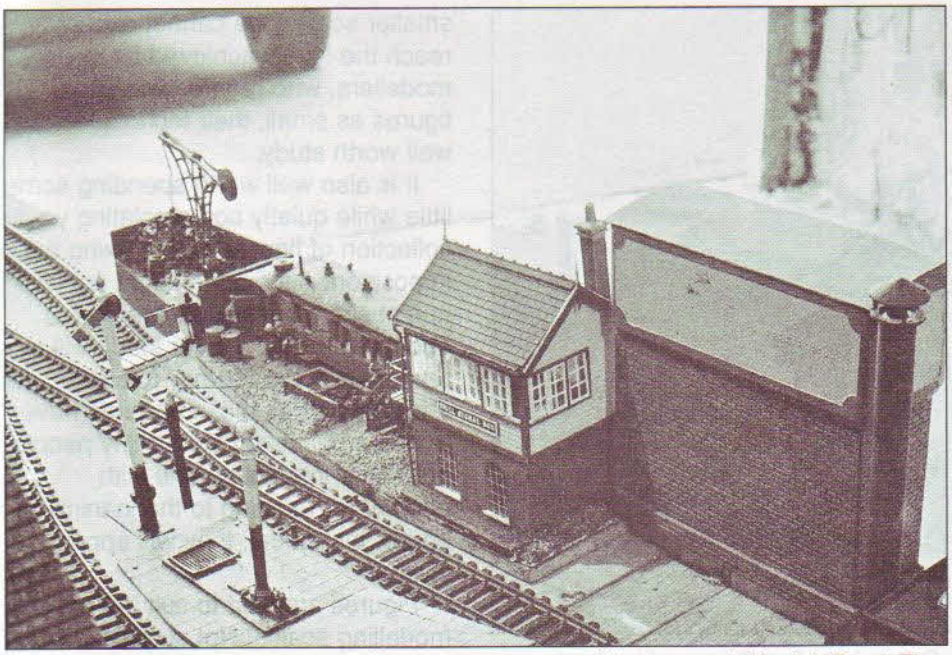
Below: *In the front the ground has been finished, using in this instance two-part body filler since the area involved is quite small. Scatter 'grass' provides the ground cover. A couple of steel drums are standing around, and one of the staff is just opening the hut door. Another is enjoying a packed meal, whilst a third is on his way somewhere.*

smaller scales, we cannot expect to reach the levels achieved by military modellers, who regard 3/8 in scale figures as small, their techniques are well worth study.

It is also well worth spending some little while quietly contemplating your collection of figures before fixing them in position. Although it might appear at first sight that people are dotted about at random, closer study will reveal several patterns. To create an effective model, those patterns have to be emphasised. If your tiny people are either interacting one with another, or reacting to the inanimate part of the model, they will appear lifelike.

Figures are sold to suit the major modelling scales. Not surprisingly, whereas the British manufacturers offer 4 mm scale figures, Continental manufacturers provide 1:87 scale people. Fortunately, human beings come in assorted sizes and it is possible to incorporate 1:87 figures

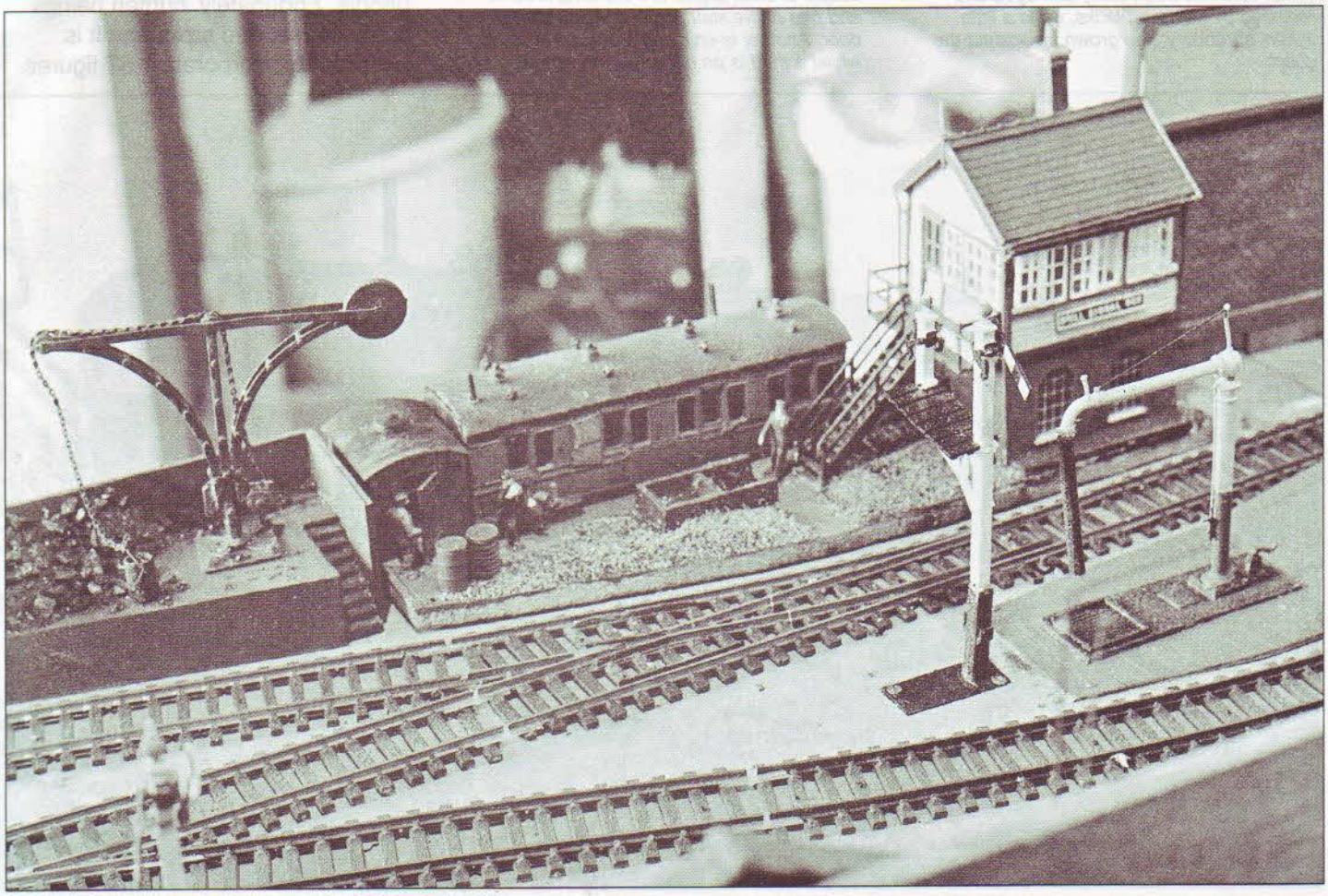




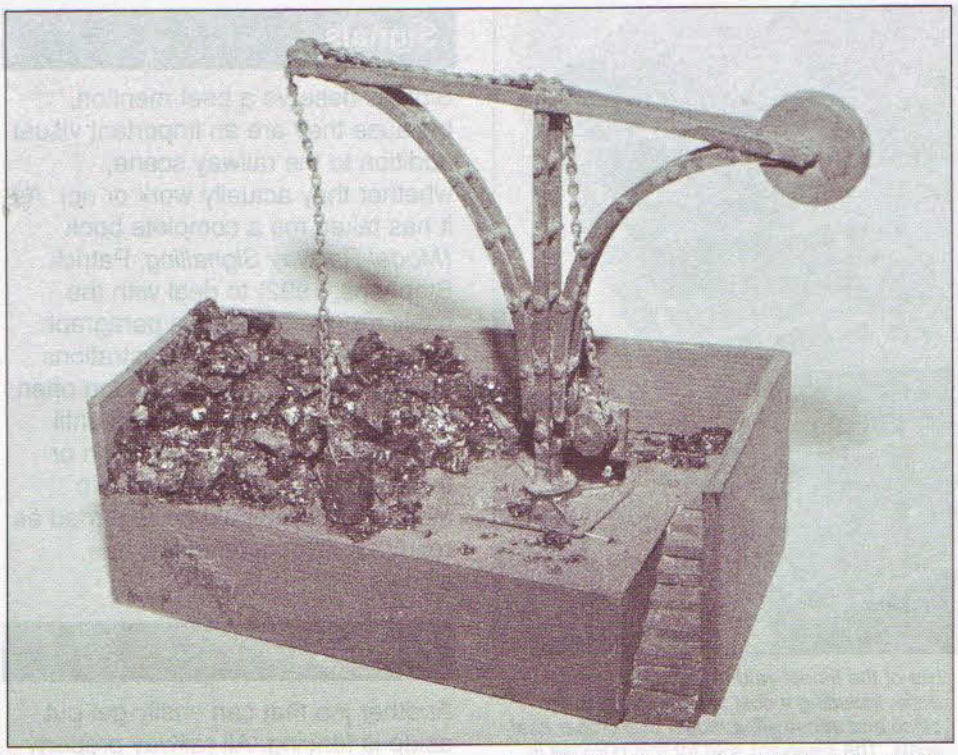
The little scene is now in place on the layout. Against the signal cabin is the water tank, half of an Airfix/Dapol kit, neatly covering the hinge on this side. The other half of the kit is doing the same job on my son's Dugdale Road. *The factory chimney that will foul the signal box is just visible.*

into a 4 mm scale scene without the difference in scale being obvious, providing you don't mix the two scales in the same, or closely adjacent groups. This is fortunate for historical modellers, since the best and most extensive range of turn-of-the century figures are produced by the German firm, Preiser.

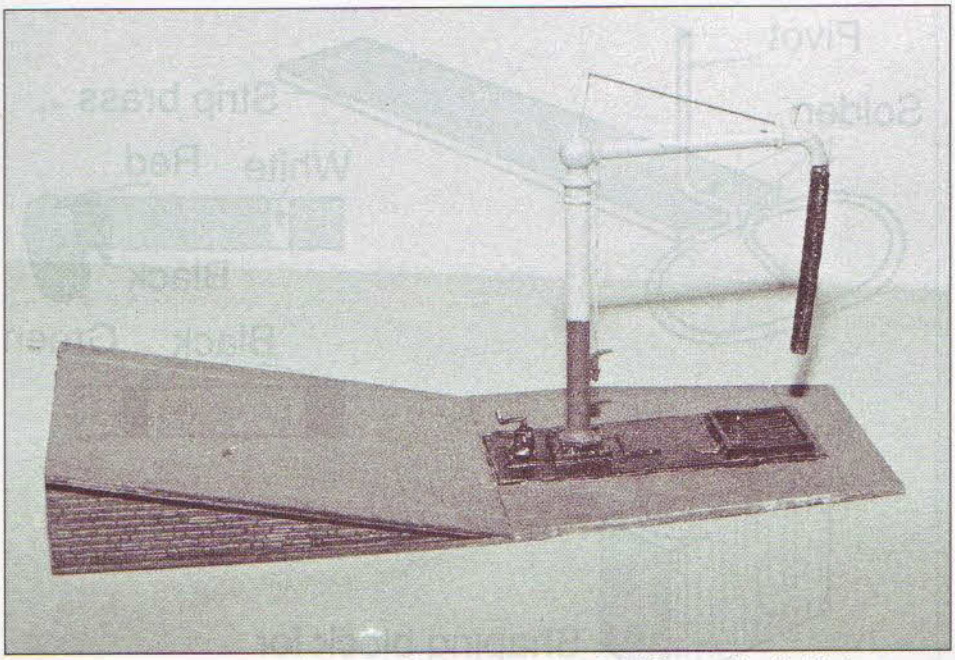
Apart from figures, there are plenty of small scenic accessories on the market. Many building kits include a selection of appropriate fittings which can be switched around the model townscape to good effect. It is very useful to have a collection of such



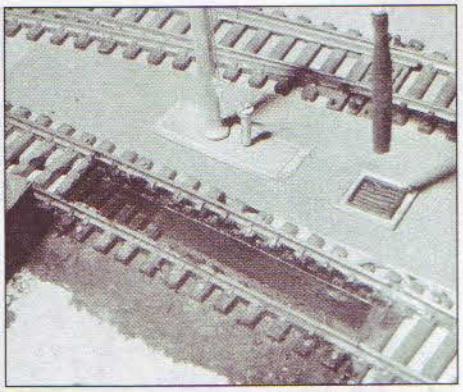
The signal box scene viewed from the opposite direction. In due course a wooden foot crossing will be provided to link the path to the end of the station platform ramp, This is vital on a single track branch since the signalman has to take the train staff or tablet to the driver to provide authority for travel over the next section. On the extreme left we have the coaling stage.



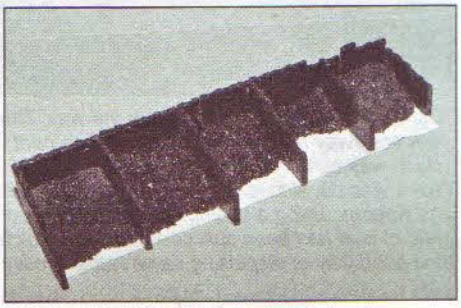
The coaling stage features a Mikes Models GWR coaling crane. This is a fairly straightforward piece of modelling. The outer parts are all plastic sheet, with Slater's brick Plastikard very much in evidence. Inside the base there is not only a piece of wood for fixing purposes, but also a layer of insulation board. This allowed me to pin down the crane base, after I had drilled out the moulded fixing bolts. The coal bucket was made from a length of thin wall brass tube with a wire handle and is screwed to the base. The coal is the genuine article, glued to a chunk of insulation board carved to shape.



Steam locomotives used prodigious quantities of water in a working day and needed to refill their tanks at frequent intervals. Water cranes were installed wherever possible and on Brill *one was needed at the end of the platform. The Mikes Models crane has had its base partially buried by Slater's embossed paving stones, which were also used for the platform surface.*



It was essential to gain access to the inside motion of many steam locomotives, and for this purpose inspection pits were provided at main and sub-depots. They are quite easy to model, just a long rectangular hole, brick lined, with a flight of steps at one end.



The sleeper-built coal bins for the Brill *coalyard diorama were made from several Wills kits, assembled on a piece of 20 thou plastic sheet. Had the kits been used 'as is', the result would have been regimented, the exact antithesis of the sleeper-built bin, so several sides and ends were carefully dissected along the joints between the sleepers and re-assembled in a different order. The plastic 'coal heaps' provided are somewhat unrealistic, but make excellent foundations for the real thing. as well as adding stiffness to the completed structure.*

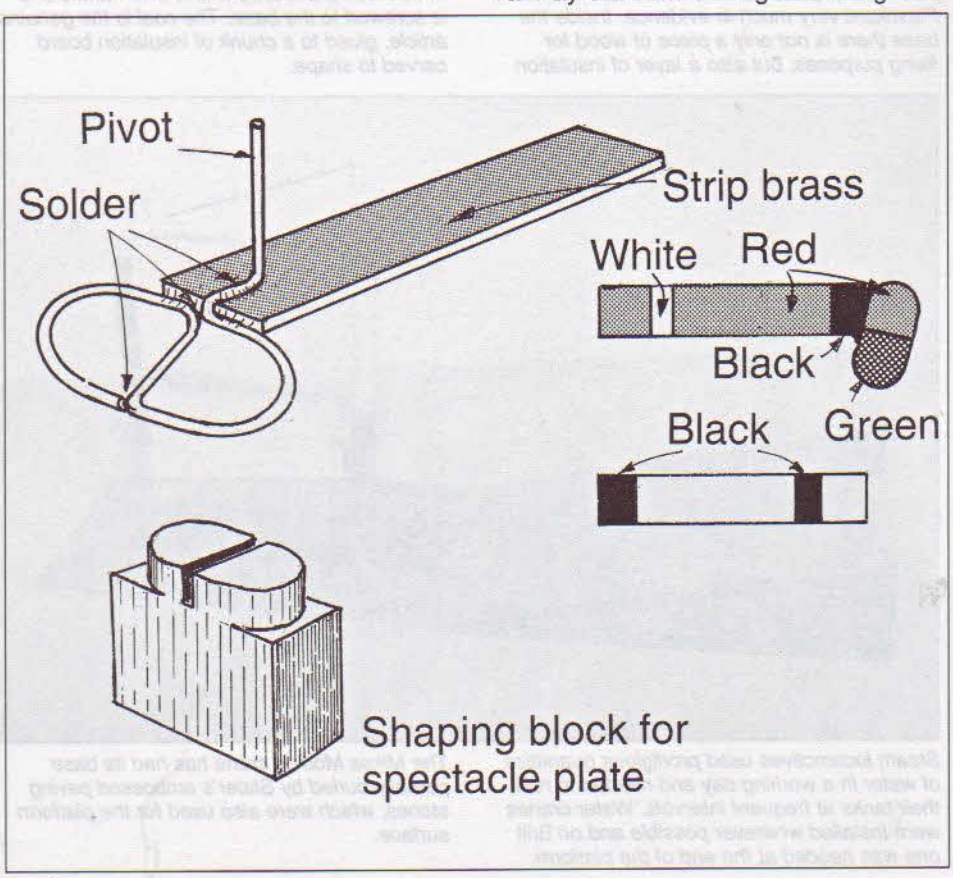
items, even though you have no immediate use for them, since a good way of filling in an idle quarter of an hour is to add a couple of details to the model scene.

Vehicles

Although we are modelling a railway, road vehicles are a necessary part of the overall picture. The original Matchbox range was more or less 4 mm scale, but most of the diecast cars currently on the market are more suited to O gauge use. However, there are some excellent

The coal yard a little further along the way. The bins are away from the track, an arrangement which was quite common, and which meant that it was usual to load the sacks directly from the wagons, using a tipping coal scale. A good deal of coal has been spilt over the yard, which is a good way of disguising some rather glossy bits of the model yard. A lot remains to be done, including a coal merchant's cart, the office and above all, a model of a proper coal scale. The steelyard sold for this purpose is the wrong device. Indeed it is probable that an attempt to bag up coal on a steelyard would wreck the machine.

buses in 4 mm scale, and as these are commonly seen beside railway stations and have even been known on occasions actually to meet the trains, an important part of the railway scene is now being covered. Several specialist manufacturers offer 4 mm scale kits for horse-drawn and mechanically-propelled commercial vehicles, though the private car is less well supported. In HO the story is different. There are several European firms who offer extensive ranges of both private and commercial vehicles, mostly modern designs. As with figures, an HO car will not look obviously out of place provided you don't have a 4 mm scale policeman alongside taking down its details.



Making lower quadrant semaphore signal arms. The main components are strip brass for the arm and wire to form the spectacle plate. A shaping block ensures that all spectacle plates are identical. The coloured 'glass' can be bought from good model shops, or alternatively you can use sweet wrappers.

Signals

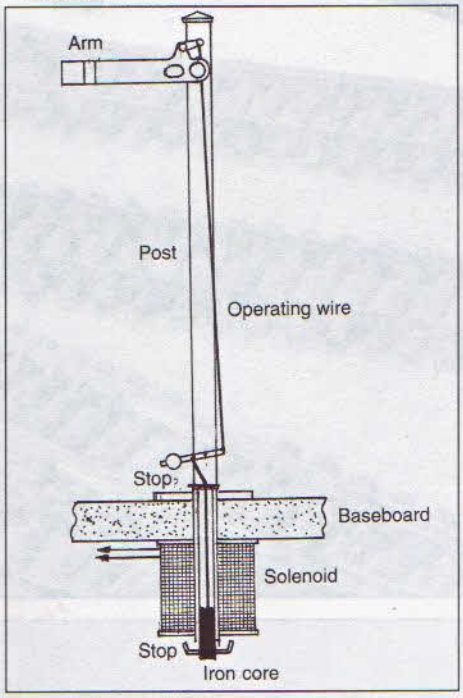
Signals deserve a brief mention, because they are an important visual addition to the railway scene, whether they actually work or not. As it has taken me a complete book *(Model Railway Signalling*, Patrick Stephens, 1992) to deal with the basic requirements, this paragraph and the accompanying illustrations must serve as a pointer. All too often this important detail is put off until the wind is in the right direction or the auguries are favourable. No model railway should be regarded as ready for inspection until it has signals.

Fencing

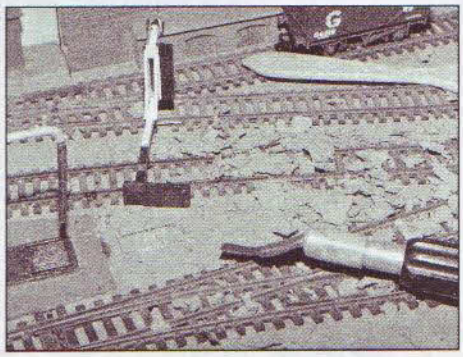
Another job that can easily get put aside is fencing. All railway property must be fenced, and in addition safety fences are placed to prevent railway staff wandering into danger.

Construction of a simple two-aspect colour light signal. Three and four-aspect signals are similar, except that more LEDs are needed.

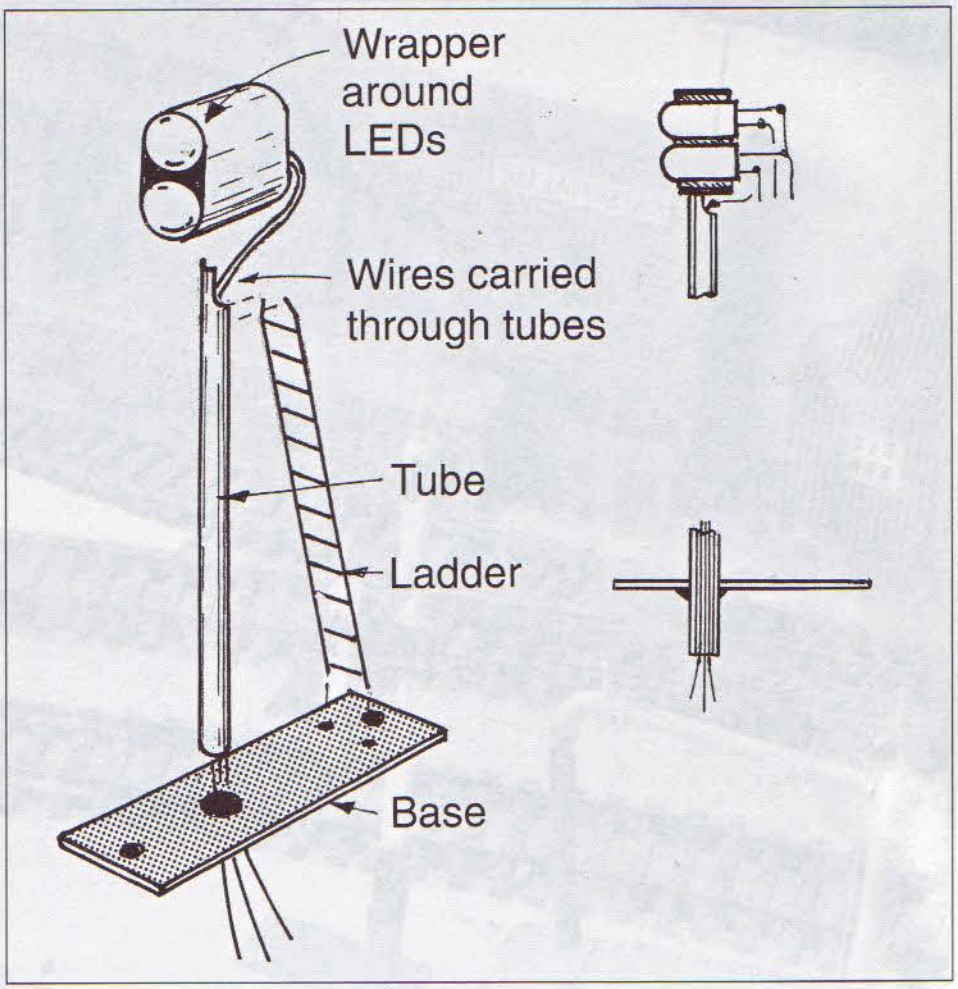
Good fences not only make good neighbours, but they also make good models. There are many types available; Peco, Ratio and Wills between them supply most common patterns in plastic, whilst there is a good selection of 'wrought iron' fences in the ranges of etched components on the specialist market.

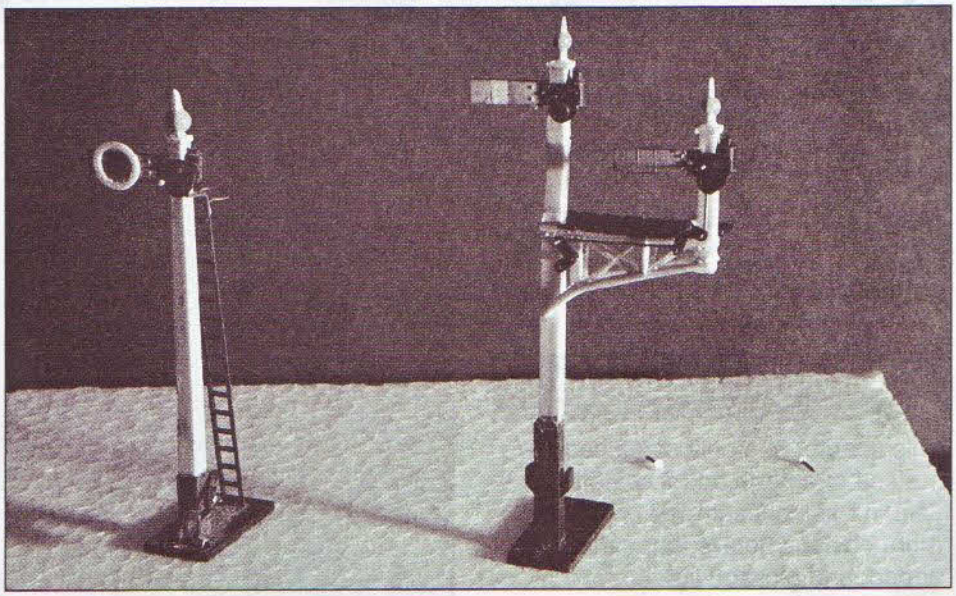


Electrically operated upper quadrant signal.

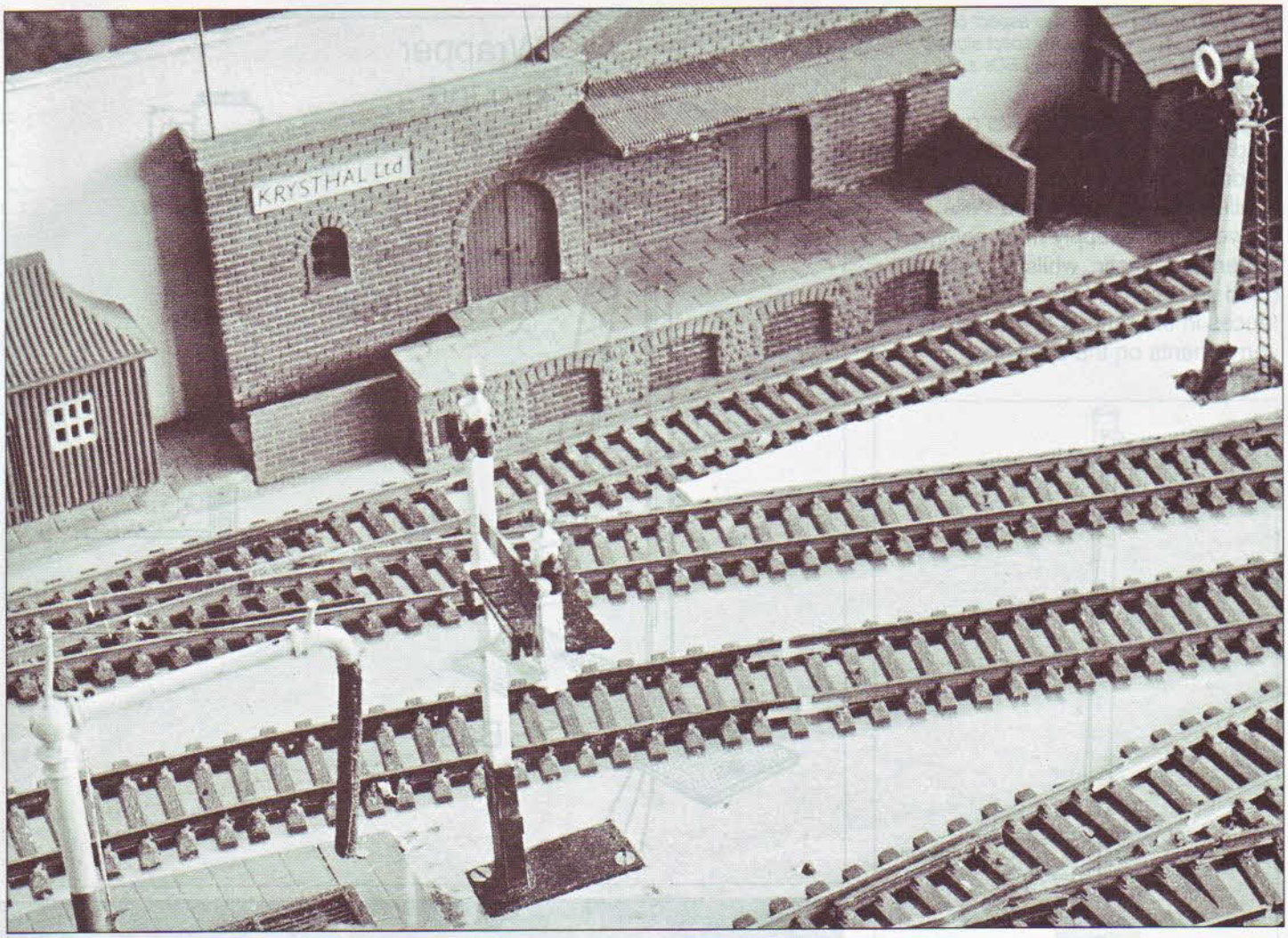


Prototype signals do not sit on large slabs proud of the ground surface, so the base needed to be flush with the trackbed. Insulation board is very easy to carve with sharp tools and a very little effort with an Xacto chisel blade produced a neat rectangular hole - and a good deal of mess!



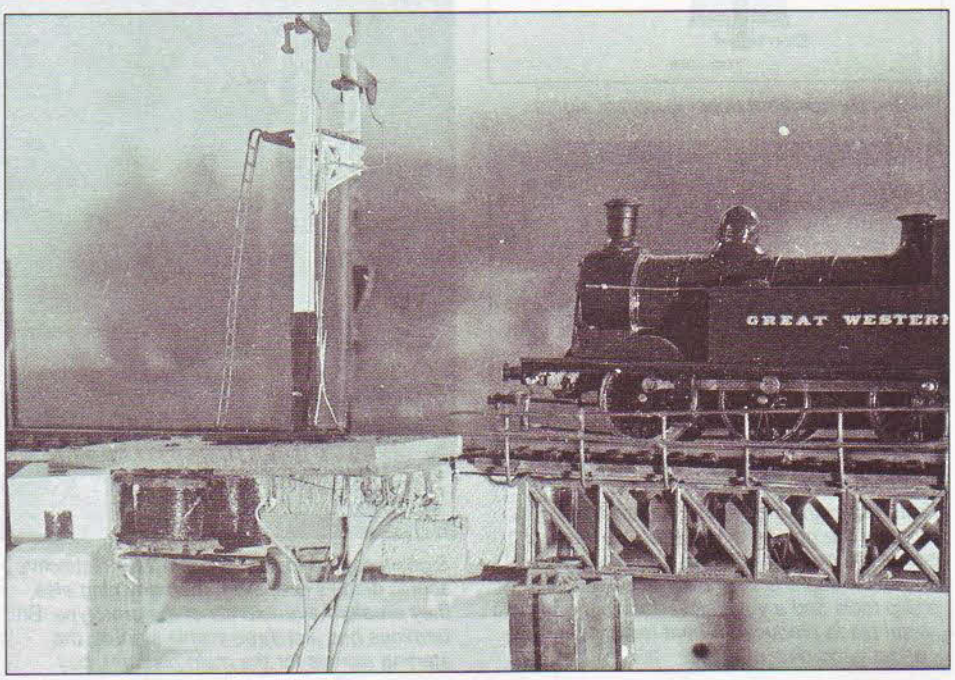


Signals can be looked on as a very distinctive scenic detail since, more than anything else, they create the ambience of the prototype. Brill *terminus has just three visible signals, the starting signals for the main platform, bay road, and goods loop. They are early Ratio products. The two starters form a bracket signal whilst the goods signal, on the left, has a ringed arm.*



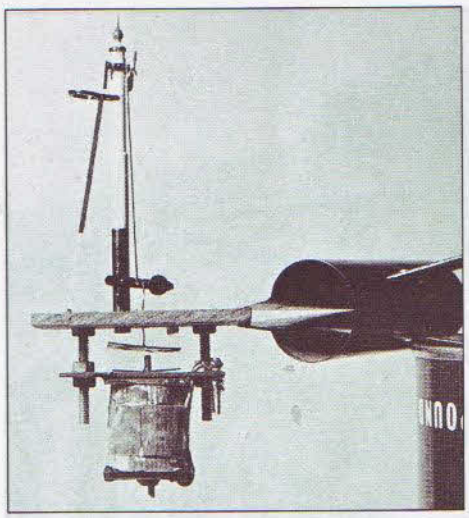
Above: *The starter signal is now securely screwed down into its hole. The goods starter sits in a hole cut in a piece of mounting board. Around goods yards, the sleeper tops are usually on a level with the roadway.*

Right: *The* Brill *signals are dummy – at present. Here we have a Ratio bracket signal operated by a pair of sub-baseboard electromagnets.*



Observing the prototype

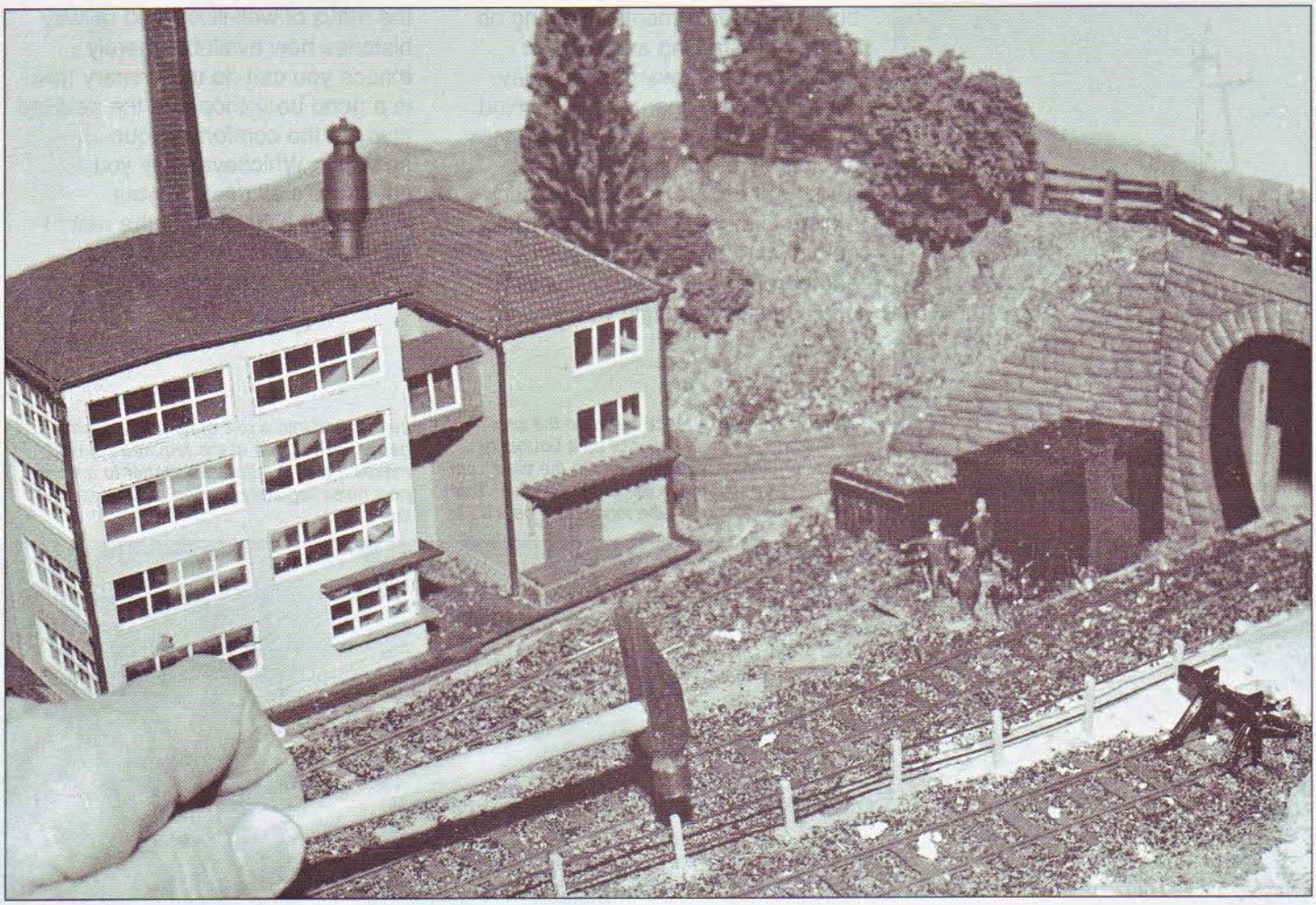
This chapter has only scratched the surface of a large and fascinating field. It has concentrated on the more obvious details that can be added, and glossed lightly over what are perhaps the most important aspects of the subject, observation and imagination. You can get enough ideas to keep you



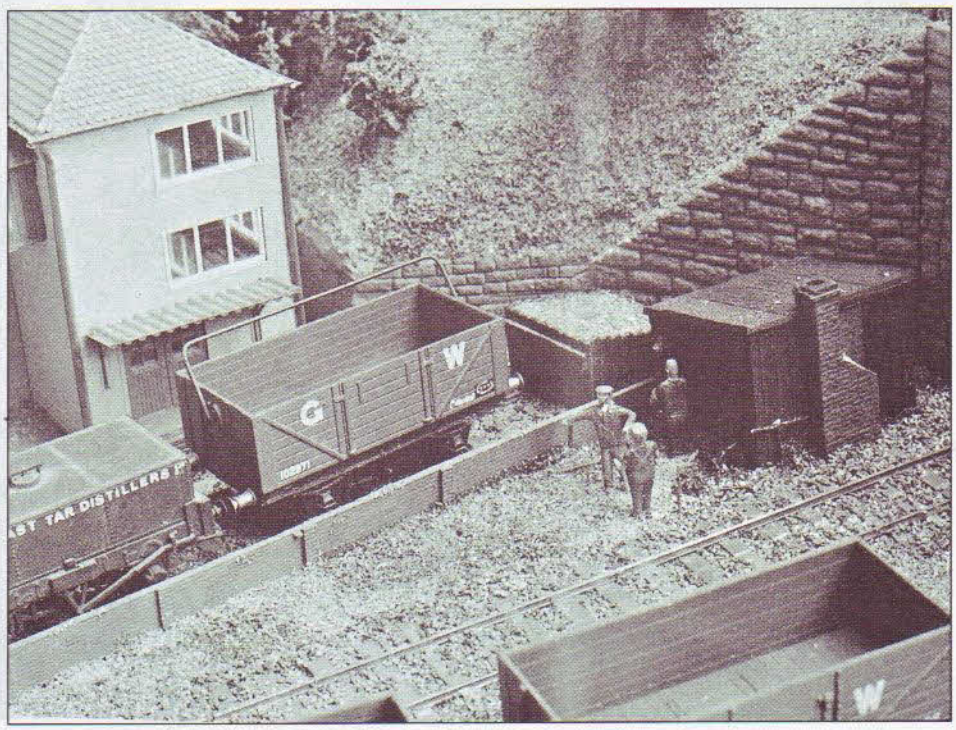
Above: *A clearer view of a home-made electro magnetic signal.*

busy for at least month by doing no more than strolling around your home town on a warm sunny day with your eyes open and your mind receptive. Better still, take a camera and plenty of film and record the scene. Of course, if you're building a historic model this is not quite so helpful, but the recent interest in old photographs culminating in a flood of albums of nostalgic views, with the mass of well-illustrated railway histories now available merely means you can do the primary trawl in a good bookshop and the detailed study in the comfort of your armchair. Whichever way you choose, it's all down to your imagination, which, like the rest of you, functions best when it has regular, gentle exercise.

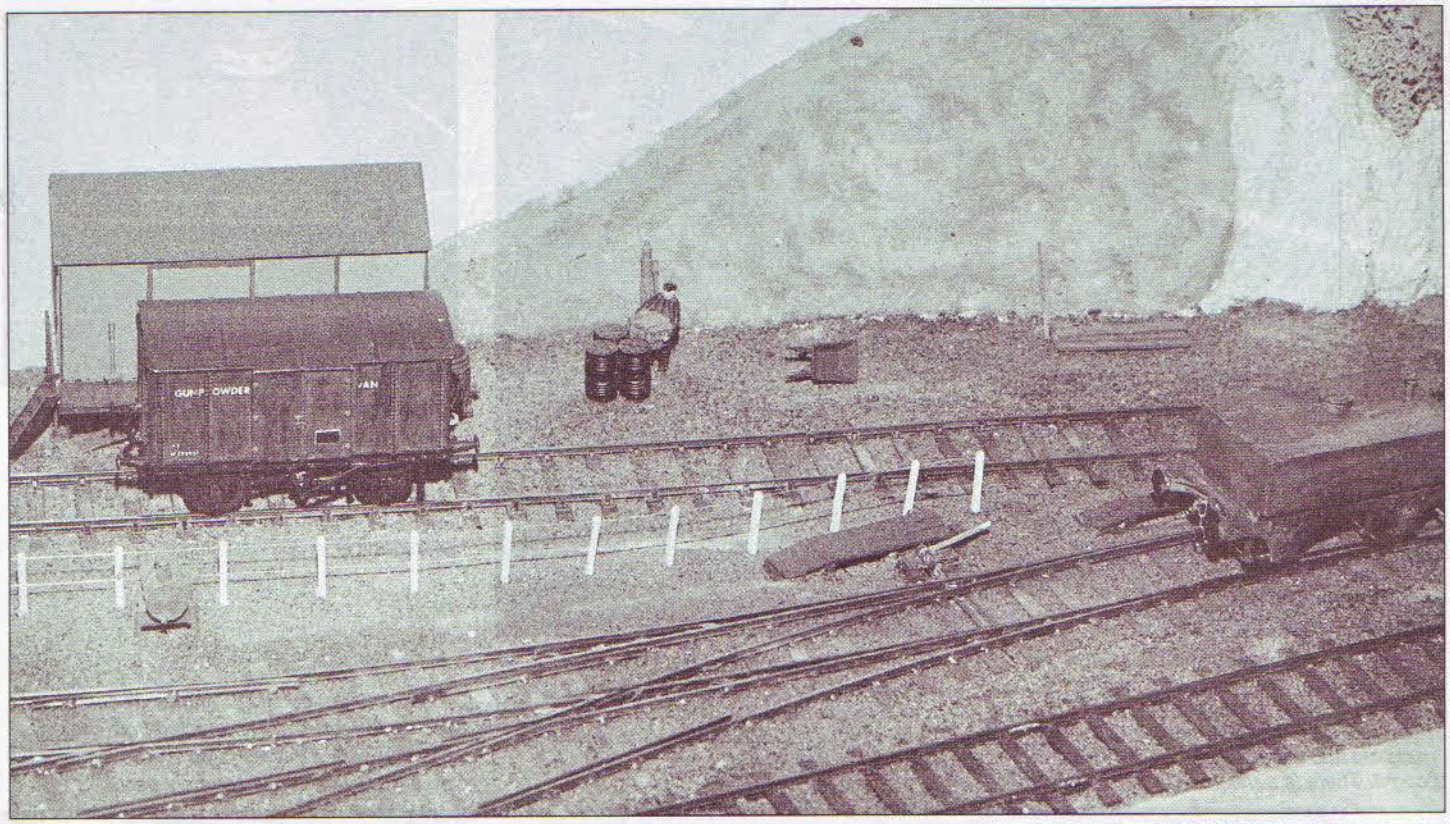
Below: *There is a fence between the coal siding and the main line, not as a boundary, but to prevent anyone working in the yard from accidentally straying in the path of a train. This is a simple post and tube fence, and needed to be inserted into a row of holes. A wooden gauge, marked off at the required spacing, makes it a straightforward matter to get the post holes regularly spaced along a straight line.*



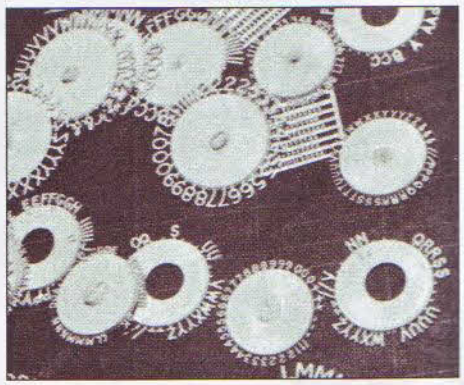
The fence is made from Ratio plastic posts and straightened copper wire, in place of the fiddly filament supplied with the kit. Obviously a fence incorporating a large amount of steel tube is more expensive than one with only wire, but the much stronger tube is favoured for this situation. The posts were strung on the wires, positioned carefully using the same wooden gauge, and then gently tapped into the holes.



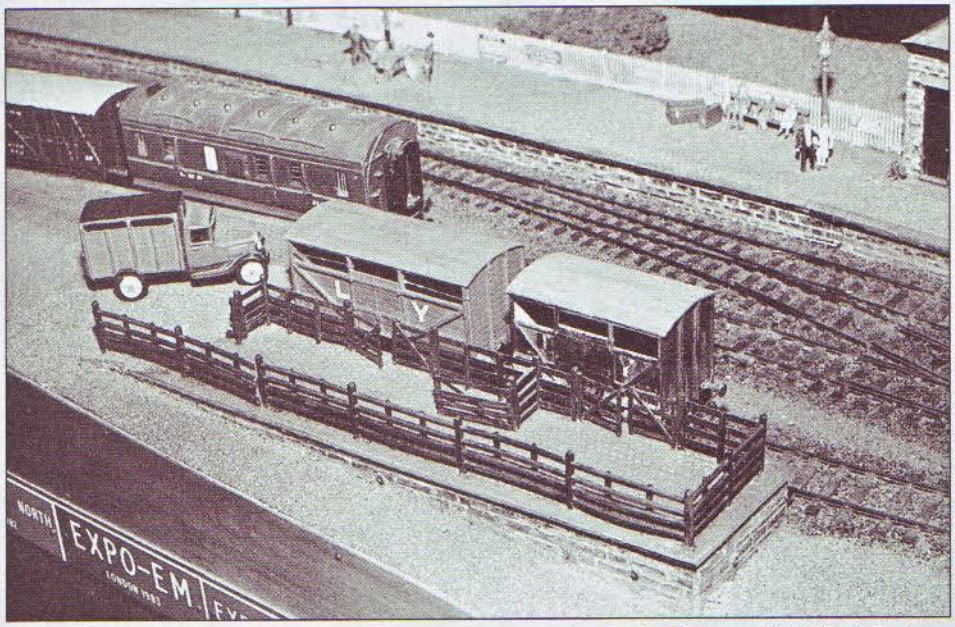
The gasworks is surrounded by a scale 4 ft high boundary wall. This is made by sandwiching two pieces of Slater's garden wall bond embossed Plastikard together and adding piers cut from a sandwich of brick plastic on 20 thou sheet. Having gone to the trouble of adding piers, I put them on the outside where they can be seen. A Cambrian Models platelayer's hut nestles in the corner alongside the tunnel mouth. Three of the Springside permanent way gang are mounted on the small sub-base which has been blended in with ballast and grass.



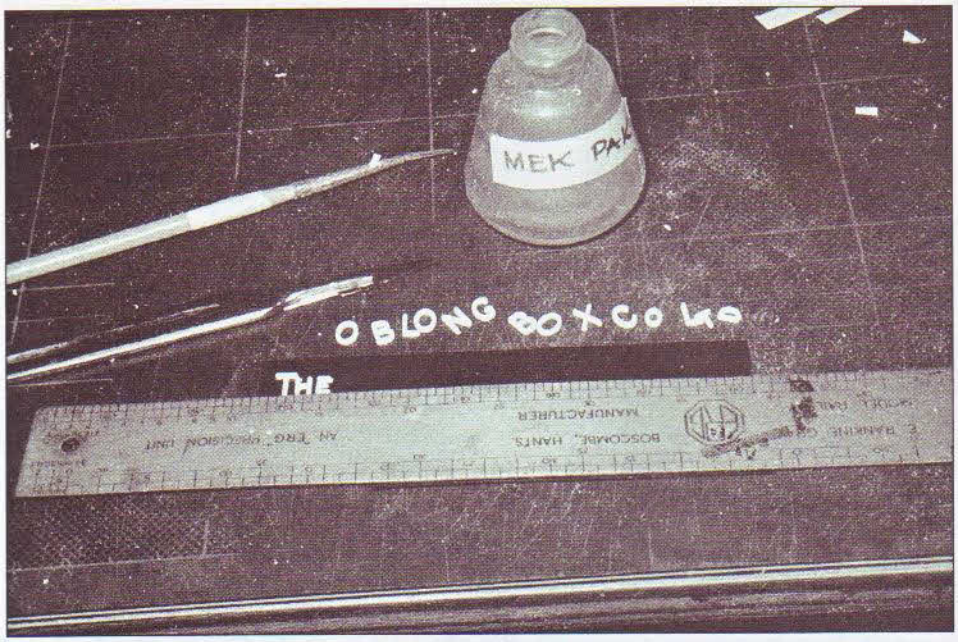
Post and wire fencing on Geraint Hughes' Cromford & High Peak layout, separating the merchandise siding from the rest of the station. The van is fitted for gunpowder traffic, the body design is derived from the old GWR `Iron Mink', which Ratio offered as a kit. Iron was preferred for this traffic, not for greater protection, but because wood has a nasty habit of getting impregnated with gunpowder. In this condition it is highly flammable.



Although the old wood or cast iron raised lettered sign is slowly disappearing, it was a characteristic fitting of the steam age, since unlike the painted sign it could be easily refurbished by any competent member of the station staff with a pot of paint and a decent brush. Such signs are simple to make, using the Slater's plastic letters, now available in a wide range of heights.



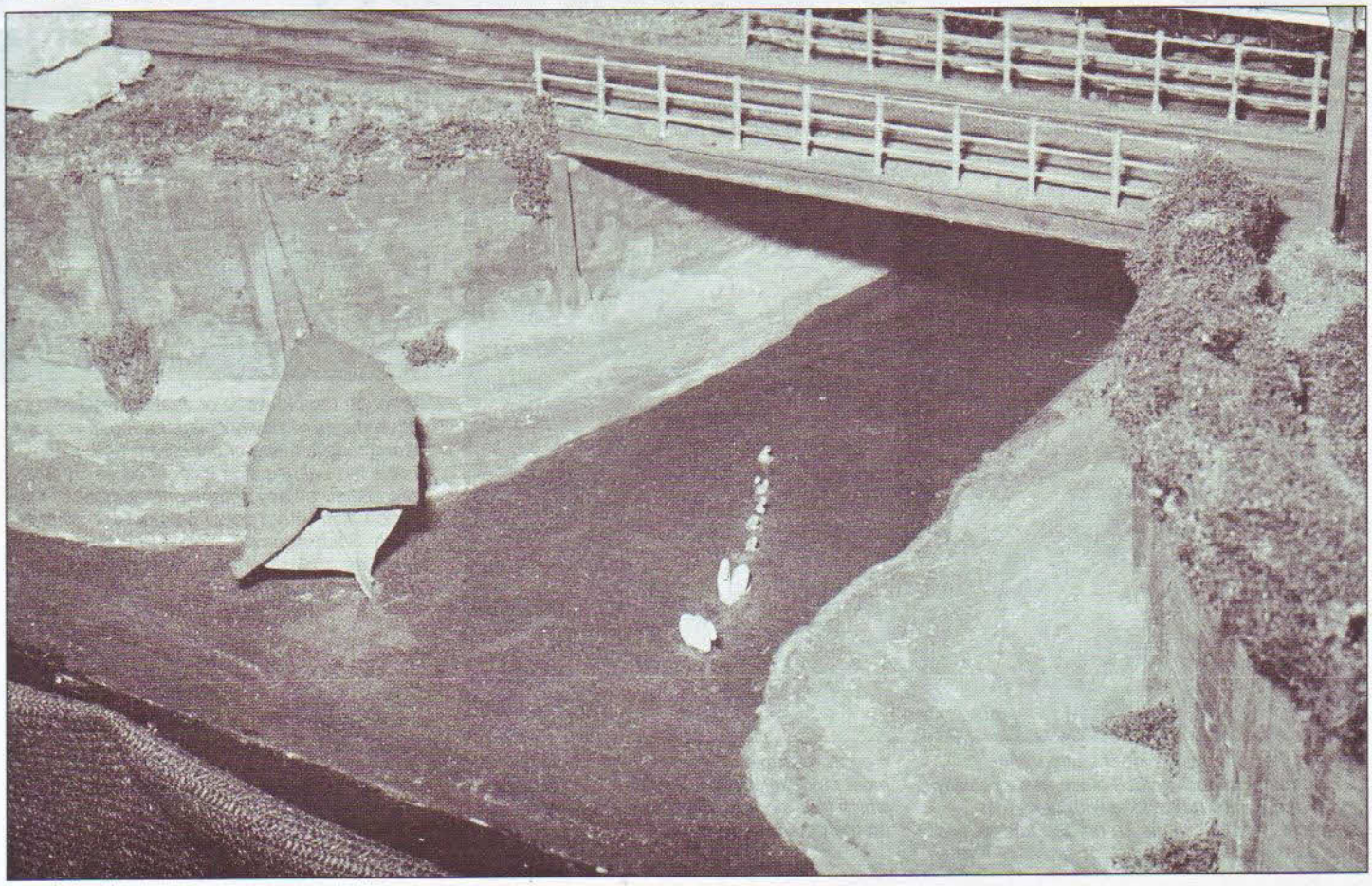
Where a station saw a lot of cattle traffic, loading and unloading took place at a specially equipped platform provided with pens into which the animals could be herded and loaded into the wagons without risk of straying. This is a good example of a scratchbuilt dock, but most modellers today start with the Ratio kit, which incorporates the very necessary drains on the platform top.



The easy way to make a sign is to stick the white letters on to a piece of black plastic sheet. I am using a brass scale rule by the long defunct firm ERG of Bournemouth, over 40 years old and still as useful as the day it was bought. There is a much superior etched steel rule on the market today. The letters are carefully set out in order, then picked up one by one by pressing the point of the scalpel into them, carefully positioned and secured with a dab of Mek Pak.

When the letters are in place the surrounding frame, also of white plastic, is cemented in place. Once all this had hardened, the unwanted plastic can be cut away. After that, I painted the sign. It's not quite as easy in 4 mm scale as it is in 305 mm scale!

A spot of neat detail in S gauge. A small boat lies on the foreshore, protected from the weather with a tarpaulin, whilst two swans and their five cygnets sail serenely past.



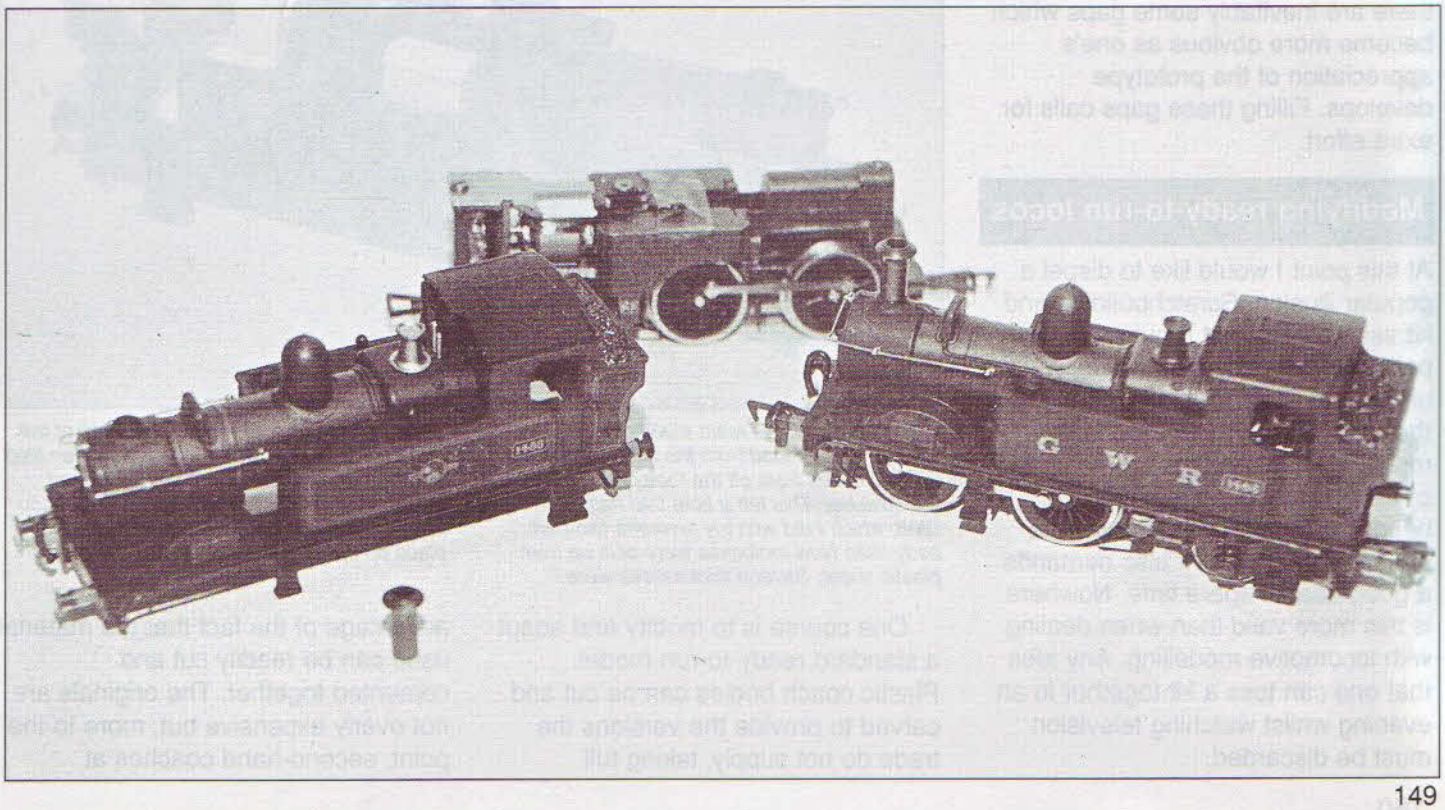
Chapter 14

Locomotives and Rolling Stock

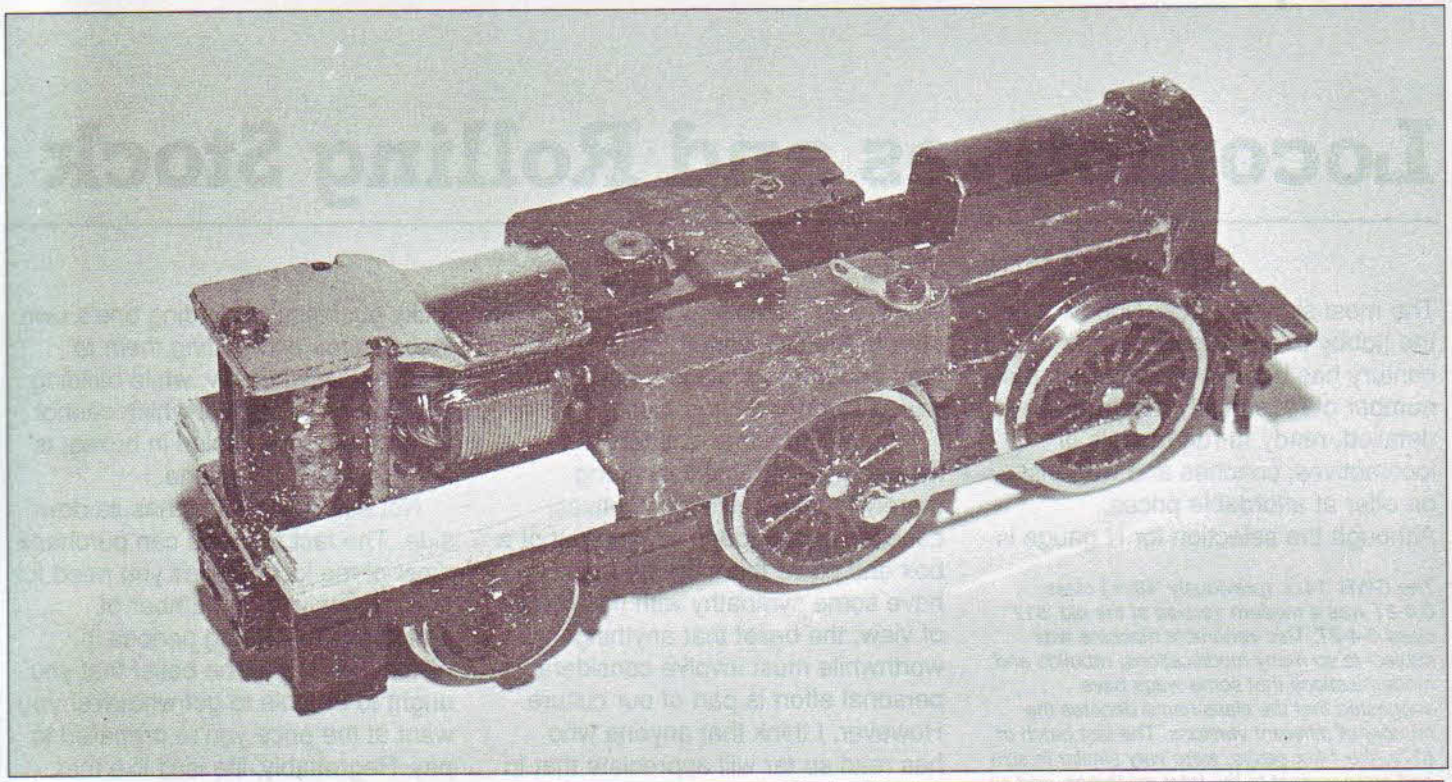
The most significant development in the hobby over the past quarter of a century has been the increase in the number of reasonably accurate, well detailed, ready-to-run models of locomotives, coaches and wagons on offer at affordable prices. Although the selection for N gauge is small when compared with that on offer to the OO worker, there is more than enough to provide a good and varied stud for a large layout.

There is in some quarters a lingering feeling that it is wrong merely to take one's locomotives, coaches and wagons straight out of a box and place them on the track. I have some sympathy with this point of view; the belief that anything worthwhile must involve considerable personal effort is part of our culture. However, I think that anyone who has read so far will appreciate that to create even a modest layout up to the standards set by the current products of the trade calls for a good deal of hard work. There is no doubt that being able to defer the very tricky business of building one's own locomotives *and getting them to perform satisfactorily*, while building that part of the model which cannot come ready assembled in boxes, is an enormous advantage.

Not surprisingly, this has its down side. The fact that one can purchase most of the locomotives you need for a surprisingly large number of prototypes at varying periods in history has led to the belief that you ought to be able to get whatever you want at the price you're prepared to pay. Regrettably, life isn't like that. So, while the newcomer in OO and N gauge (or in the case of overseas prototypes, HO and N) can get his initial requirements for locomotives, coaches and wagons ready-made,



The GWR '14xx' (previously '48xx') class 0-4-2T was a modern version of the old '517' class 0-4-2T. This venerable machine was subject to so many modifications, rebuilds and modernisations that some wags have suggested that the class name denotes the number of different versions. The last batch of 517s, the 14xx series, were very similar in size and arrangement to the later machines, and so using the old Airfix ready-to-run model it is not too difficult to create its direct ancestor. In this photograph we have, on the right, the model in GWR livery, and on the left the body of the BR version, ready for modification, with its chassis to the rear.

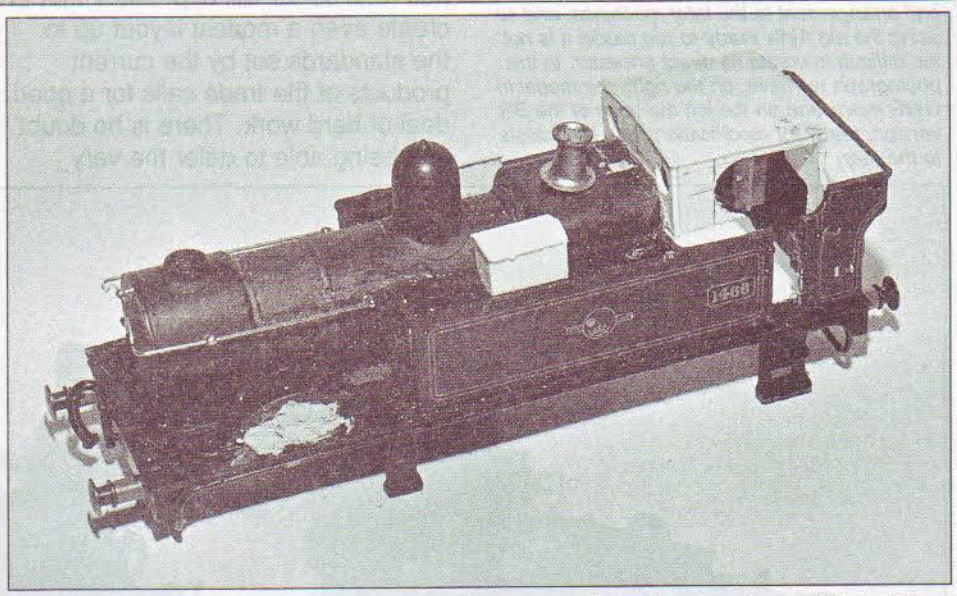


The only modification to the chassis was the addition of some packing at the rear to support the modified cab end of the body. This was built up from plastic sheet, secured to the metal chassis with epoxy resin.

there are inevitably some gaps which become more obvious as one's appreciation of the prototype develops. Filling these gaps calls for extra effort.

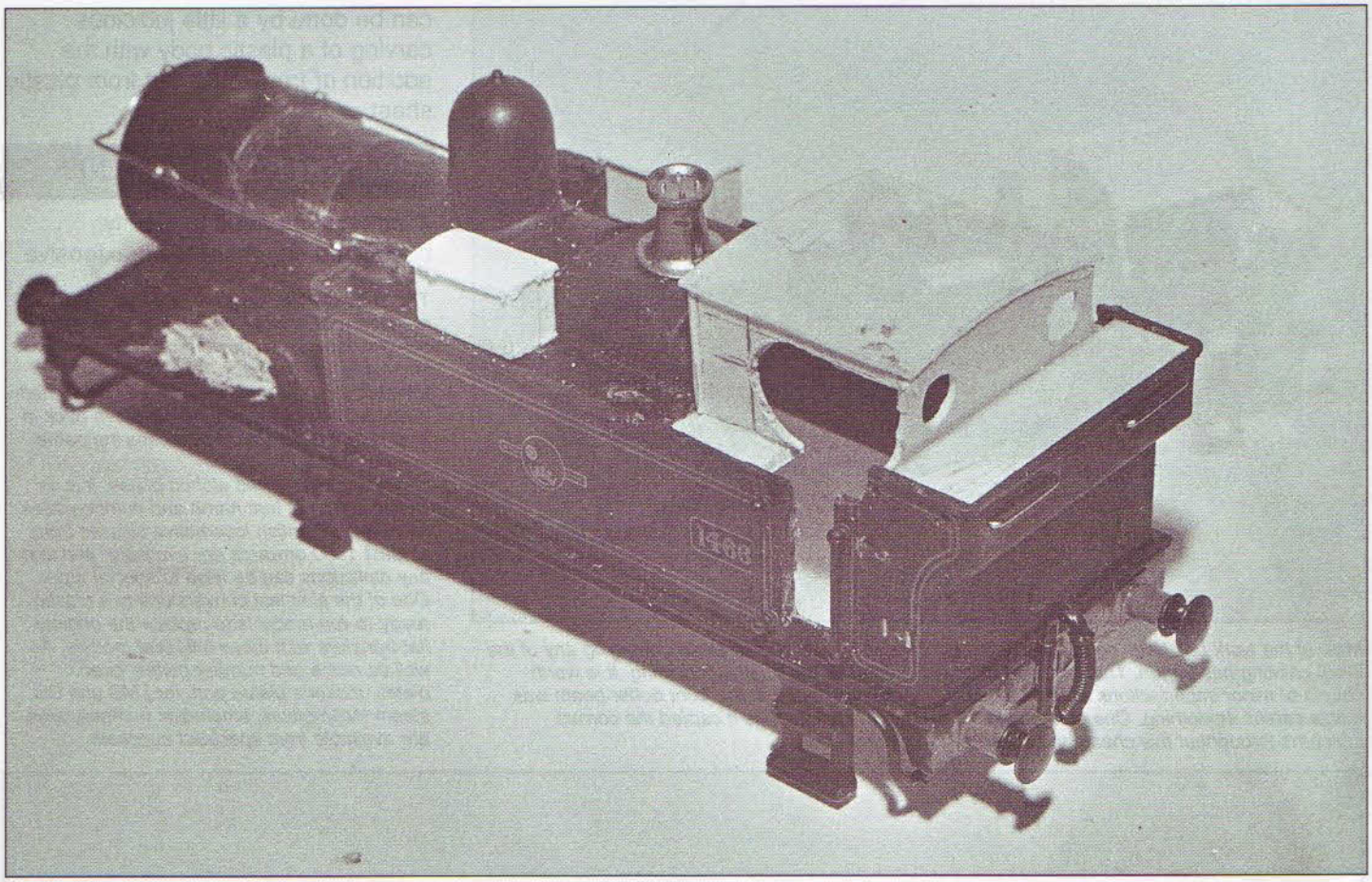
Modifying ready-to-run locos

At this point I would like to dispel a popular illusion. Scratchbuilding and kit assembly do not require infinite patience; the patient individual waits uncomplainingly for the trade to make the ready-to-run model. Serious model making requires a great deal of determination, an almost pig-headed refusal to give up until the project is complete. It also demands a good deal of spare time. Nowhere is this more valid than when dealing with locomotive modelling. Any idea that one can toss a kit together in an evening whilst watching television must be discarded.



At the front end, the main modifications were to remove the top feed from the boiler and to cut the tool boxes from off the footplate in front of the splasher. This left a hole that had to be filled, which I did with my favourite two-part body filler. New toolboxes were built up from plastic sheet. Several thicknesses were cemented together to make up a block of the required depth and width, which was then filed to give the top a semi-circular profile. Two boxes were cut off and provided with 10 thou plastic sheet lids before being cemented in place on the tank tops.

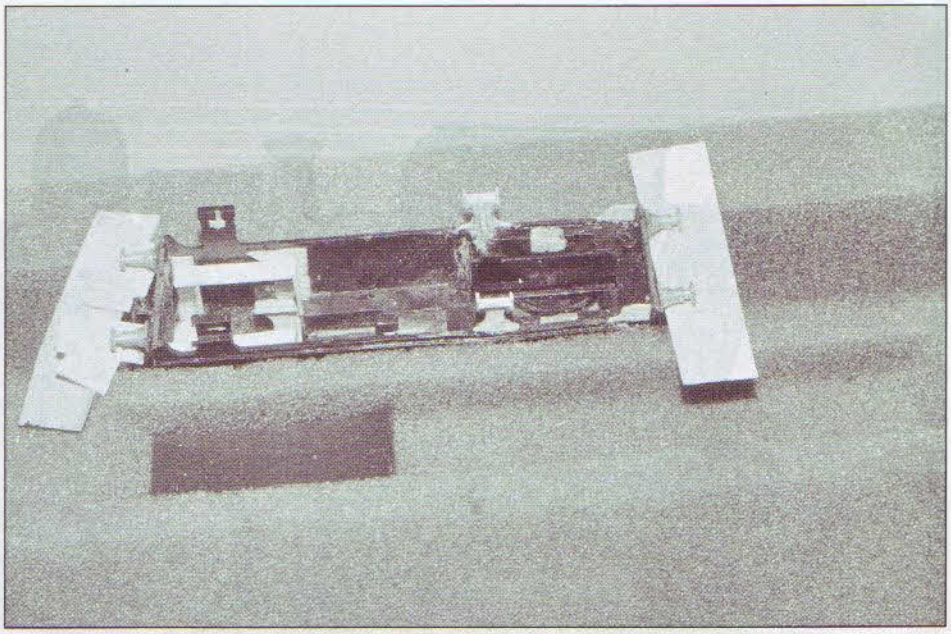
One course is to modify and adapt a standard ready-to-run model. Plastic coach bodies can be cut and carved to provide the versions the trade do not supply, taking full advantage of the fact that the material used can be readily cut and cemented together. The originals are not overly expensive but, more to the point, second-hand coaches at



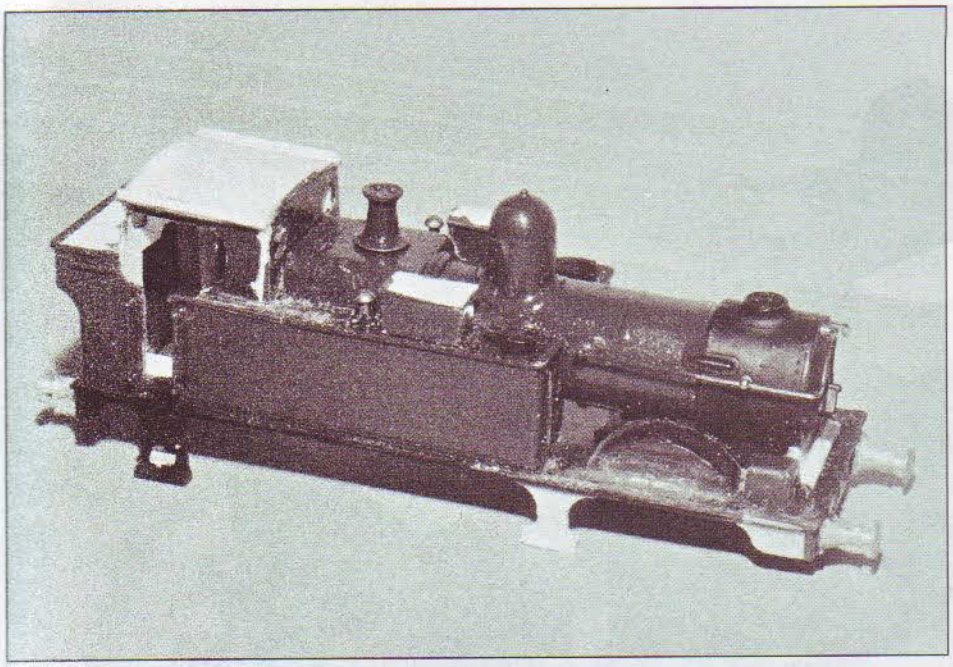
The new cab was made from 20 thou plastic sheet and cemented in place. As it is considerably narrower than the Collett version, packing pieces had to be cemented to the tank sides. In fact, making and fitting the cab was far less fraught than cutting the original away. The bunker steps and cab doors were cut off; photos seemed to indicate that the '14xx' series 517s did not have these.

bargain prices can usually be found on club bring-and-buy stalls at local exhibitions. A couple of well-used, battered coach bodies are the ideal raw material for one's first essay into modification.

Locomotives are an equally promising field for alteration. Crownline Models now offer a large range of modification kits which either provide additional detail for a standard model, or the parts needed to convert it into a different batch of the same class, or another type altogether. Goods vehicles are less promising, largely because it is simpler to modify a kit. A good deal



Further alterations were needed below the footplate. New front steps were fitted as these had a different profile, and little infills were put at the front end of the valance. Most important of all, the parallel shank buffers were replaced by the earlier taper pattern. This work was carried out in a foam plastic locomotive cradle, intended for maintenance but equally useful for holding a body upside-down while the epoxy resin holding the buffers in place set. Note the packing pieces of scrap plastic sheet used to keep them level.



Most of the work has been completed and the initial painting has begun. This revealed a couple of minor imperfections which needed a little careful smoothing. One of my main concerns throughout this cheap and cheerful conversion was to avoid damaging any of the detail of the original moulding. It is worth pointing out that the front buffer beam was not repainted, as it carried the correct number.

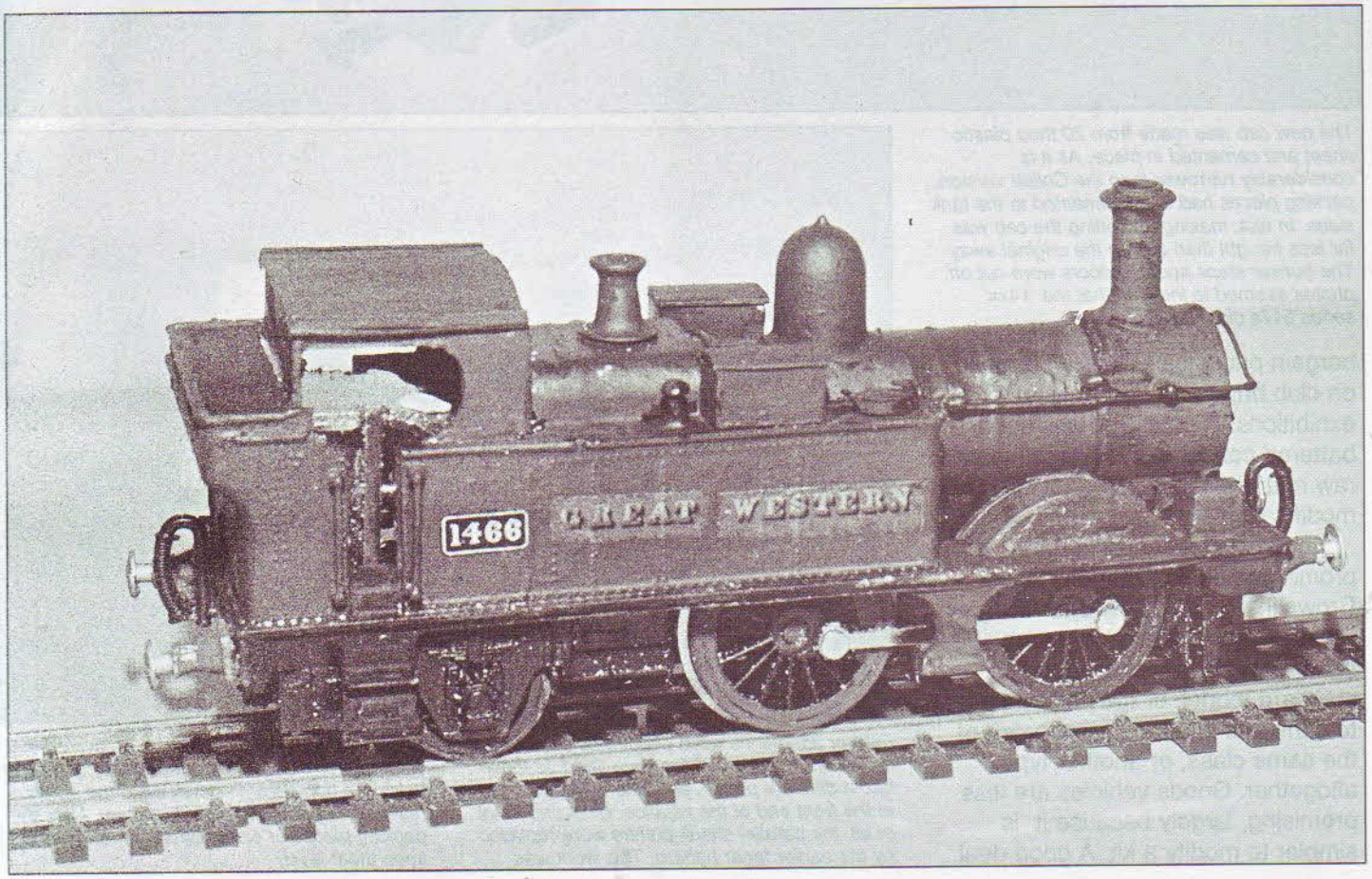
can be done by a little judicious carving of a plastic body with the addition of fresh parts cut from plastic sheet.

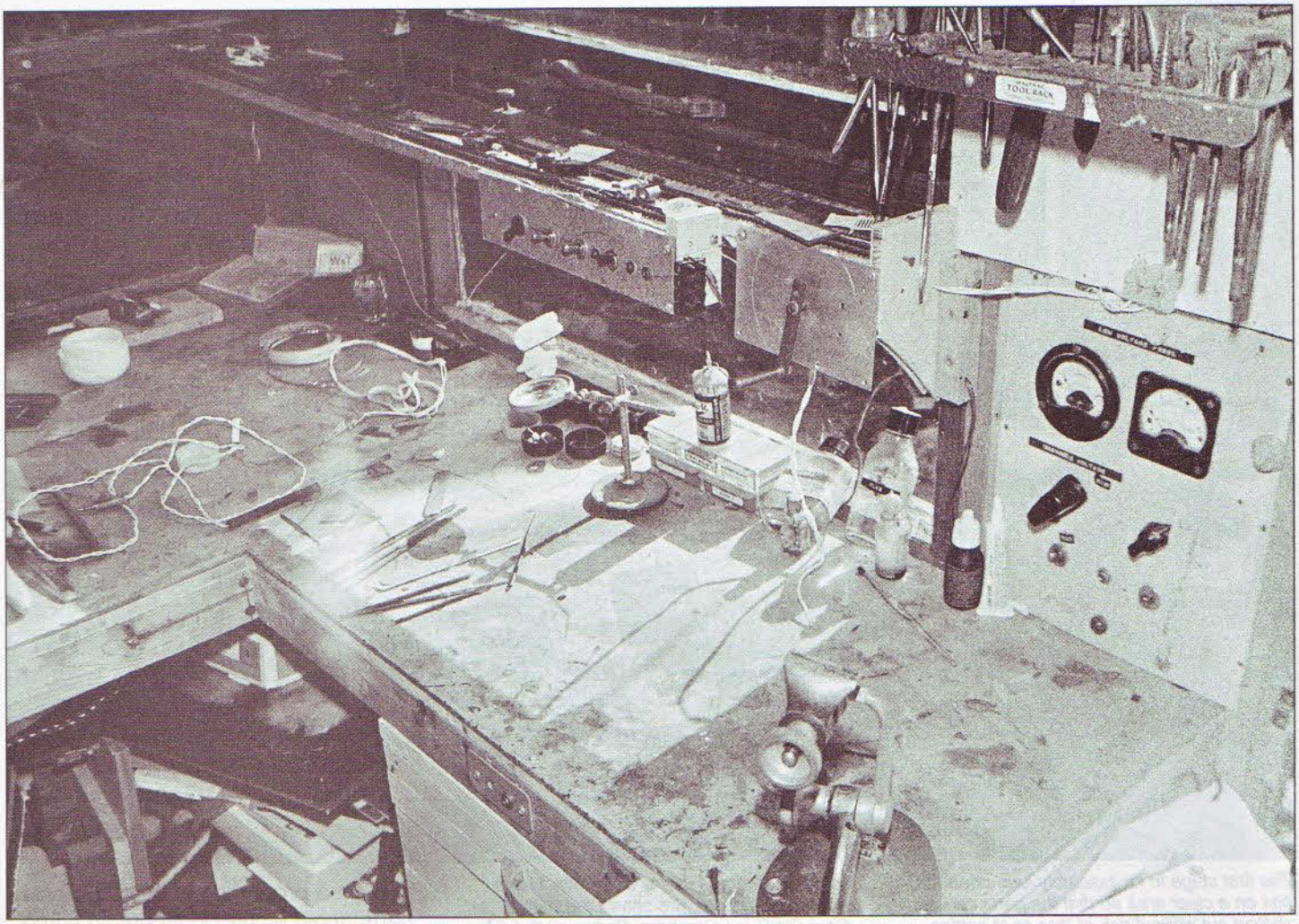
Building from a kit

If indeed, you need to modify, because today there is an extensive

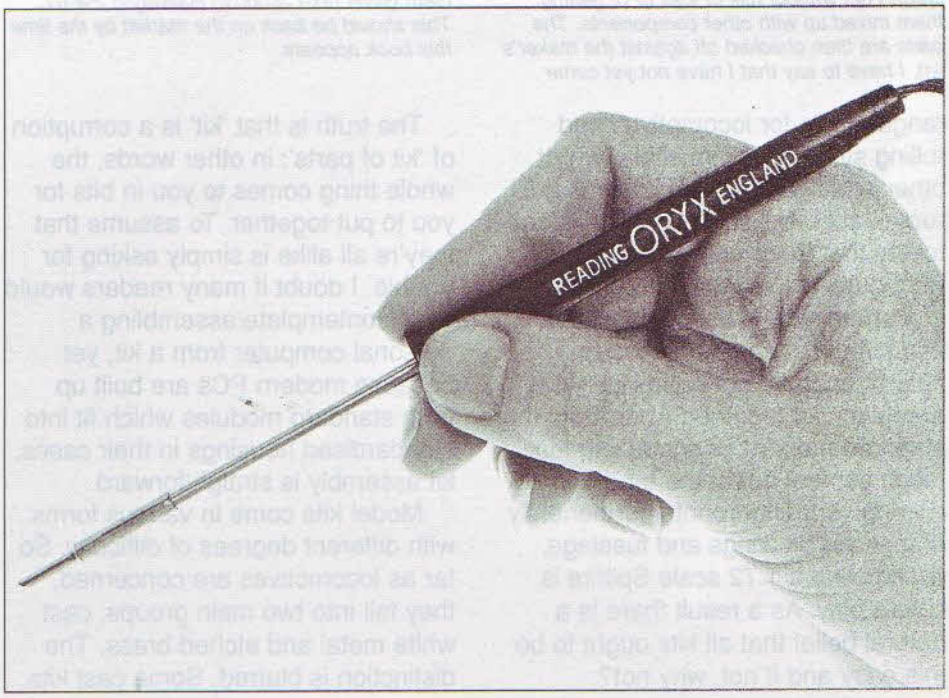
The body is now complete and has been reunited with its chassis. Now the cab roof is painted, the rain strips, thin Slater's Microstrip, can be seen. The lettering is by transfer, the new numberplate a CGW etched plate. A pleasing feature of this move back in time is that the locomotive carries the same number, 1466.

Having mentioned etched plates, it is as well to point out that name and numberplates for nearly all British locomotive classes from at least 1900 onwards are available, and that any omissions can be filled to special order. One of the simplest conversions to a plastic ready-to-run model is to replace the original flat transfers with these full-relief models. As well as name and number plates, shed plates, maker's plates and, for LMS and BR steam locomotives, smokebox numberplates, are available from specialist suppliers.





Above: *While this photo might be thought to have strayed out of Chapter 4, it shows the workbench in my shed workshop in Devon just before work began assembling a cast white metal kit. The Versa-Vice is in the centre foreground, and is a very useful `third hand' during assembly. The low voltage power panel is on the right and to its left, in front of the window, there is a dual gauge test track, with 16.5 and 9 mm gauge tracks with a built-in controller and a battery of switches to provide isolation. The test tracks are functioning as a lumpy shelf. A collection of old needle files and scrapers is arranged on the left of the working area. These will be used to clean up the castings during assembly.*



Right: *The Oryx low-voltage soldering iron. I have used one of these for something over 20 years for cast kit assembly. On about 10 volts it is hot enough to melt low-melt solder without affecting the castings. It is fed by my bench power unit at around 10 V. Occasionally I turn up the voltage to melt the castings to make an even stronger joint.*

The first stage in kit assembly is to open the box on a clear area so that the parts can be spread out without risk of loss or of getting them mixed up with other components. The parts are then checked off against the maker's list. I have to say that I have not yet come across a shortage in any of the kits I have examined. This picture shows the parts of a Gem GWR (ex-Cambrian Railways) 2-4-0T. This should be back on the market by the time this book appears.

range of kits for locomotives and rolling stock for 4 mm scale, whilst other scale/gauge combinations are remarkably well supplied. This is not to say that the process is hazard free, quite the reverse.

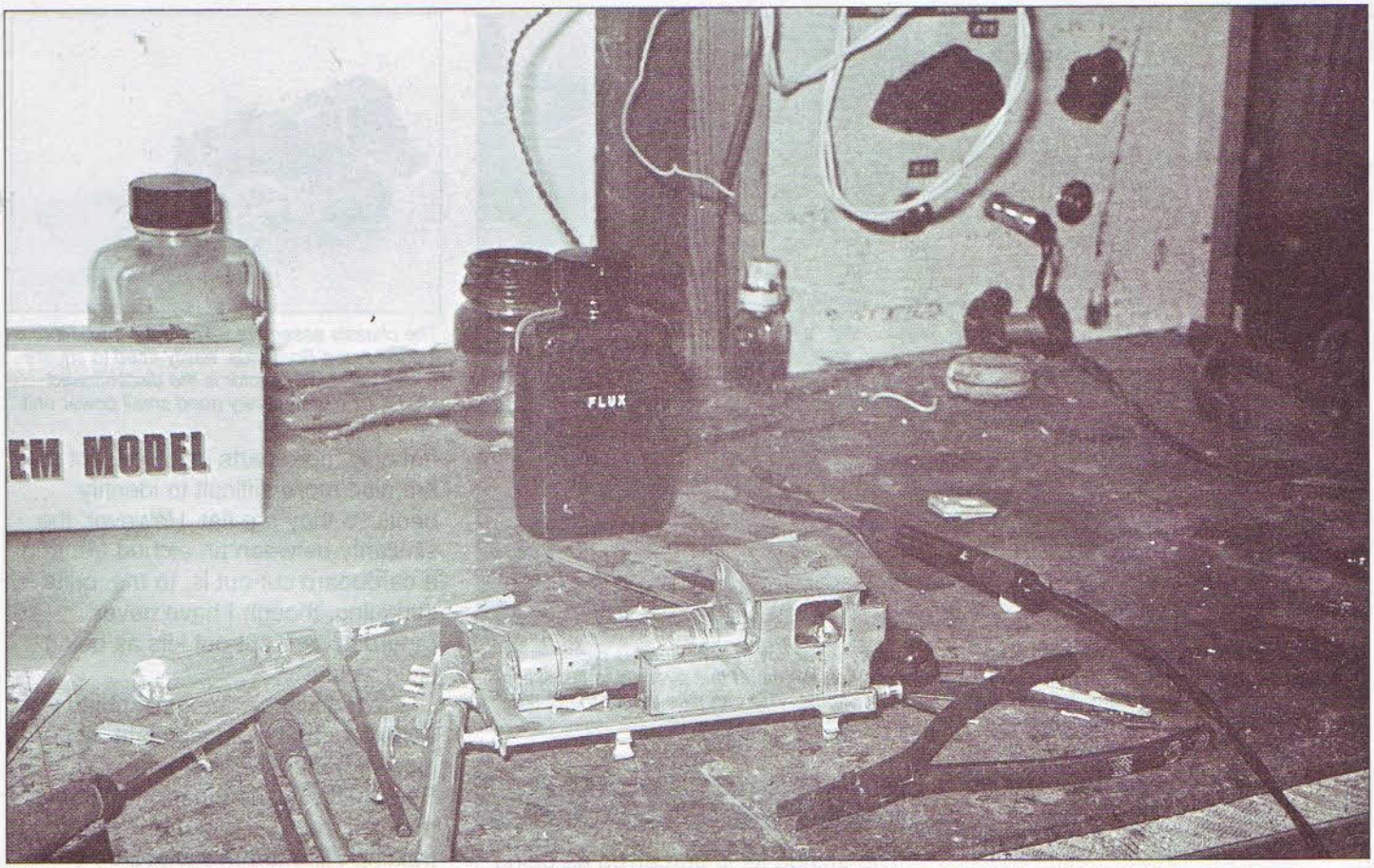
Perhaps the worst complication is that almost everyone has, at one time or another, put a plastic aeroplane kit together. Apart from the standard hazards of squeezing too much cement out of the tube and leaving your fingerprints permanently embossed on wings and fuselage, assembling a 1:72 scale Spitfire is child's play. As a result there is a natural belief that all kits ought to be this easy and if not, why not?

The truth is that 'kit' is a corruption of 'kit of parts'; in other words, the whole thing comes to you in bits for you to put together. To assume that they're all alike is simply asking for trouble. I doubt if many readers would even contemplate assembling a personal computer from a kit, yet because modern PCs are built up from standard modules which fit into standardised housings in their cases, kit assembly is straightforward.

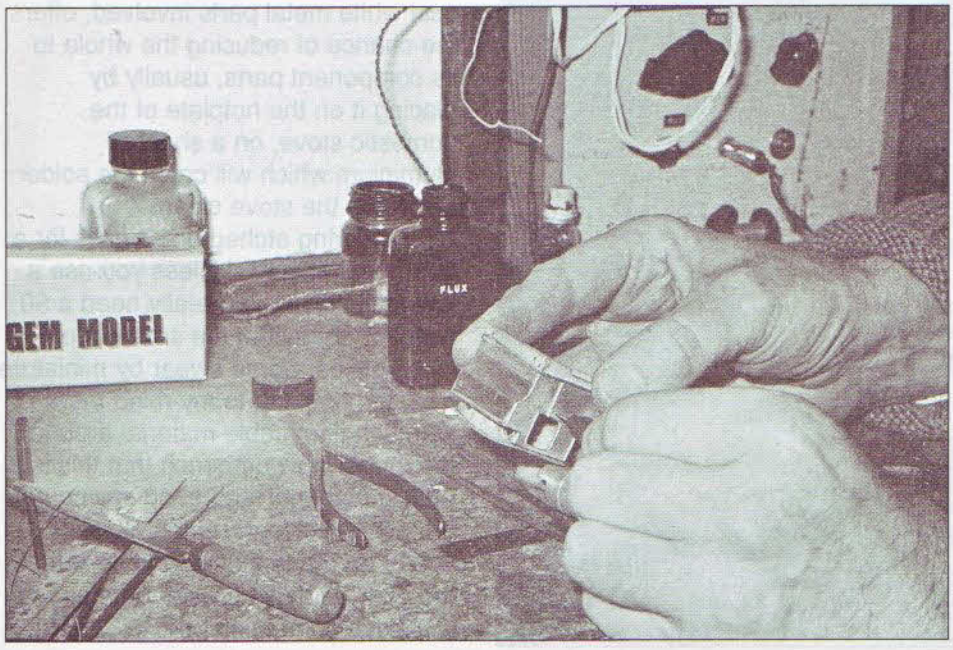
Model kits come in various forms with different degrees of difficulty. So far as locomotives are concerned, they fall into two main groups, cast white metal and etched brass. The distinction is blurred. Some cast kits contain a proportion of etched brass parts, most etched kits contain some cast components, whilst both types may include cast and turned brass components. All include wire, screws and other bits and pieces.

Cast kits

The cast kit is the easier one to assemble, providing the builder appreciates that casting hot metal in a synthetic rubber mould is not a precision process and that some filing, fitting and filling will almost certainly be required. Although relatively low strength adhesives have been used with considerable success, my preference is for either quick-setting epoxy resin or low melt solder, used with a 12 V soldering iron run from a variable transformer/rectifier at about 10 V.

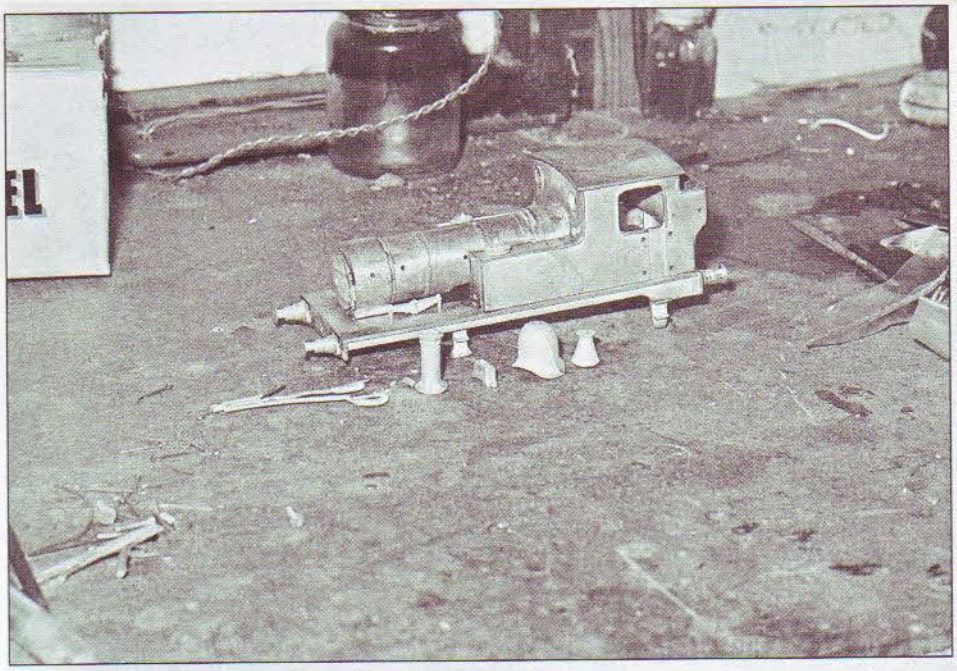


The preliminary assembly of the locomotive body is finished and the model is recognisable. There aren't that many parts involved at this stage. They are large and easily handled, and providing you take care to ensure that everything fits, by filing or scraping, this part of the assembly can move smartly forward. The photo also shows a selection of tools used in the work. Note that the low-voltage soldering iron is resting on a metal support to keep the hot bit off the workbench.



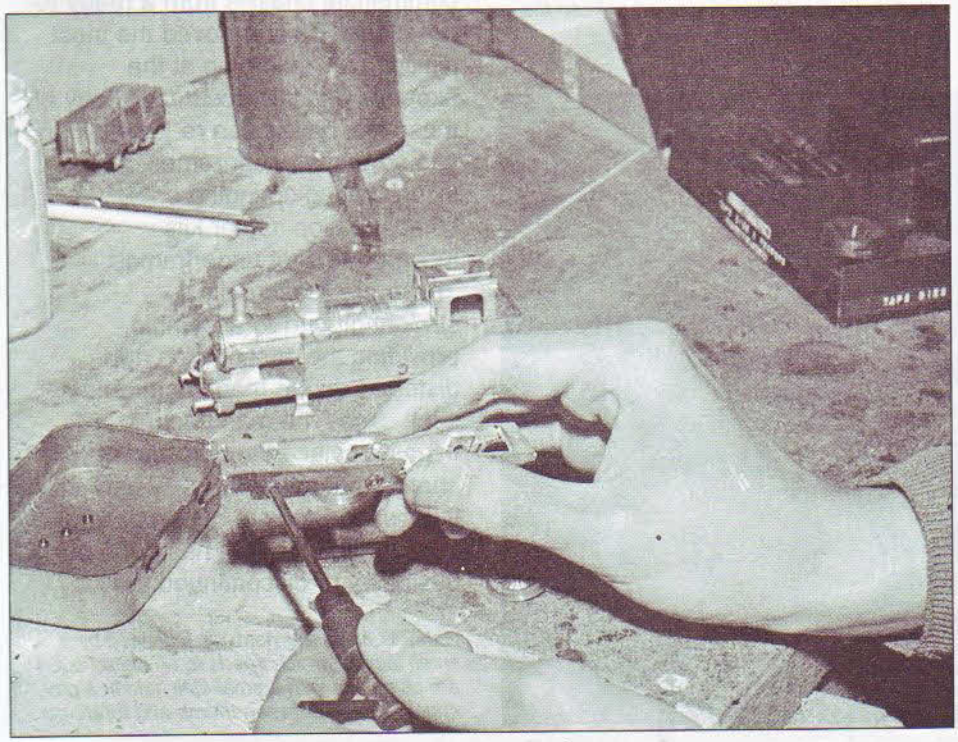
Most of the early cast kits were for bodies only, and fitted on to a commercial chassis from a ready-to-run model. This removed the most difficult part of the job at the expense of scale accuracy. Many of these kits have been re-issued with etched brass underframes, often incorporating springing or compensation. Other kits incorporate cast underframes. These are reasonably straightforward to assemble, providing the casting was not distorted during manufacture. In such cases the manufacturer will usually replace the part free of charge, but some difficulty can arise if between the time of purchase and construction the firm has gone out of business, or discontinued the kit.

Handrail holes are normally indicated by a small dimple, which needs to be drilled out. I am doing this with a small drill held in a pin chuck, twirled between thumb and forefinger.



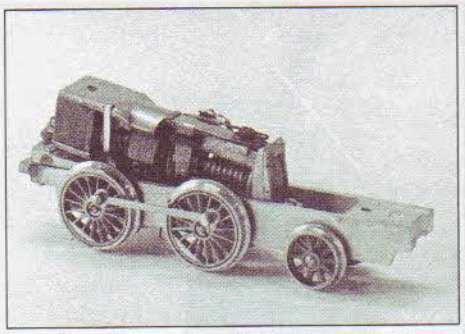
The rest of the bits and pieces for the body. This was a simple prototype, so there aren't that many, but quite apart from cleaning the flash marks from the dome, chimney and safety valve cover, considerable care has to be taken to ensure that everything fits exactly as it should. This can take longer than putting the main body together.

The axle holes of a cast chassis need to be reamed out with a 1/8 in diameter parallel reamer. This is held in a tap wrench and gently twisted through. At a pinch, a new 1/8 in diameter drill will just about do the job. This photo shows the assembly of an LMS 'Jinty' 0-6-0T chassis.



Etched kits

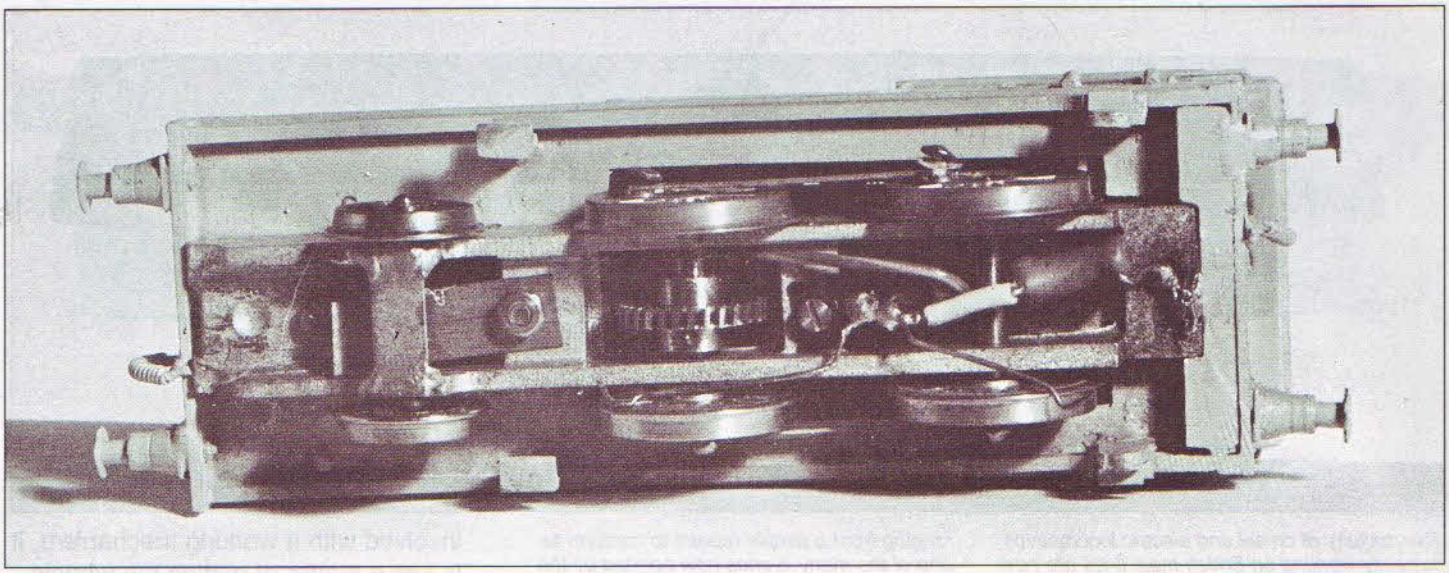
The etched kit is perceived as being more difficult to build. It is frequently more complicated in that there are not only more parts involved, but they are also more difficult to identify because they are flat. However, the similarity between an etched fret and a cardboard cut-out is, to me, quite intriguing, though I have never regarded card cut-out kits as being child's play.



The chassis assembled. The driving wheels are insulated Romfords, easily fitted to square-ended axles. The motor is the discontinued Triang TT motor, a very good small power unit.

Etched kits *can* be assembled with adhesive, and cyanoacrylate `super glue' is generally recommended. Personally, I cannot get on with this material, but by temperament and training I like to have a degree of adjustment during assembly. With these instant adhesives you do not get a second chance. Soldering not only permits adjustment during the initial assembly but, provided there are no cast white metal parts involved, offers the chance of reducing the whole to its component parts, usually by placing it on the hotplate of the domestic stove, on a sheet of aluminium which will catch the solder and keep the stove clean.

Soldering etched brass calls for a good deal of care. Unless you use a low-melt solder, you really need a 60 watt iron for all but the smallest of locomotives. Some swear by miniature blow torches, but to my mind there is so much flammable material around the modelling workbench that this is unacceptable. It's no good saying you will put all solvents, glues, plastic sheet, card and stripwood well out of the way, because sooner or later you will leave something behind.



Underside view of the completed chassis showing the pick-up arrangements, a pair of springy wire wipers rubbing against the back of the insulated wheels. The blobby thing on the far right is a small capacitor to minimise TV interference. The leading wheels have limited side and vertical play and a simple form of springing has been provided.

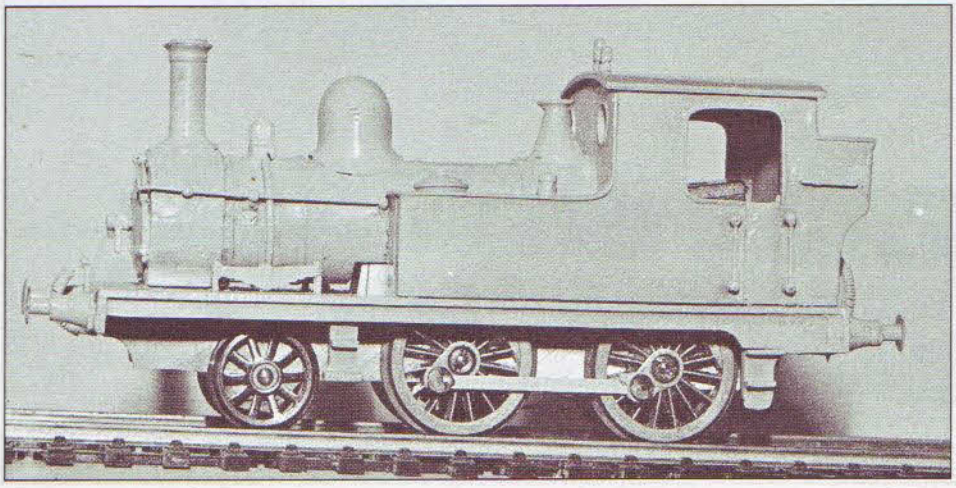
Resistance soldering kits

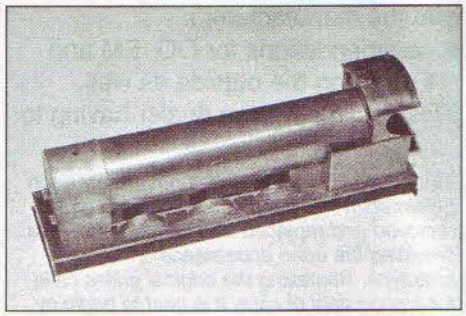
I have no personal experience of the relatively new resistance soldering kits, but every kitbuilder I know who has used one is loud in its praise. It consists of a powerful transformer from which one lead terminates in a clip, the other in a probe. In use, the clip is attached to the larger piece of kit, the smaller piece is put in place with a small dab of solder paste between the two, the probe is placed on the joint and the foot switch is depressed. A heavy discharge of low voltage electricity passes through the parts, heating the immediate vicinity of the probe well above the melting point of the solder but leaving the rest of the kit relatively cool. The only snag is that it is fairly expensive, but for anyone setting out to build many etched kits it would be a very sound investment.

The completed model finished in priming grey. This sort of locomotive, without the complications of outside motion or even pivoting pony trucks or bogies, is the best introduction into the craft of kit building.

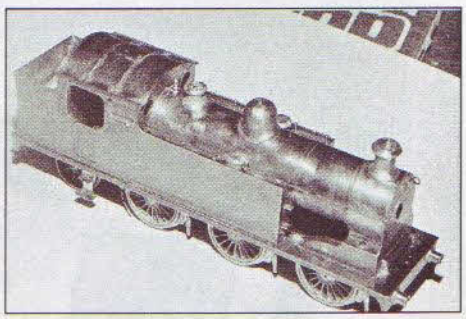
Motors, gears and wheels

Very few locomotive kits include motor, gears or wheels. This is partly to keep the perceived cost of the kit as low as possible, and partly because most modellers have very strong views on which motor, which gear set and which wheels should be used. In the case of the more advanced etched kits, this point has considerable validity. It is less

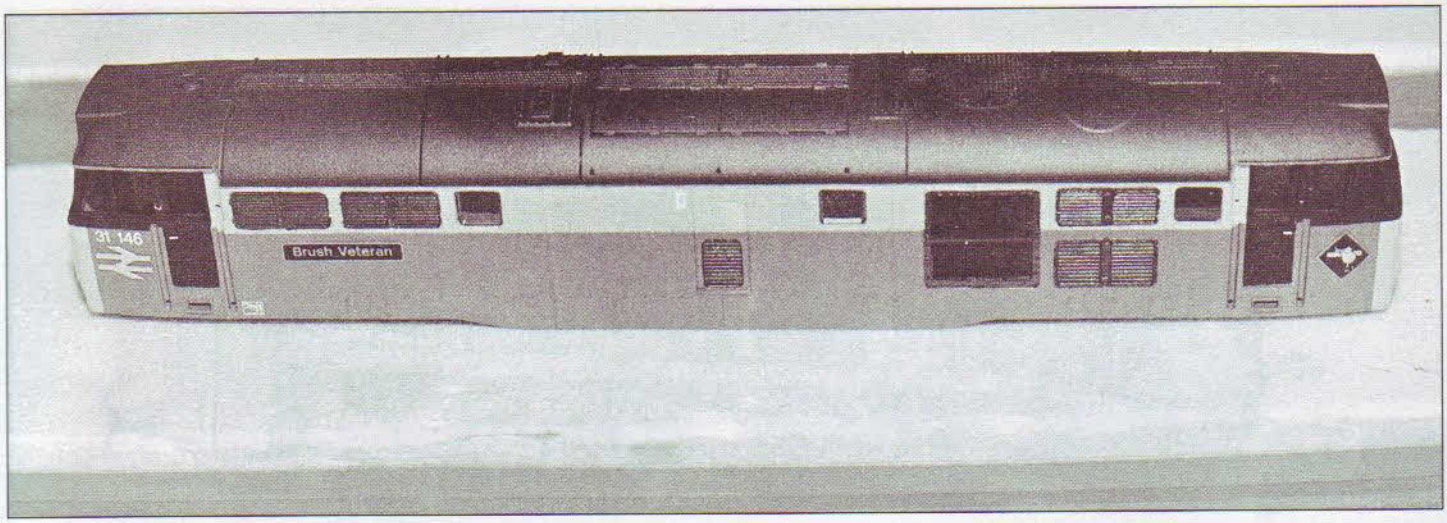




The basic bodywork of an etched brass LNWR 0-8-0. Cast boiler mountings have yet to be fitted.



Glasgow & South Western 0-6-2 tank built from an etched brass kit. The smokebox door and sprung buffer heads have still to be fitted.



The majority of diesel and electric locomotives currently working on British main lines are now available as ready-to-run models, enabling a representative stud to be assembled 'straight out of the box'. It also avoids the difficulty of creating the subtle curves and intricate details of the prototype body shells, something best done with a plastic moulding. The mouldings are capable of considerable development, ranging from a simple repaint to conform to one of the many liveries now sported by the prototype to the addition of fine detail and modifications to the basic shell to represent one of the sub-classes of the prototypes. In this case a basic Class 31 bodyshell has been repainted, renumbered and embellished with an engraved nameplate, depot symbol and raised 'double arrow'.

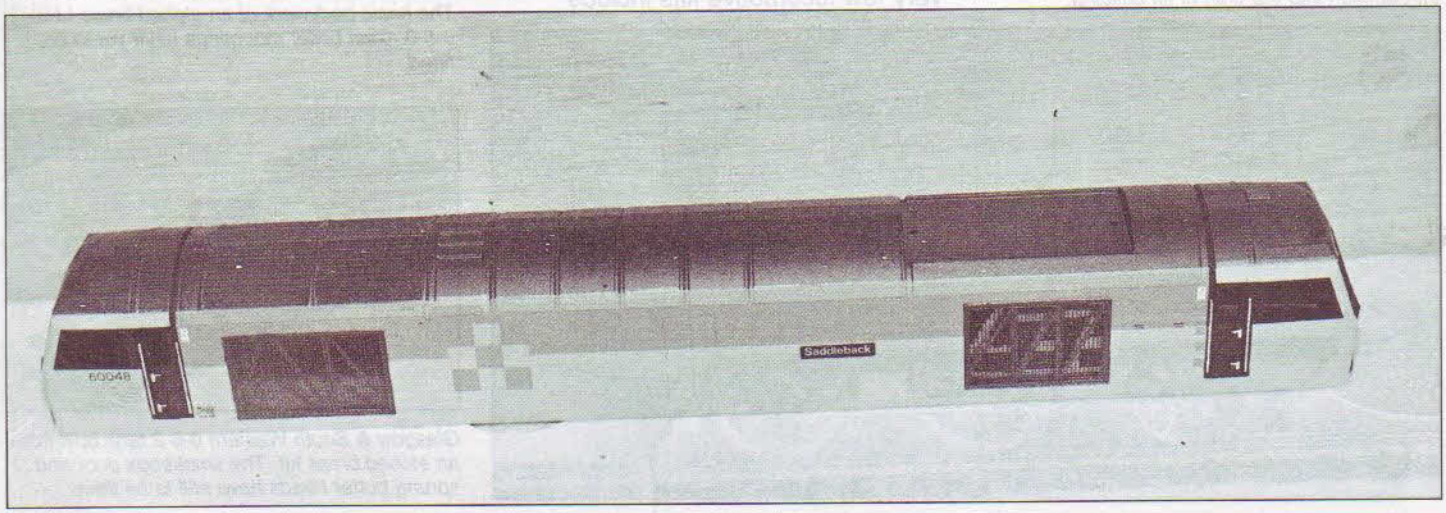
significant where the simpler cast kit is concerned. The practice would be more acceptable were the fact to be stated in large type on the box label and the manufacturer's recommendations for OO, EM and P4 given on the outside as well. This would save the dealer having to open up the box to find out, not to mention help him to stock the right bits for the kits he is selling.

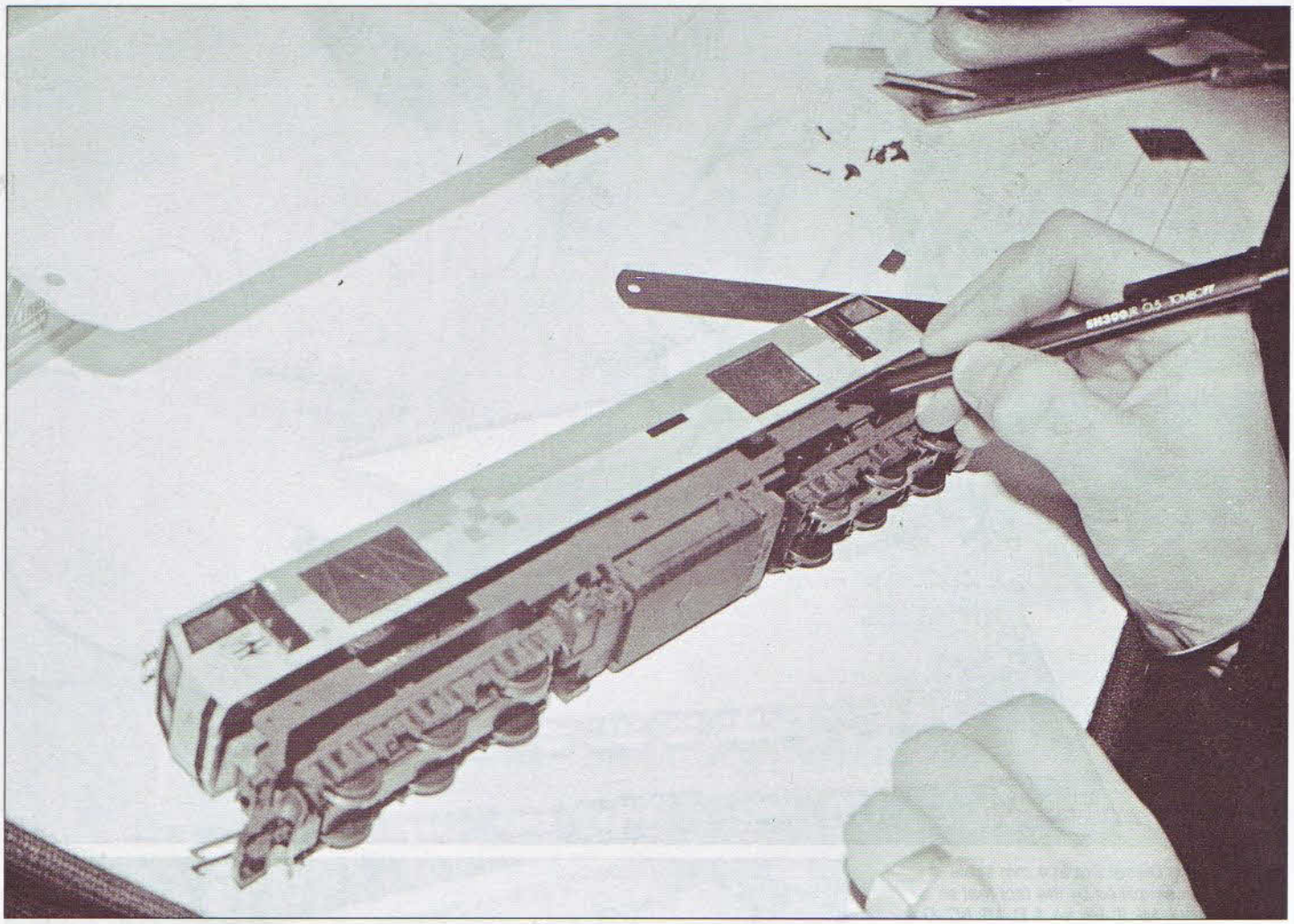
Coaches and wagons

Coach and wagon kits are more straightforward since one is not involved with a working mechanism. It is just a matter of getting the wheels in alignment. Here you will find a good selection of plastic kits. These are probably best suited to the newcomer, not merely because of their more straightforward assembly techniques, but also because the fact that a plastic kit demands a longer production run, means that these kits cater for the more common types of vehicle, the ones that one would expect to find on a visit to the prototype. The more unusual and older prototypes are catered for by etched and cast kits.

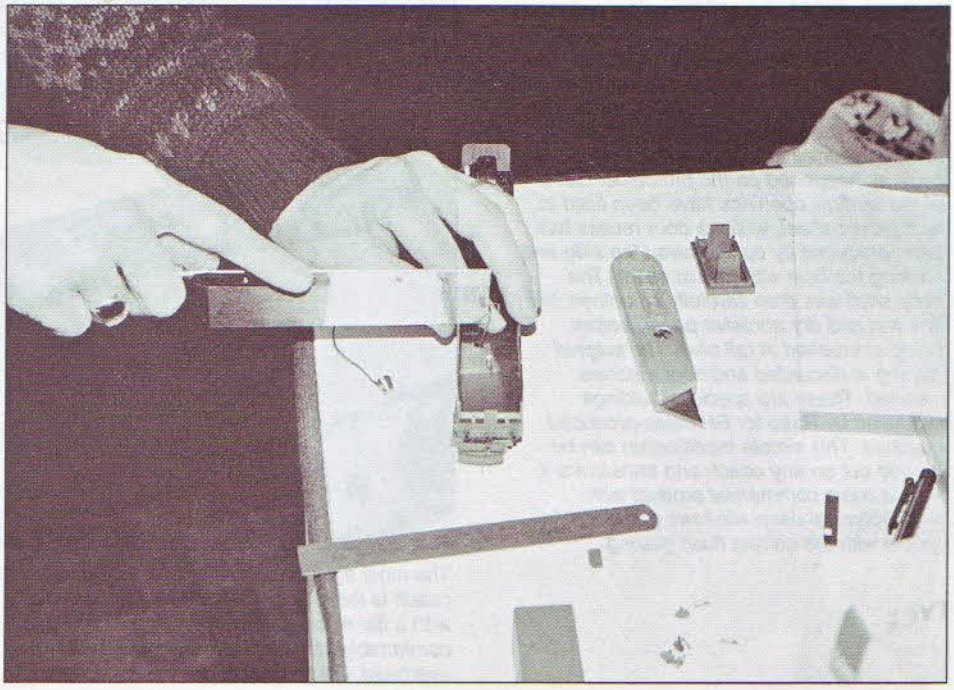
The general opinion is that whilst wagons are a reasonably straightforward proposition, coaches call for a good deal more work to get a good result. This is compounded by the

This Class 60 bodyshell has not merely been repainted, it has had its moulded side grilles removed and replaced with etched frets, thus providing the open appearance of the prototype. Removing the original grilles calls for a good deal of care. It is best to begin by drilling holes in each corner, then carefully cutting between them with a saw. The initial hole is made undersize and then carefully opened out to fit the grille with a needle file. The brass grilles are secured either with cyanoacrylate glues or epoxy resin.

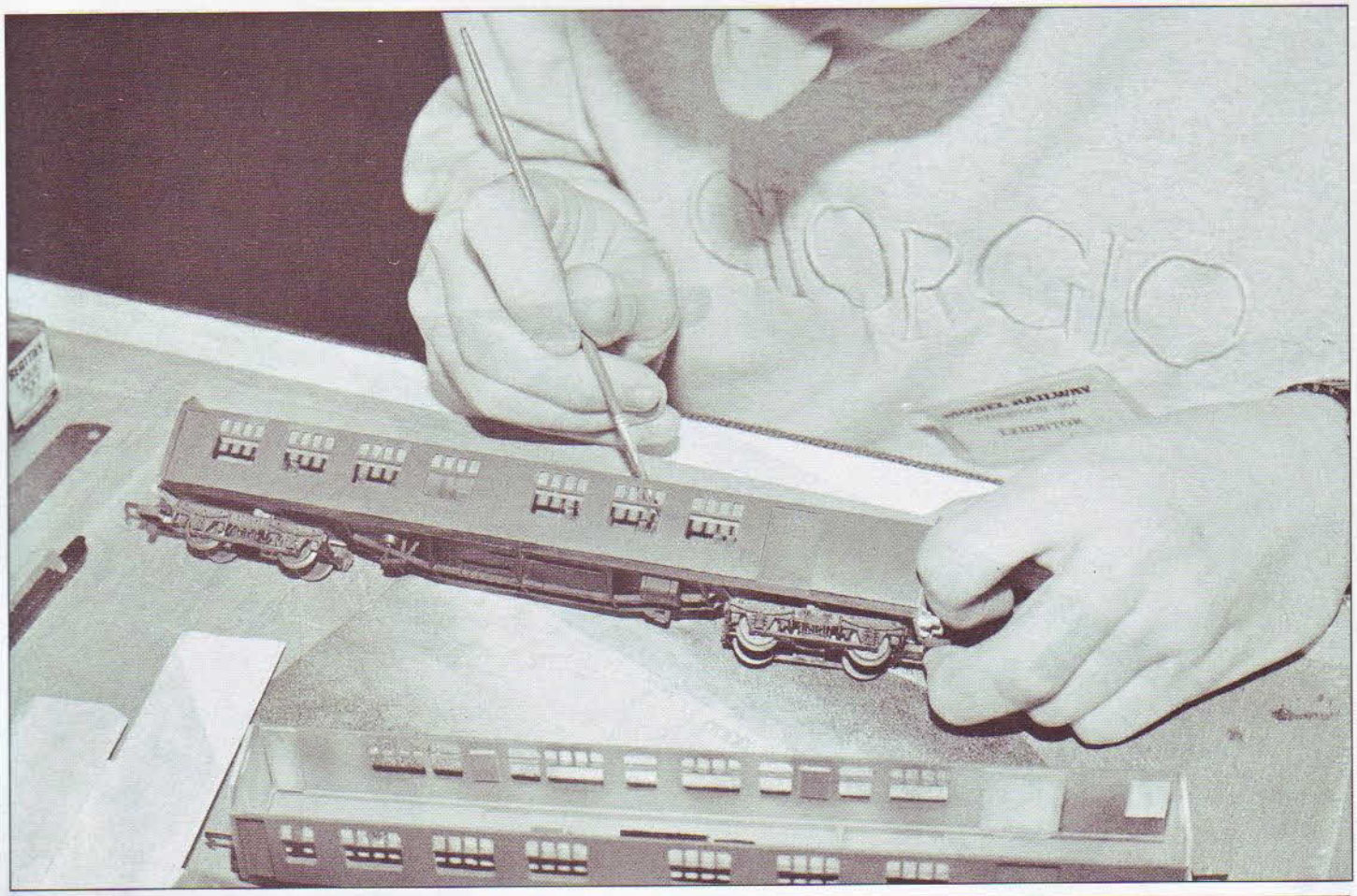




Above: *There is little point in opening out the grilles if the deep inner skirt of the locomotive chassis is left in place to blank off the bottom of the opening. As it is undesirable to remove more than the absolute minimum the gaps need to be carefully marked out. This could be done by careful measurement, but the most satisfactory method is to offer the body up to the chassis and mark the actual position of the grill on the chassis skirt with a felt-tip pen. The left-hand gap has already been cut away. It is best to mark out each gap in turn, since it is very easy to wipe the felt-tip marking away whilst handling the chassis during cutting.*

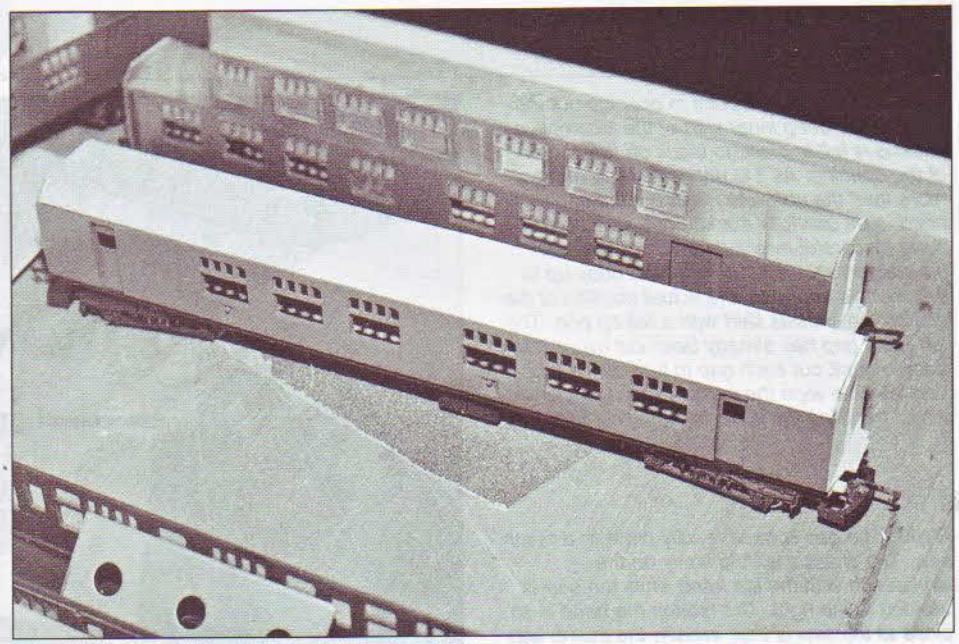


Right: *The gap is most readily cut with a razor saw. The chassis is held firmly on the workbench with the left hand while the saw is wielded in the right. The reason the hand is so close to the saw is that, initially, the thumb was used to guide the first strokes of the saw. In this instance, I wasn't doing the job. One of the members of the Model Railway Club's 16.5 group kindly showed me how it is done during the 1994 IMREX exhibition.*

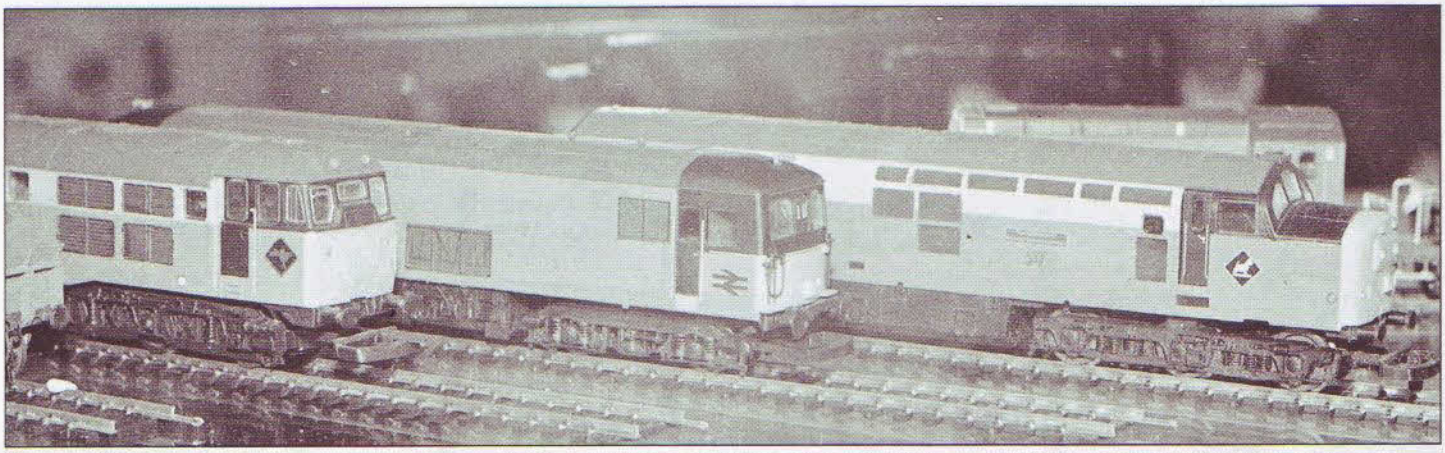


Modelling the Diesel Era in 4 mm scale is even further simplified by the fact that all six classes (Mk I, Mk II, Mk IIA & B, Mk IIC, D & E, Mk III, and Mk IV) of BR corridor coaches are available in ready-to-run form. Although all variants are not available, particularly in the very varied Mk I series, the plastic body shells lend themselves to ready modification.

Here we see a set of Mk I body shells being converted to form an overhead wiring train, as happened on the prototype. Some of the window openings have been filled in with plastic sheet, whilst a door recess has been produced by cutting away the side and backing the hole with plastic sheet. The body shell was then carefully smoothed with fine wet and dry abrasive paper, before being airbrushed in rail blue. The original glazing is discarded and new windows inserted. These are special mouldings produced by Ratio for BR mass-produced coaches. This simple modification can be carried out on any coach and transforms it from a basic commercial product with unprototypical deep windows to a good model with the correct flush glazing.



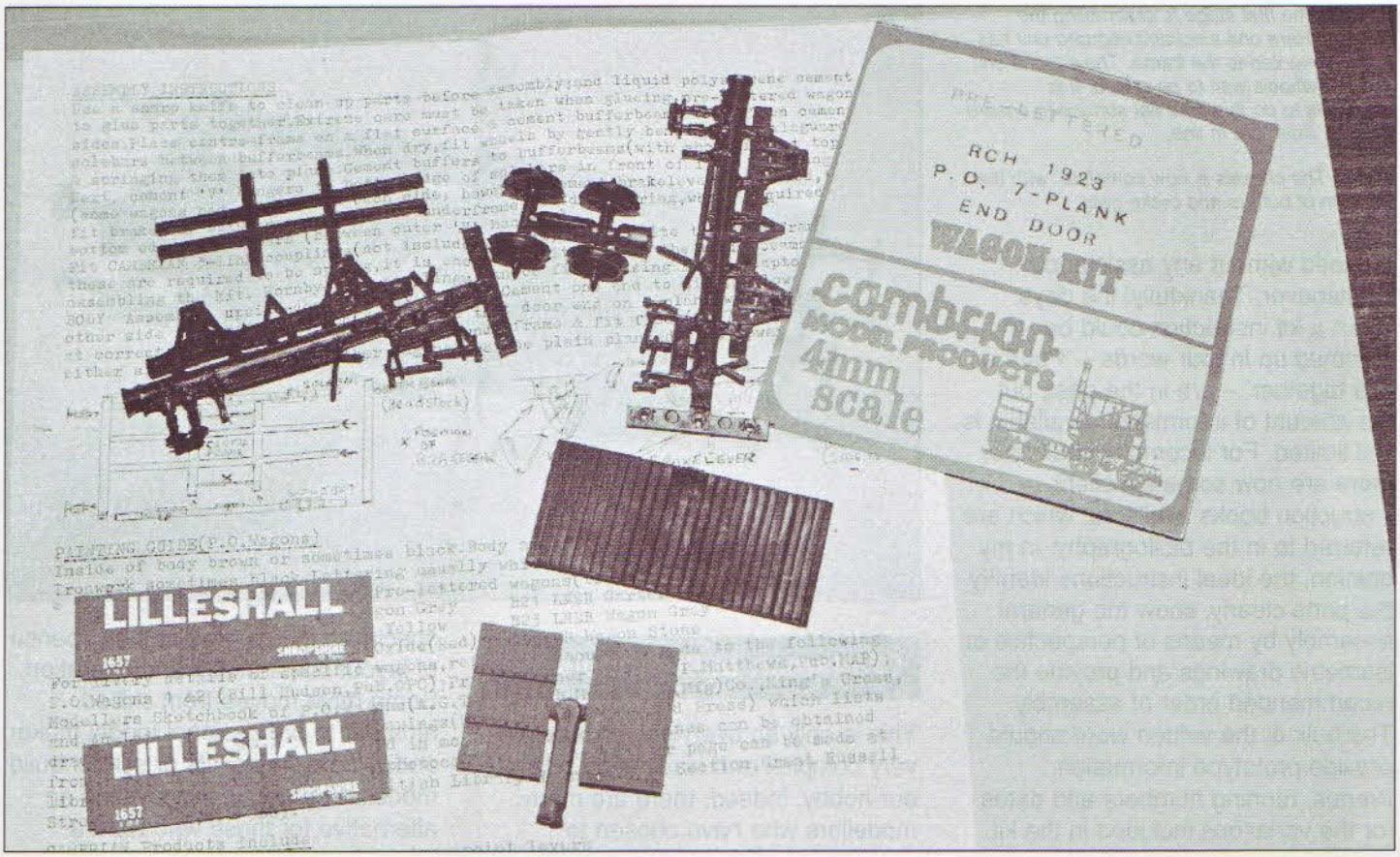
The most significant feature of a wiring train coach is the replacement of the elliptical roof with a flat wooden top on which the crew can comfortably stand whilst attending to the overhead. On the model, the change is greatly simplified by the fact that the roof is a separate moulding, which can be put into the spares box and replaced by a new top made from plastic sheet. Replacement flat ends are also modelled in this useful material.



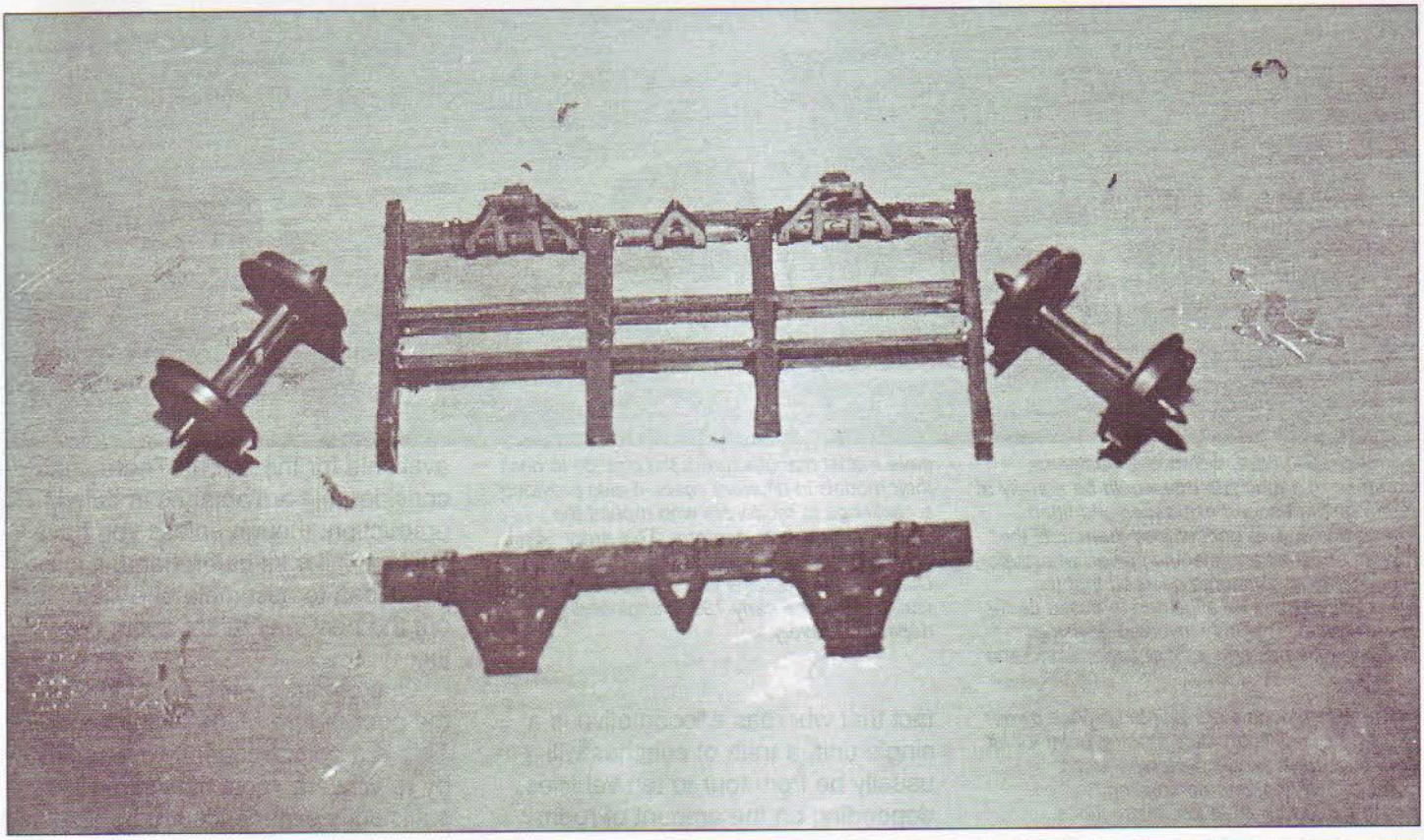
For over 150 years, locomotive designers dreamed of a machine that would be equally at home on high-speed expresses and fitted freight trains. This goal eluded them until the advent of diesel and electric power, whereupon a gaggle of accountants decreed that the locomotives must be allocated to duties under sectorisation. This only involved devising elaborate liveries and a lot of paper work, and gave model manufacturers the chance to deck their models in different coats. It also provided a challenge to modellers who repaint the standard models to conform. This array shows, from left to right, a Class 31 diesel, a Class 73 electrodiesel and a Class 37 diesel in variations of the early 1990s engineering department livery.

fact that whereas a locomotive is a single unit, a train of coaches will usually be from four to ten vehicles, depending on the amount of room available for the layout. There are considerable advantages in batch production, though unless you have built a similar kit beforehand, it is a good idea to assemble one kit to find out the best way to set about the job.

One common criticism of kits is the poor nature of the instructions. This is a point frequently overlooked by re-viewers, most of whom are sufficiently experienced to be able to

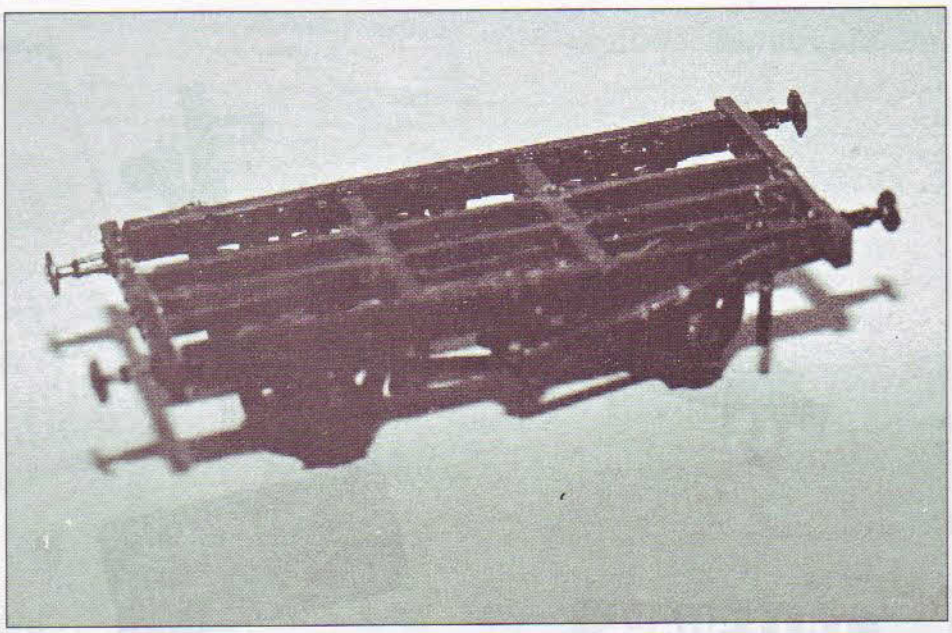


A Cambrian Models pre-painted private owner wagon kit. This is an ideal starting point for kit construction, a simple prototype and a complete kit requiring no painting, accompanied by adequate instructions.



Above: *The first stage is assembling the chassis. Here one solebar/axleguard unit has been cemented to the frame. The second unit and the wheels wait to be added. It is advisable to do this on a flat surface to ensure that the axles are in line.*

Right: *The chassis is now complete, with the addition of buffers and brake gear.*



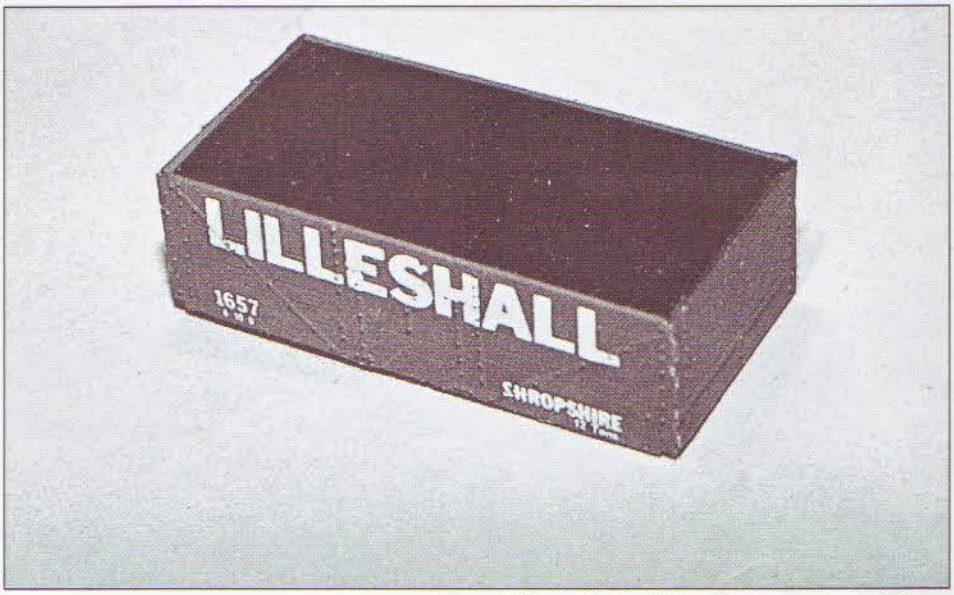
proceed without any assistance whatsoever. Thankfully, the days when a kit instruction could be summed up in four words – 'Put the bits together' – are in the past, but the amount of information available is still limited. For locomotive builders, there are now some excellent instruction books available, which are referred to in the bibliography. In my opinion, the ideal instructions identify the parts clearly, show the general assembly by means of perspective or isometric drawings and provide the recommended order of assembly. The bulk of the written word should provide prototype information, liveries, running numbers and dates for the variations included in the kit.

Craftsman-built models

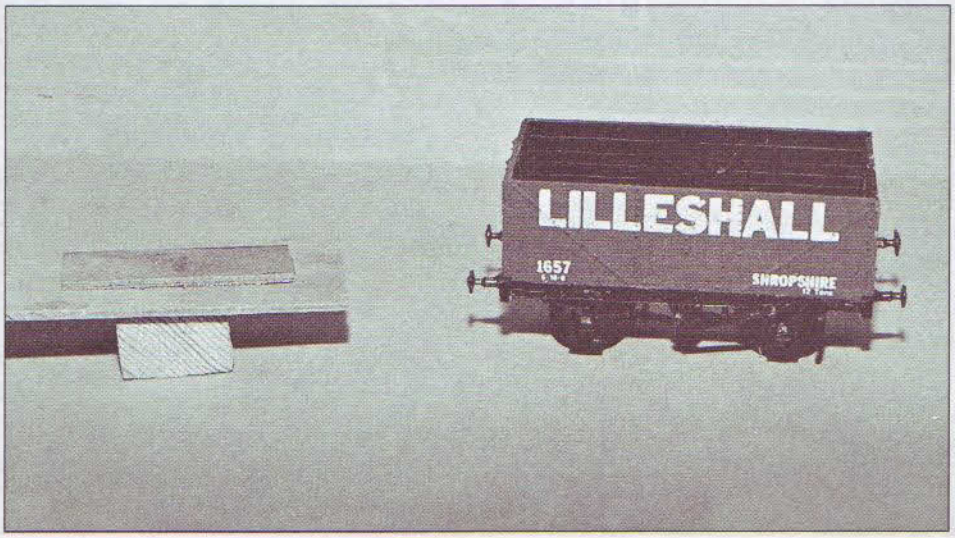
This is only an overview of what is a very complex and fascinating side of our hobby. Indeed, there are many modellers who have chosen to specialise in this area at the expense of layout construction and operation. Some have moved from skilled amateur to professional model maker and will assemble kits or scratchbuild models to order, thus providing an alternative for those who want a

The next stage is assembling the wagon body, a straightforward matter of putting the four sides together on the base. Two points need to be noted, first that the 'hinged' end door is fitted the correct way round, and second that all corners are square.

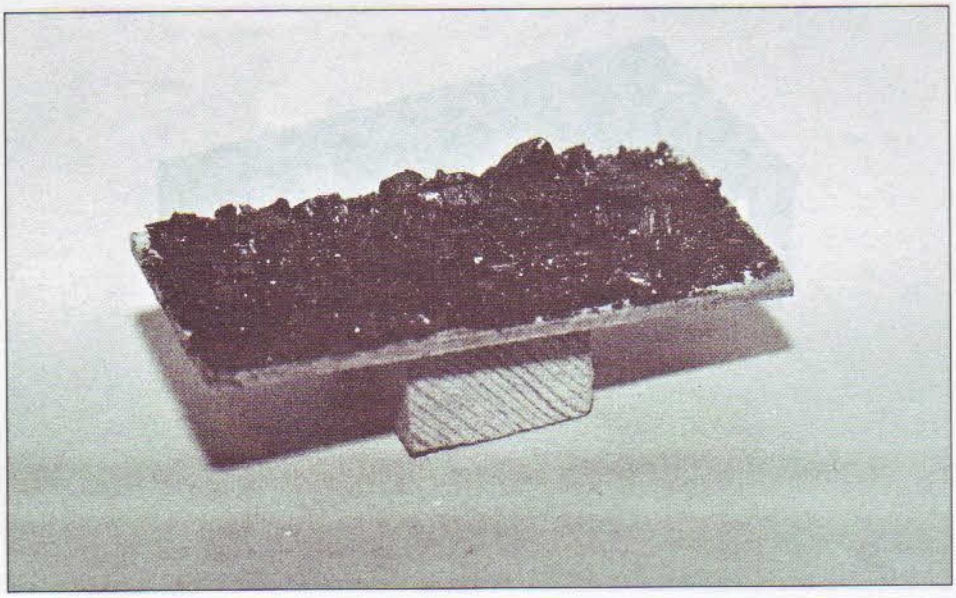
All that remains to be done now is to fit the body to the chassis. Or is it? For a start, couplings need to be added. In most instances the builder will adopt the type already in use, which for most British products means the tension lock coupler. The options are the prototypical, but non-automatic three-link and specialist couplings such as the unobtrusive and very popular Sprat & Winkle marketed by Model Signal Engineering Ltd, or the long-established Peco Simplex. Coupling choice is a very personal matter, I have merely mentioned the four types I have experience with and know to work reliably. Then there is the question of loads...



different model and are prepared to pay for it. Such models do not come cheap and there is a belief that this course is only open to the very wealthy. In point of fact, men on quite modest salaries are prepared to save steadily in order to own a craftsman-built model.

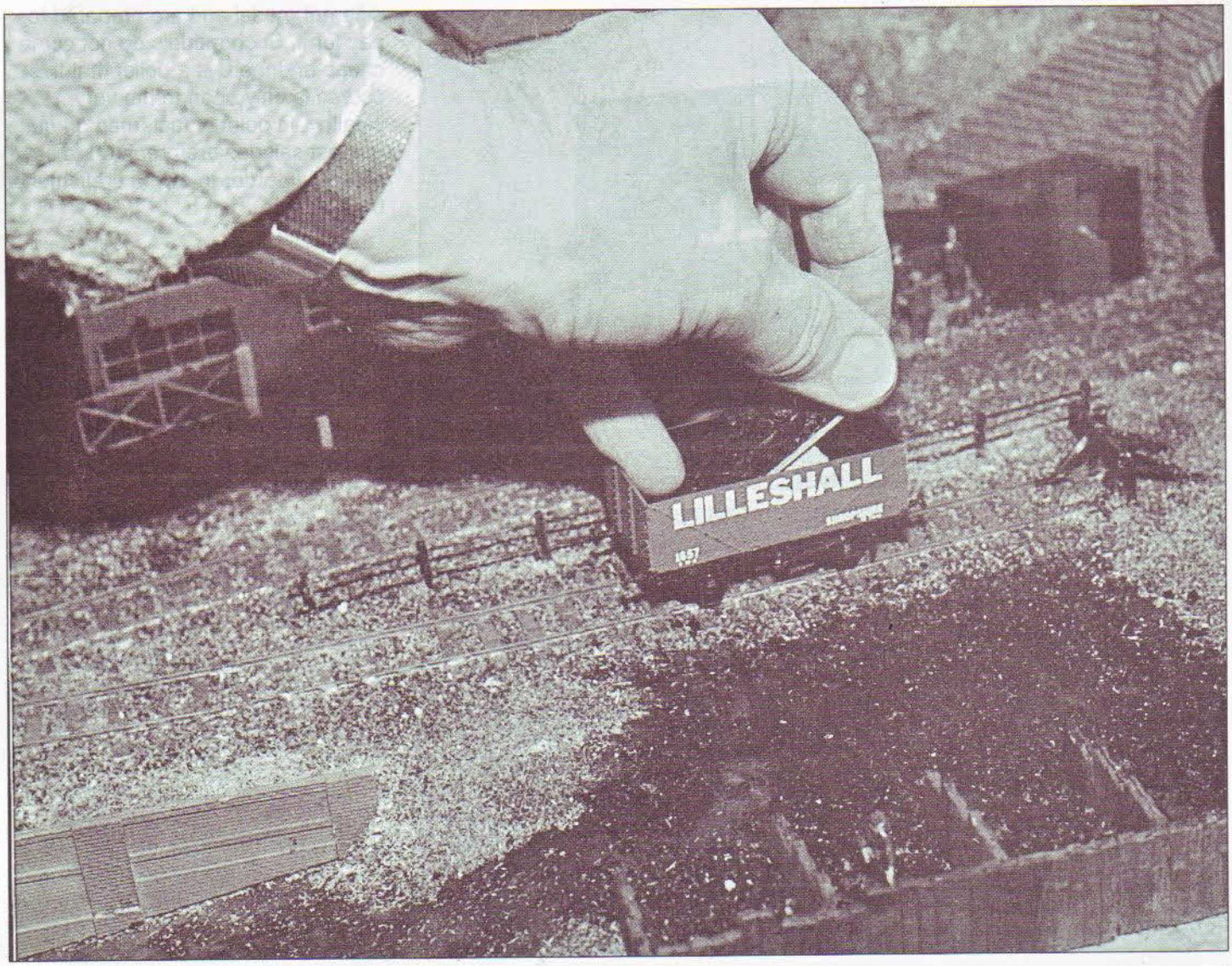


Private owner wagons were predominately used for coal traffic, and the Lilleshall wagon is no exception, as it is a colliery owned vehicle. It could simply be filled with loose coal, messy and liable to be spilt. The better route is to provide a removable load. This is built on a simple base, consisting of a rectangle of material (wood in this case) that fits snugly but freely into the wagon body. This is supported on a small wood block to bring it close to the wagon top, and, in this instance, has a bit of packing to help build up the load.



Left: *The load is glued to the base. Coal is not only the most common load on a steam age railway, it is also the easiest to model realistically. Coal is a very friable material. All you need do is take a small lump, wrap it in a piece of rag and belabour it with a hammer. The resulting dust needs to be sieved to take out the overscale lumps, which can get a further beating in due course. The only problem today might be finding your lump of coal in the first instance. My supply came from a preserved railway.*

Below: *Coal wagons ran loaded in one direction and unloaded in the other, so it is not a good idea to have a permanent load in the wagon. The reason the packing block is quite small is that, by pressing down on one end with the finger, the load will tip and can be taken out. When a layout is operated to timetable, the removal and replacement of loads takes place between 23.59 hrs of the first 'day' and 00:01 hrs of the second.*



Chapter 15

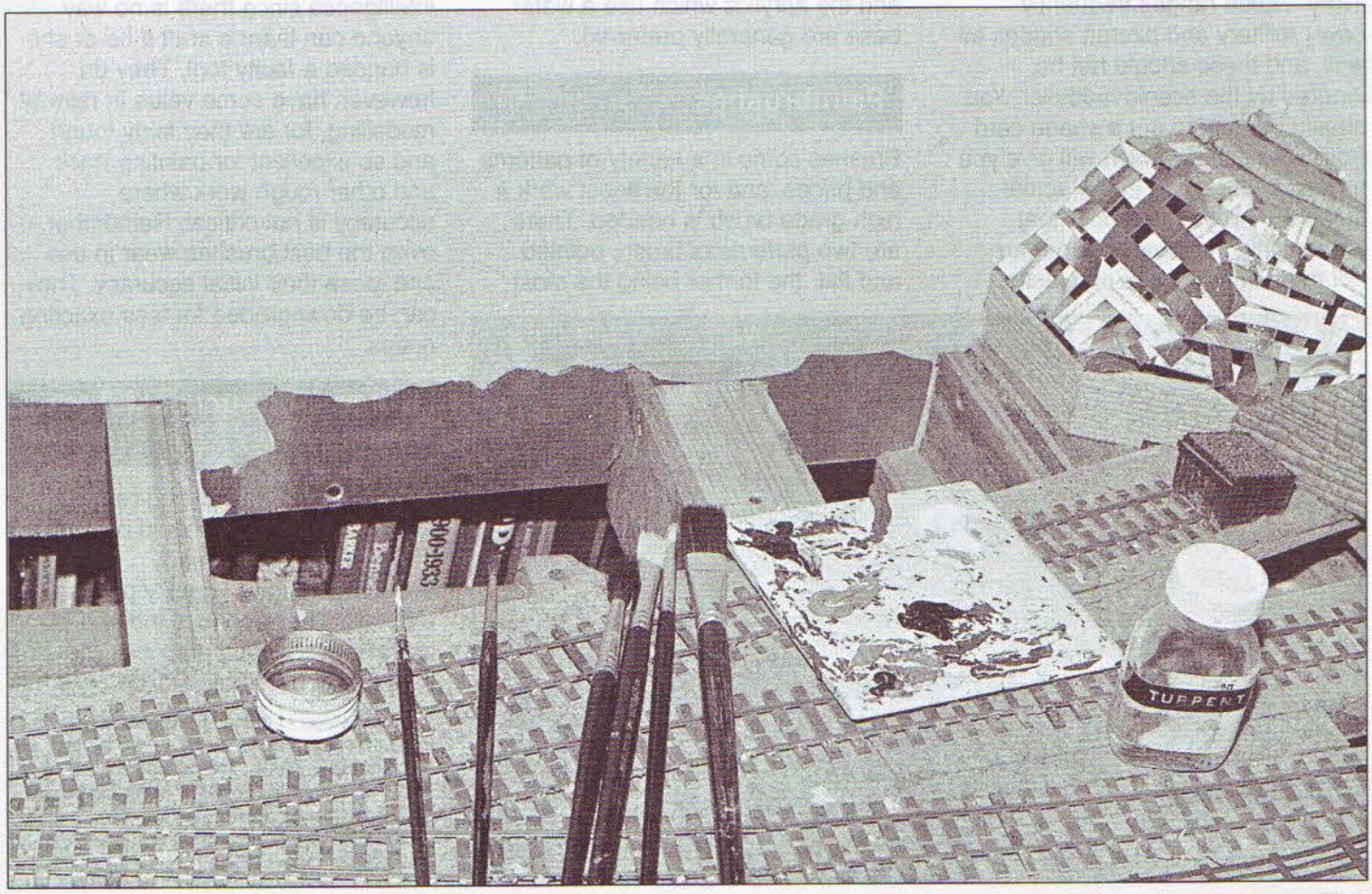
Paints and Painting

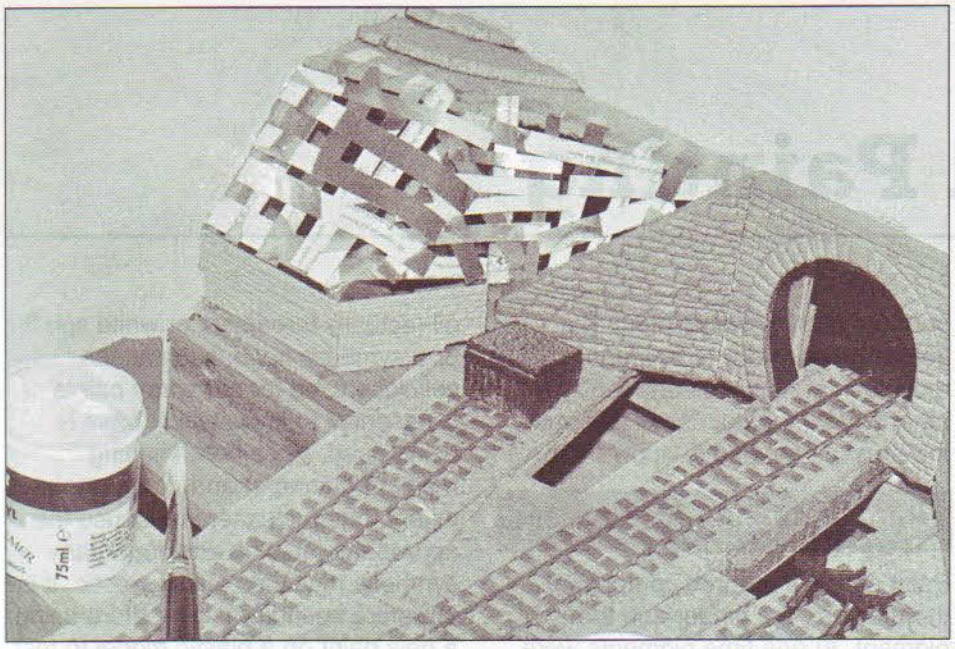
More models are ruined by a poor paint job than from any other cause. There is a very good reason for this: painting only looks simple. Many experienced locomotive modellers don't even attempt it, but pass their models over to a professional. Unfortunately, this option is not open to the scenic modeller, who must perforce do his own painting. But before we consider techniques, we must look at materials and tools, in other words, the paints we use and the brushes needed to apply them.

Painting the 'landscape' on a 'sky' background. The various paints have been put on to the palette, mostly greens and blues, with a fair amount of flake white and a very little black. A selection of brushes has been laid out ready, turpentine is in the bottle cap and the ready-use bottle is also to hand.

Choosing paints

Paint consists of three components, the medium, the binder and the pigment. At one time pigments were made by grinding natural materials, but since the 1940s increasing use has been made of synthetic colorants. The medium can be water, oil (actually turpentine or white spirit) or a synthetic base, such as the cellulose used for car spray paints. It is essential to know which base is being used, since both thinning medium (thinners) and, to a certain extent, brush cleaners must use the appropriate fluid. In addition, many synthetic mediums attack plastic. It is therefore sound practice before using a new paint on a plastic model to test it on an unobtrusive part of the moulding. Oil and acrylic-based paints, the most common model paints, are safe.





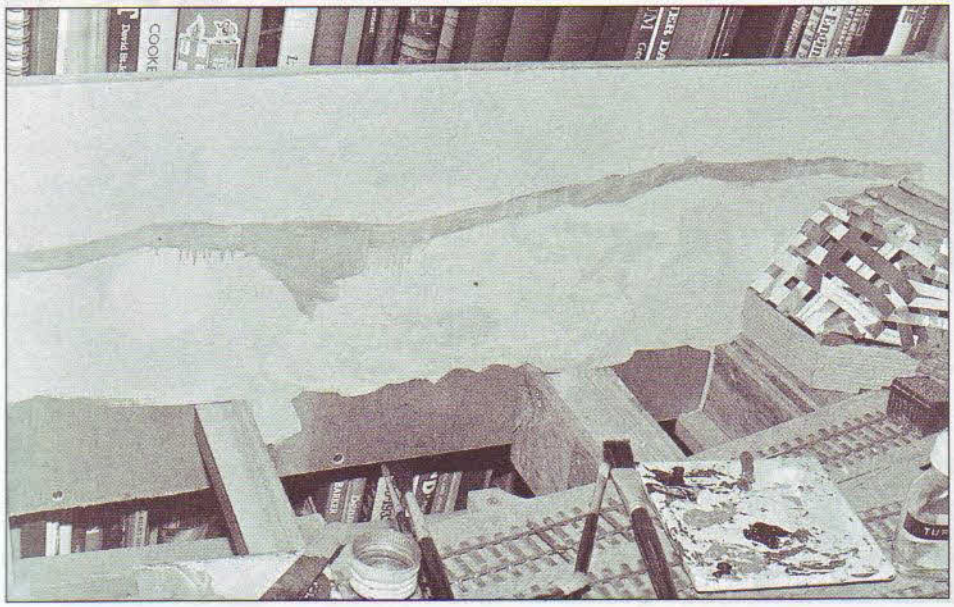
Left: The first stage in painting a backscene is to apply emulsion paint to the plywood to seal the grain. I used sky blue paint from one of the small tester pots that were widely available some years ago. This was a good idea that hasn't caught on, and the quantities were ideal for modelling.

There are several ranges of model paint on the market, with colours matched with considerable accuracy to the original railways' livery. These ranges frequently cover military and aircraft shades as well, and these should not be ignored by the scenic modeller. You should be able to get a shade card from your dealer, which will give you a reasonable guide to the actual colours. Always remember that printing inks for card or paper are not the same as paint on plastic, wood or metal. You can also get a wide selection of colours in tubes from an artist's supplier. Artists' oil-based paints are very slow drying, and the acrylics which use a water base are generally preferred.

Paintbrushes

Brushes come in a variety of patterns and prices, and for the finest work a high-grade brush is needed. There are two patterns of brush, pointed and flat, the former being the most readily available. Not all pointed brushes finish in a fine point, although the more expensive artist's sables are more reliable in this respect than the cheaper modeller's brushes. However, although a brush that doesn't make a perfect point is of little value for top quality painting, it is quite useful for less exacting work. In addition, the relatively inexpensive flat artist's brushes which are now widely available in DIY stores and even street markets are, I find, quite adequate for much scenic work.

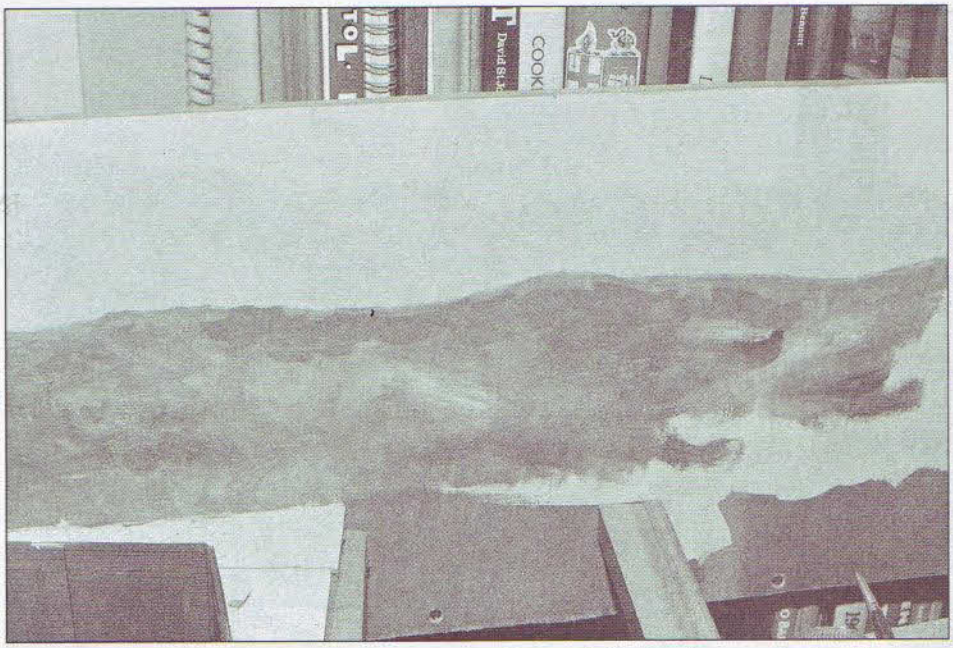
There are some very cheap bristly brushes which are offered as suitable for children. This infuriates anyone of intelligence since there is no way anyone can learn a craft if he or she is handed a faulty tool. They do, however, have some value in railway modelling, for are they fairly tough and so excellent for painting track and other rough work where accuracy is not critical. Remember, even the best brushes wear in use and loose their initial accuracy. They can be downgraded for less exacting duties.



The next stage in painting the backscene was to rough out the skyline with a very dilute wash of greeny blue. The dilution can be seen by the little dribbles from the paint. These are not significant here, although they would only be serious were they running well down the backscene.

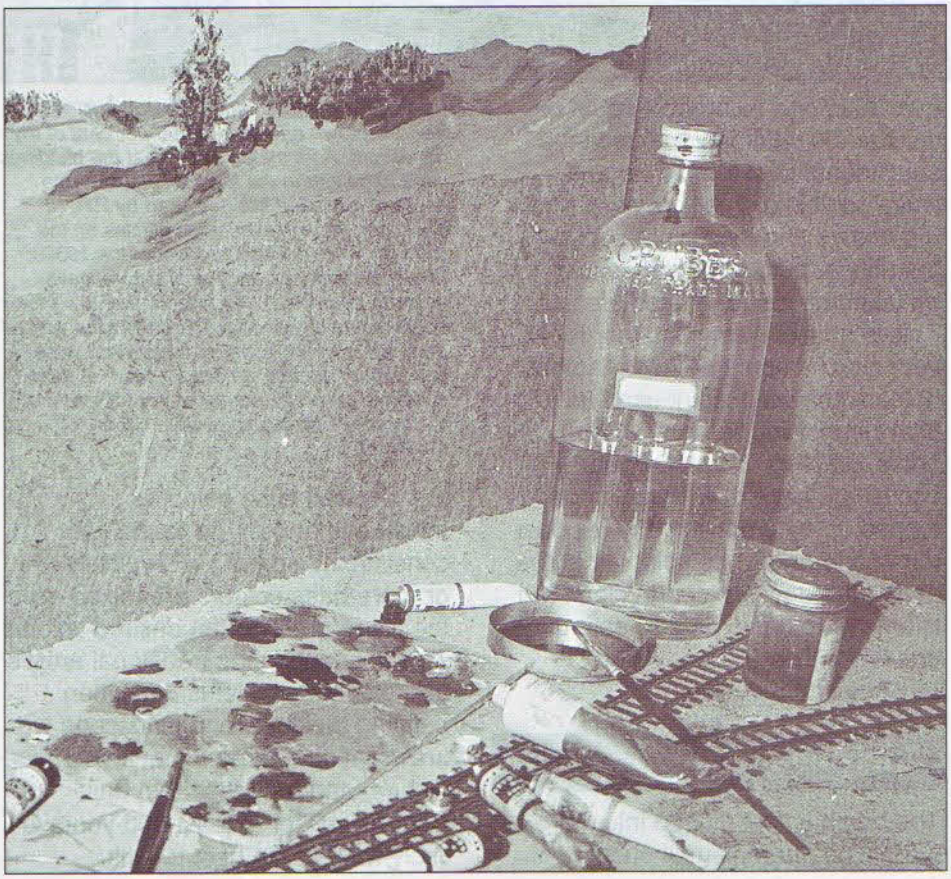
Criteria for successful painting

Successful brush painting requires that four conditions should be met. The first we have already encountered, good quality paints and brushes. The second is the one we meet in every craft, practice. The third is a comfortable stance, with the



A monochrome picture does not show the range of colours used; in this instance the loss is small because there wasn't a large range to begin with. Where many people fall down is forgetting that this is a backscene, *not a landscape painting and that the middle distance and foreground are provided by the low-relief buildings and the track respectively.*

Too much detail only serves to draw the eye away from the model. Bowing respectfully to the Impressionists and taking my cue from Turner, I just slapped greens, blues and a little brown on to the plywood to create an illusion of distant hills, knowing that most of it would be covered anyway.



painting wrist well supported for fine work. You may find that for detail painting, some form of magnification is desirable. The fourth is a good light of the same colour temperature as the model will be viewed under.

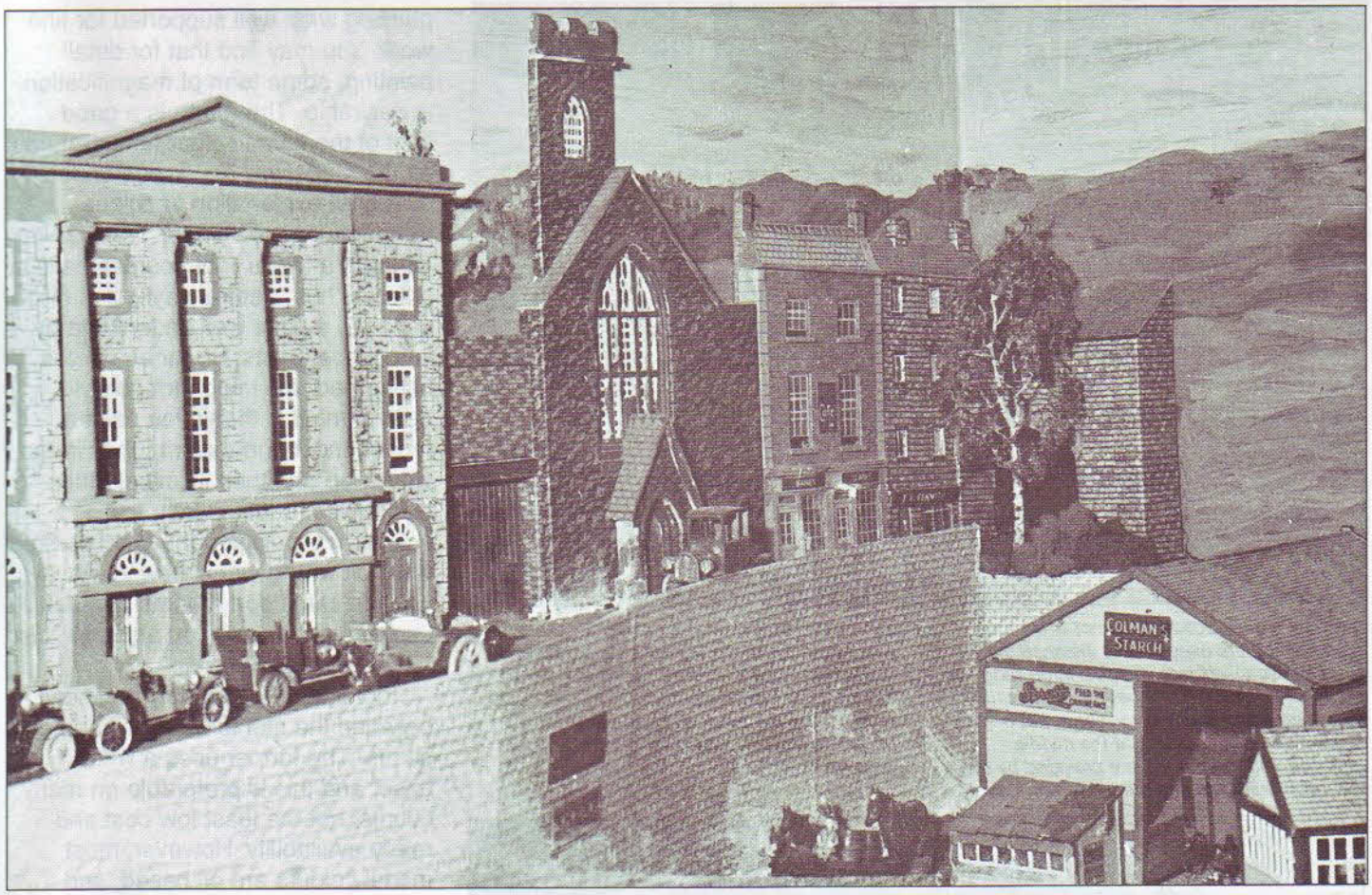
A brief explanation of colour temperature is called for. Not only do different artificial light sources have a different hue, natural daylight is also variable, a point well understood by landscape artists. So far as we are concerned, the important point to bear in mind is that if you paint a model under fluorescent tubes in the workshop and then illuminate the layout with tungsten lamps, the colours which look right when painted will look wrong when viewed. Always use the same sort of lamp and don't use daylight unless you also use this to view the layout.

Today, opinion is finely balanced between the merits of acrylic and oil paints. The former uses a water base, and this is preferable on many counts, not the least low cost and ready availability. However, most model colours are oil based, and my own techniques are based on this type of paint.

Painting techniques

There is no short cut to successful brush painting. It is very much a case of practice making perfect. The most important thing to bear in mind is not to apply too much paint in one coat. This not only takes a very long time to dry, but it also covers all detail and produces an unattractive, overly glossy effect that is unkindly referred to as painting with a tarbrush. If anything, err on the side of caution. Several very thin coats are preferable to one thick one.

Work in progress on an earlier backscene for my 1955 Tregunna. *Here I set out to create a more detailed painting, which was great fun and took a whole afternoon. It was quite effective. I even put in a couple of menhirs to accentuate the Cornish setting, and achieved some very effective trees.*



I was quite pleased with the result until I built a low-relief town and covered 90 per cent of my handiwork! As a matter of interest the buildings were largely from the long defunct Anorma range of low-relief kits designed by P.R. Wickham, while the vintage vehicles on the roadway were another product of the 1950s. While by modern standards the cars leave much to be desired, the Anorma kits – a combination of wood, good quality card with all parts set out for cutting, superior brick paper and printed acetate windows – were at the fine cutting edge of current technology. Even more to the point, the buildings were full of character.

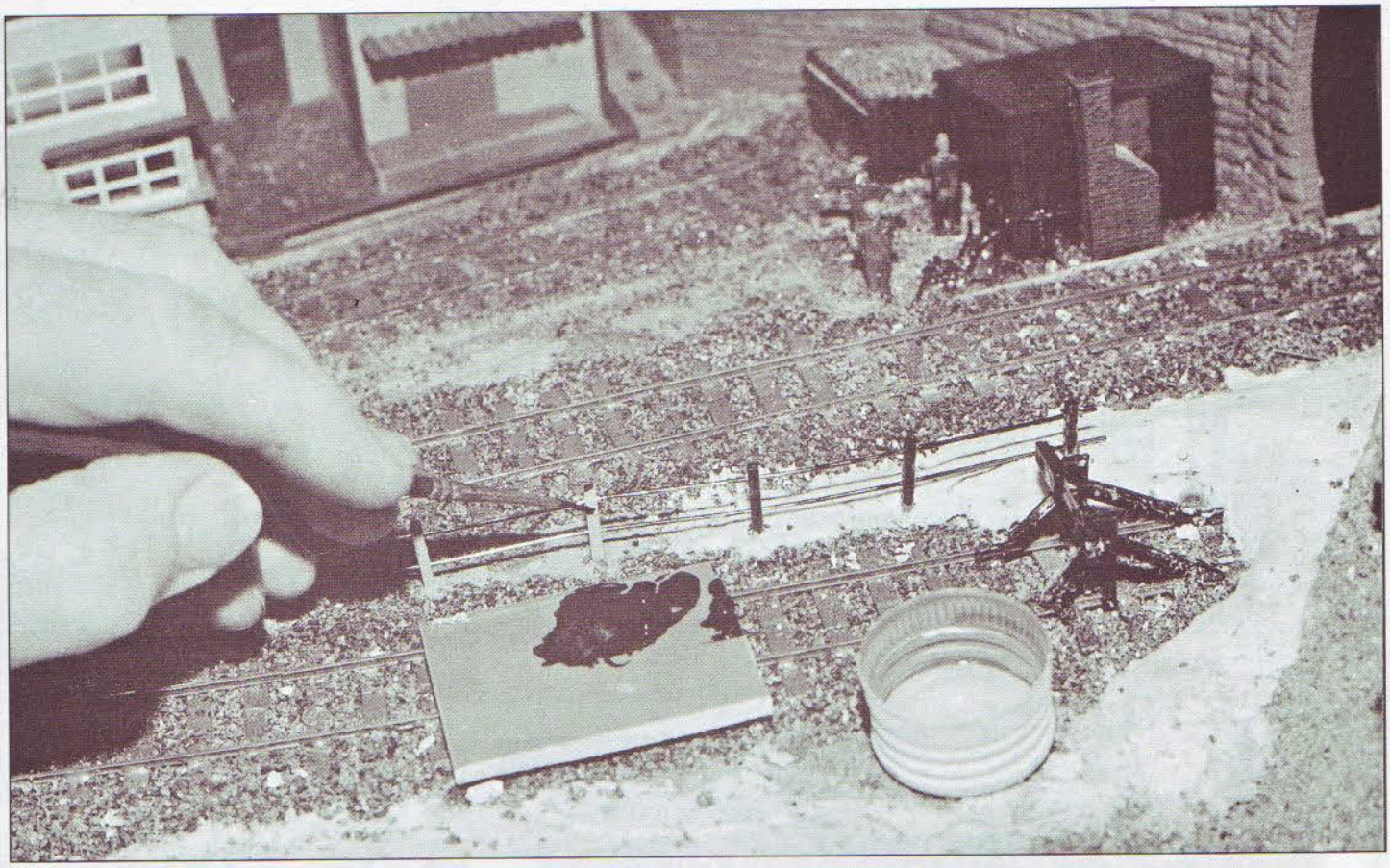
For detail work, it is vital to support your wrist. One advantage of painting plastic parts on their sprues is that you can lay them flat on the working surface and rest your wrist on the bench top. It can help to paint on a sheet of plain white paper.

For scenic and building work, I do not use model paints as supplied, but pour away slightly over two thirds of the supplied medium, leaving a sticky mass of pigment. Small quantities of the pigment are then placed on a palette, or, to be exact, a plain ceramic tile. Several colours are put on the same tile, the exact selection depending on the effect I want to achieve. Occasionally I supplement these with artist's oil colours.

Turpentine is generally regarded as the best medium for oil paints, and is stocked by the better DIY outlets. As I dislike having large quantities of a flammable liquid on or near the workbench, I decant a small quantity of turpentine and white spirit into small capacity screw top bottles and then pour a small quantity of pure turpentine into a metal bottle top for immediate use. This is an excellent container for a very small amount of fluid. Another holds some white spirit used as a final cleaner for brushes. A third bottle, labelled `Brush Cleaner' contains a base of white spirit and is topped up by emptying any residual turpentine and white spirit left at the end of the day. A piece of clean rag is always to hand, as well as a dirty one which has already wiped brushes and palettes.

Applying paint

The brush is first dipped into the turpentine, then a small quantity of the required base colour is moistened and mixed to the right consistency on the tile. Typically two or more base colours are mixed on the tile to produce the desired colour. This is adapting the traditional artist's approach. My belief is that when painting buildings and landscape we are creating a three-dimensional picture, and a method that has worked well for at least 500 years is likely to yield the best results.



Painting a length of fencing in situ. *A very small tile palette is being used since only one colour is needed. The bottle cap for the turpentine is just to the right, keeping both essential articles close to the working area. I am initially concentrating on the posts; the rails were dealt with afterwards. This was because the brush strokes for the two parts had to go at right angles to each other and it was less bother to keep a consistent approach. On a full scale fence you would work along from one end to save walking to and fro, but on a model it's just a matter of moving your arm.*

A fairly thin coat is best, because it dries more rapidly and has the matt finish we require. Several coats may be needed if you are trying to alter the colour of the base material, but where you merely want to reduce the sheen of a self-coloured plastic kit, very little paint is needed. Again, this is a matter for experiment and experience.

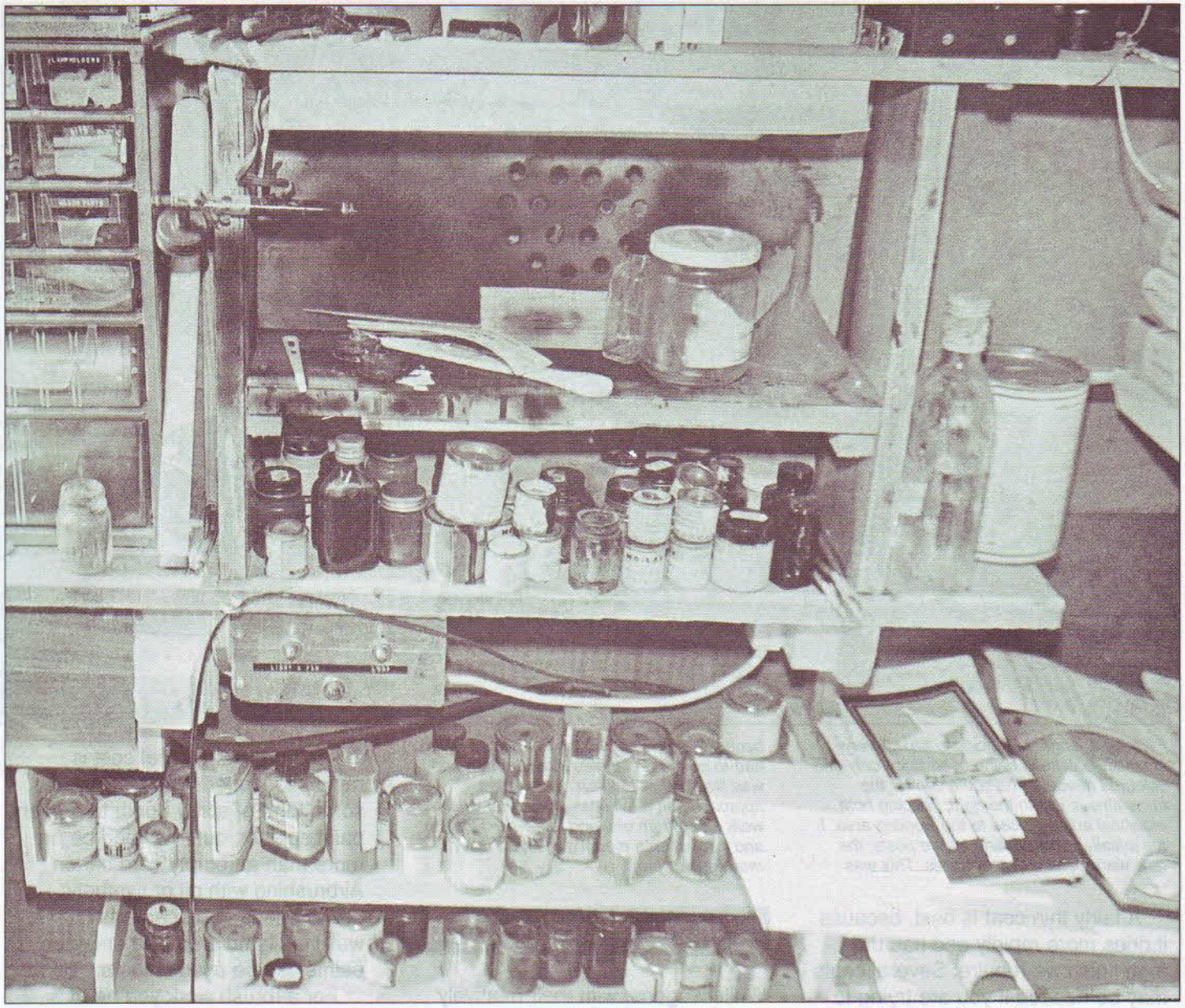
For buildings, the dry brush technique can be very useful. Here only the minimum amount of medium is used, the paint is almost dry and applied only to the surface detail. It's very effective on moulded or embossed brick and stone. This process is difficult to explain but surprisingly easy to master.

Using an airbrush

While wagons, with their relatively plain, sometimes rough finish, are readily brush painted, getting the superior finish needed for locomotives is another matter. That it can be done is beyond question, but there is ample evidence that it is not simple. My own preference here is to use an airbrush. This calls for a good deal of investment, since apart from the airbrush you need a compressor. The aerosol cans of propellant are insufficient to paint more than one, perhaps two coaches, which leaves nothing for cleaning the airbrush after use, so the compressor's initial cost is rapidly recouped. You also need some form of spray booth to prevent paint splatter, but this need be no more than an empty card carton. Airbrushing with oil or synthetic bases needs to be carried out in a well ventilated area. Water-based paints can be used indoors.

For airbrush work you need to thin the paints to about the consistency of skimmed milk. The jet needs to be directed roughly at right angles to the surface to be painted and moved sideways and upwards at a regular pace, taking care to keep the distance between the nozzle and workpiece constant since any variation will result in an uneven application of paint. Only apply a very thin coat, the paint will dry sufficiently within half an hour at the outside to allow a second coat to be applied.

While the better airbrushes have



The spray booth in my Devonshire workshop. The series of holes in the back cover an extractor fan which in this instance blew directly out of the shed though a hole cut in the wooden cladding and covered by a sliding ventilator. Illumination was by means of a striplight and the control circuit was so arranged that until the light and fan were switched on, I could not start the compressor. The airbrush was held by a terry clip on the side of the booth. The bottles, jars and plastic funnel sat on the workspace when not in use. A selection of small tins, bottles and jars was kept on shelves below the spray booth. It was very much an ad hoc arrangement that had one undeniable merit: it worked.

an adjustable jet, allowing the experienced user to apply a narrow band of colour, masking is standard practice to confine the paint to the parts you want to paint. Special low-tack adhesive tape and film are made for this purpose. Normal adhesive tape (Sellotape) is apt to lift the paint. For more intricate work, masking paint (Humbrol Maskol) is excellent, it is a rubbery compound that can be applied with an old brush. Any excess can be trimmed with a sharp knife. When this technique is used for a complicated livery, the model begins to look a little like a character in a horror film, but when the final coat has been applied and has hardened, you peel the covering away to reveal the full beauty of your handiwork.

Chapter 16

Maintenance

Although a model railway will continue working after a fashion with little or no attention, a regular maintenance session will improve matters out of all recognition. How often these sessions are needed depends very much on how much use the model gets. Paradoxically the worst situation is where running only takes place on high days and holidays. It is axiomatic that if for any reason the layout has been laid aside for over six weeks, an intensive cleaning and oiling session is essential.

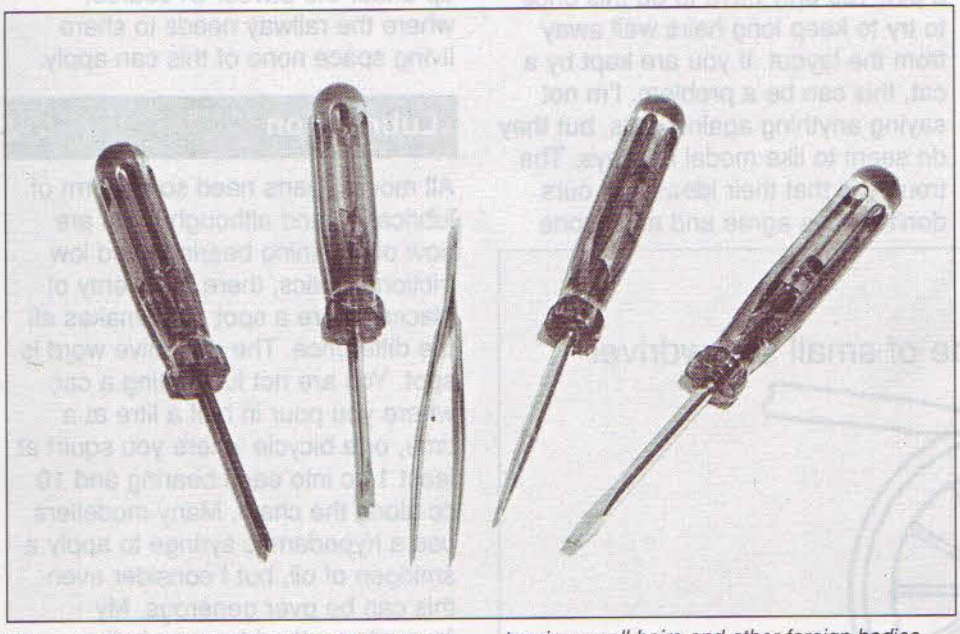
The main problem is gunge, a mixture of oil, fibre, hair and dirt with remarkable clinging power. As it has good insulating properties, so its effect is first noticed when trains begin to run slowly, then start moving in a jerky fashion. At this point the obvious thing to do is clean the track and locomotive driving wheels that pick up current from the rails.

Cleaning the track

The old idea was to use a cleaning fluid on straightforward abrasive pads, but these have now been discontinued because most had as their base the now banned carbon tetrachloride. The proprietary cleaning sprays sold by garages will reduce gunge, but often leave a nasty film of their own and may even end up causing more problems than they cure.

Instead track cleaning wagons are available for 16.5 and 9 mm gauges (HO/OO and N). They are hauled by the most powerful locomotive on the line and do a lot to keep the gunge from accumulating. Clearly, they can't do much when the track is really dirty and here the only answer is to apply a lot of elbow grease. Or to put it another way, go over every bit of track with an abrasive block.

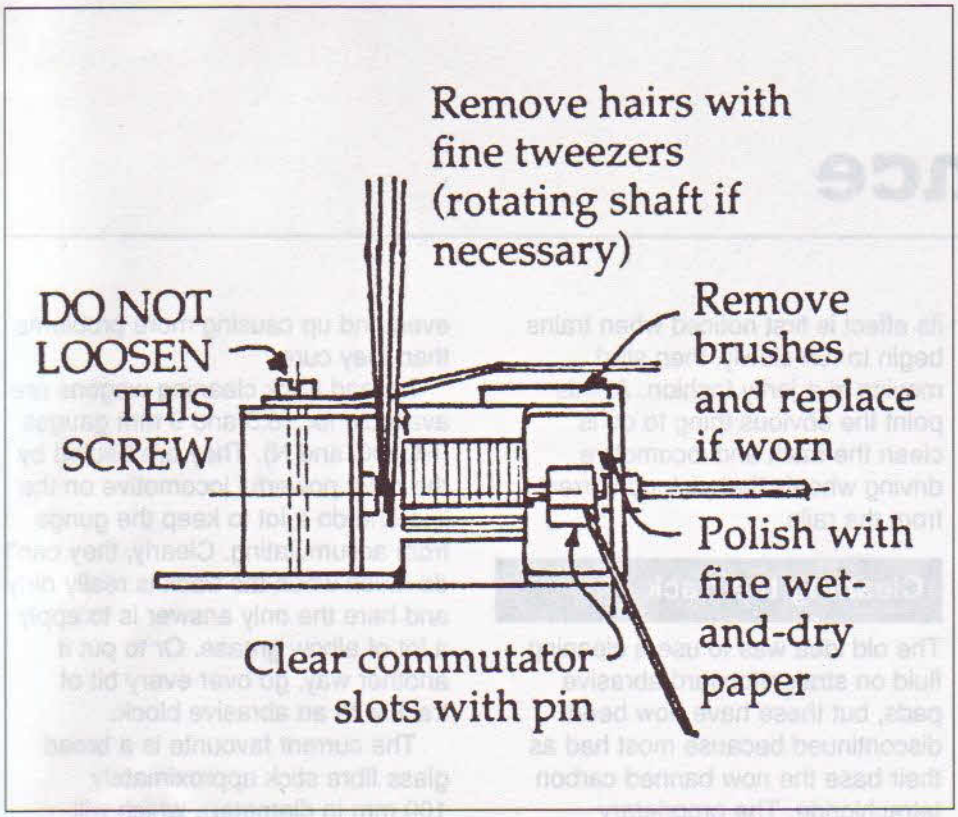
The current favourite is a broad glass fibre stick approximately 100 mm in diameter), which will clean one rail head and is very easy to use. The much smaller abrasive rubber, marketed by Peco, is my personal choice, and I've used one for years. What is much more to the point, a Peco rubber can be nailed to a strip of wood and used to clean otherwise inaccessible tracks.



This set of small tools came from Fleischmann (catalogue number 6598). The kit is designed for locomotive and other maintenance and comprises two flat screwdrivers in small and very small sizes, a small crosshead screwdriver, a fine bradawl and a pair of good quality pointed tweezers, the ideal tool for teasing small hairs and other foreign bodies out of mechanisms. It is ideally suited for its purpose, which is why I have never felt tempted to distribute the tools around my various tool stores, but keep them hanging in their wallet so that they are always to hand should any small mechanism need attention.

Wheels

It is little use cleaning the rails if the wheels are not given the same treatment. For locomotive driving wheels, a fine wire brush, insulated in the centre and connected to the power supply, will rapidly clean metal wheels, but is of little value when one wheel has a traction tyre as the wire will rip the tyre off in seconds. Gunge can be scraped off with the tip of a small screwdriver, and this tool will also remove the muck from coach and wagon wheels. These are frequently forgotten, since they do not immediately affect traction pick-up, but if left unattended they will rapidly put gunge back on to the rail

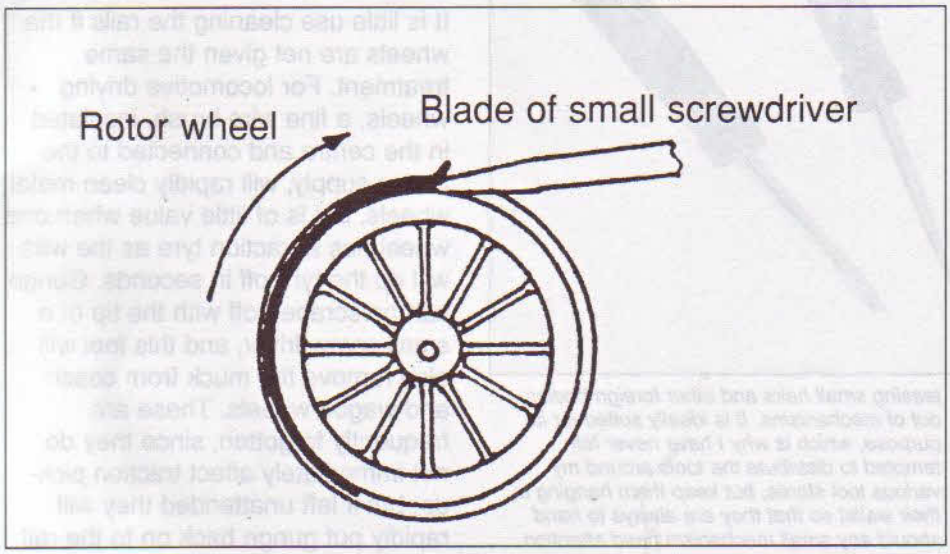


Maintaining motors.

head. If left too long, the build-up will start to initiate mysterious derailments since it alters the wheel profile and can reduce the flange depth alarmingly. Even with the coarsest wheels, you only have 1 mm to begin with.

If any long hairs get on to the track, a fair proportion end up wound around axles and shafts. They can be teased out with fine tweezers and a pin. You only have to do this once to try to keep long hairs well away from the layout. If you are kept by a cat, this can be a problem. I'm not saying anything against cats, but they do seem to like model railways. The trouble is that their ideas and ours don't always agree and as anyone who has more than a nodding acquaintance with them knows, cats do exactly as they please.

Removing muck from wheel treads.



Keeping a layout clean

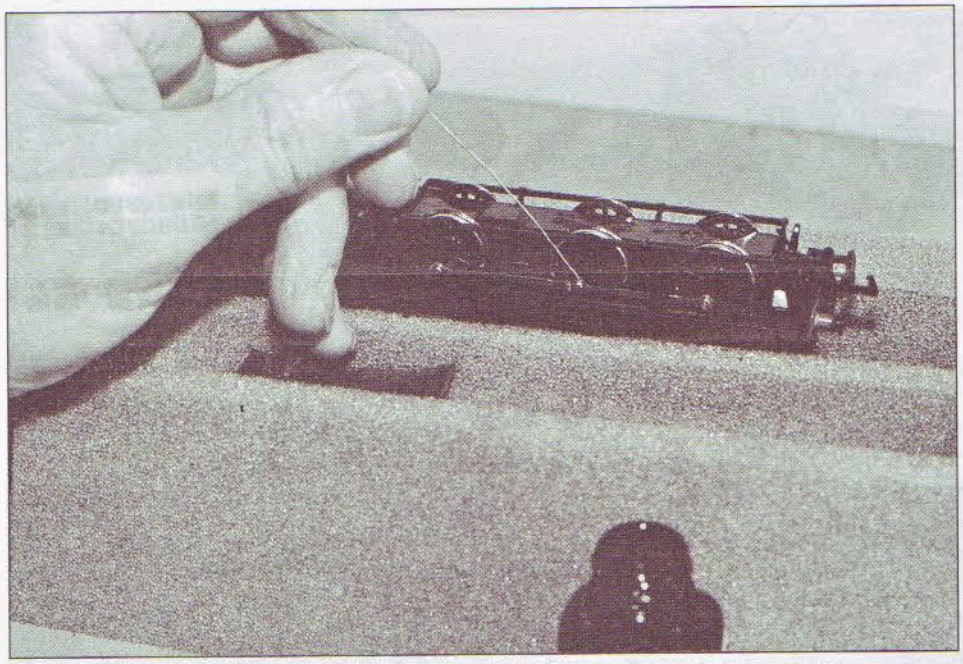
The trouble can be minimised if the deposit of gunge can be controlled, if not eliminated altogether. Unfortunately much of it is airborne, while a good deal of the oil arrives as a contaminant from internal combustion engines. If it were possible to seal the railway room and then draw air in through a filter with a powerful fan, a lot of trouble could be eliminated. This is not quite as expensive as it sounds but it does need a suitable room and a little foresight as it's the sort of fitting that needs to be put in before the layout.

A good deal can be done by keeping the room clean. It helps to live in a quiet side street rather than beside a busy road (point worth keeping in mind if you happen to be moving house). A loft needs a good inner lining, since a lot of dust blows up under the eaves. Of course, where the railway needs to share living space none of this can apply.

Lubrication

All moving parts need some form of lubrication and although there are now oil retaining bearings and low friction plastics, there are plenty of places where a spot of oil makes all the difference. The operative word is spot. You are not lubricating a car, where you pour in half a litre at a time, or a bicycle where you squirt at least 1 cc into each bearing and 10 cc along the chain. Many modellers use a hypodermic syringe to apply a smidgen of oil, but I consider even this can be over generous. My favourite method for over half a century is to apply a tiny drop with a length of wire.

Don't over oil, and in particular be very careful when oiling the motor



Oiling the chassis of a locomotive with a wire. The model is inverted in a proprietary foam plastic cradle which not only holds the model secure with no risk of damage, but also has a small pocket for the screws and other bits you might need to remove for overhaul.

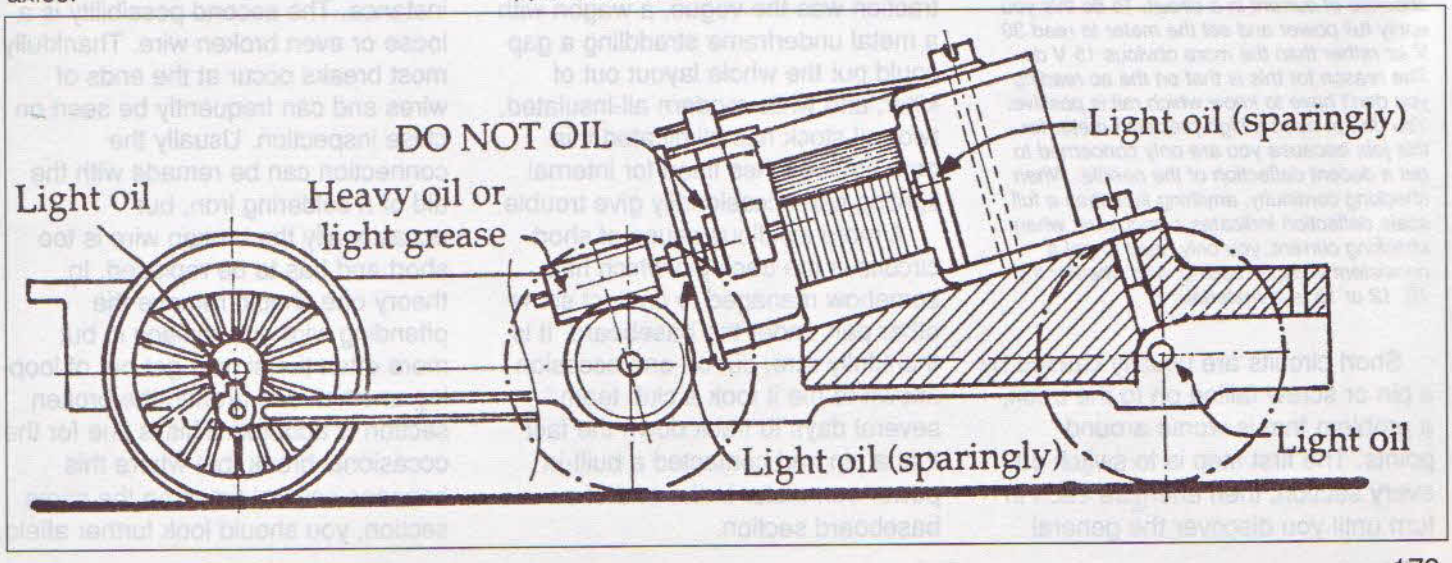
not to get any oil on the commutator. Apply a tiny drop to all joints on steam locomotive motion, side rods, connecting rods and valve gear, if fitted. Another smear on the crosshead will also help. A drop per wheel bearing is also required and a little oil on any bogie or pony truck pivots is also indicated. Oil coach and wagon axles.

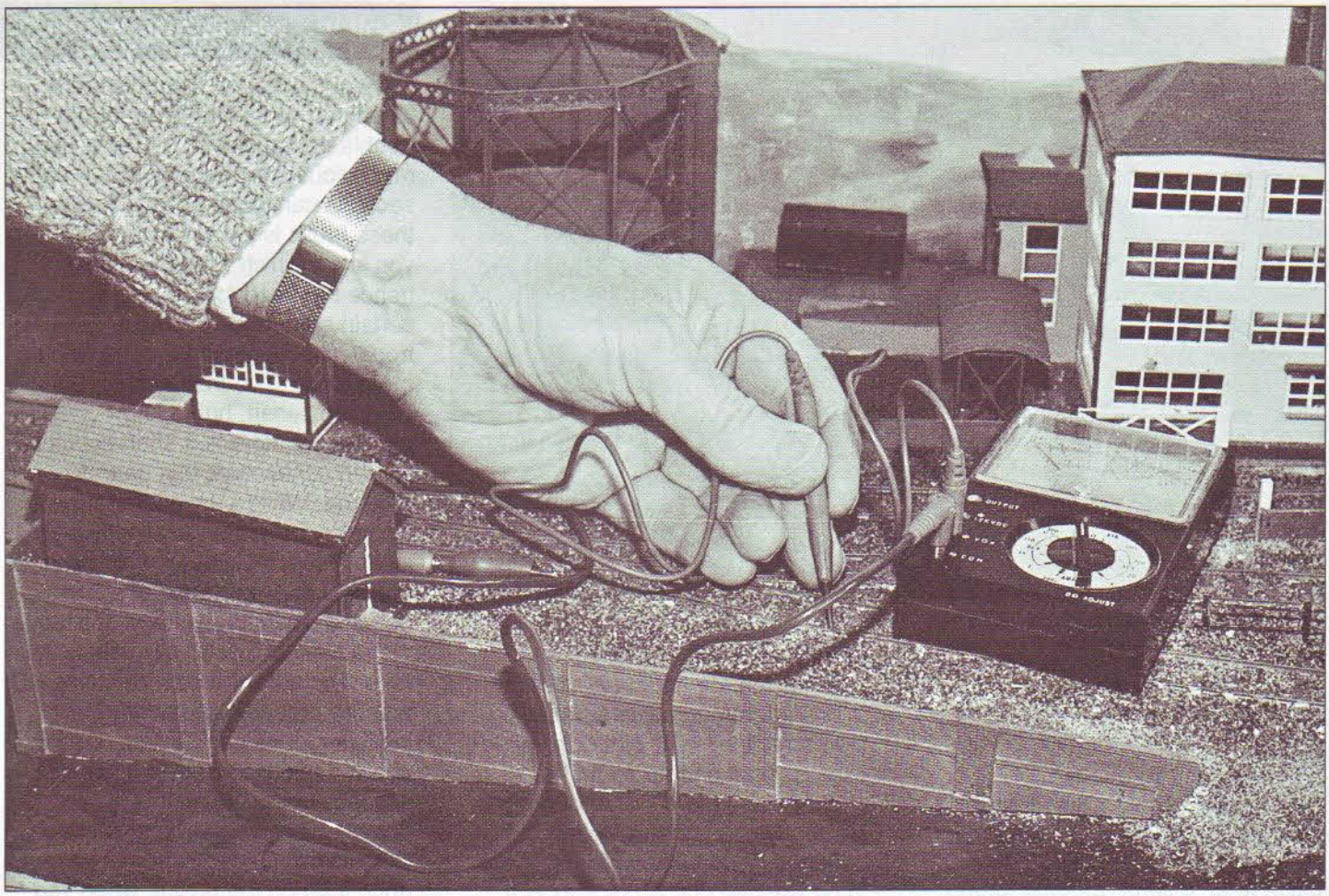
Be sparing with the oil. I know I'm repeating myself, but more locomotives are taken for attention to dealers through excessive oiling than any other fault. Not only will excessive oil end up on the track and increase the build-up of gunge, it also collects more gunge in the bearings. When this happens, it has to be washed out. A quick fix is a squirt of WD-40 or similar cleaner, but this can affect plastic. White spirit applied either with a cotton bud or a worn paintbrush is just as good, costs less, and can be applied selectively.

Solving wiring difficulties

In theory, once the layout is correctly wired you should have no further trouble in that direction. In practice, mysterious short circuits occur, and sections can loose power. Tracing these faults is always aided when you know which wire does what, hence the need for a wiring book. A certain amount of electrical troubleshooting can be done with no more assistance than simple common sense, but to know positively if there is a short circuit or broken connection, test gear is required. While simple lamp testers and buzzers are quite effective, an inexpensive multimeter which cannot only test the resistance of a circuit, but also check the voltage applied to the rail is more generally useful. As these meters will measure mains AC and the probes are properly insulated, they can be also used to check if mains current is flowing in suspect wiring. While this is not a common requirement and is more likely to be needed in home maintenance than on the layout, when you do want it, it is invaluable. It's much better to discover that a wire is live before you touch or cut it than to find out the hard way.

Oiling a steam-outline locomotive chassis.





Checking the track circuits using a multimeter. In this instance I have set the meter to read resistance (ohms) and am checking for continuity. This is registered by a full-scale deflection of the meter, but there are some multimeters on the market which incorporate a buzzer for this check. The meter will also detect the presence or, by default, the absence of current in a circuit. To do this you apply full power and set the meter to read 30 V ac rather than the more obvious 15 V dc. The reason for this is that on the ac reading you don't have to know which rail is positive. You do not need a high-precision meter for this job, because you are only concerned to get a decent deflection of the needle. When checking continuity, anything less than a full scale deflection indicates a poor joint; when checking current, you only need to get a consistent voltage reading, and whether it's 10, 12 or 15 is immaterial.

Short circuits are usually caused by a pin or screw falling on to the track, a problem that is worse around points. The first step is to switch off every section, then energise each in turn until you discover the general location of the short. This narrows down the area of search.

Occasionally no single section reveals a fault, which shows that something is bridging a section break. In the old days, when three-rail traction was the vogue, a wagon with a metal underframe straddling a gap could put the whole layout out of kilter, and while modern all-insulated, two-rail stock has eliminated this problem, coaches fitted for internal lighting can occasionally give trouble.

A more insidious cause of short circuits is the track pin which has somehow managed to contact some other part under the baseboard. It is thankfully rare, but on one occasion known to me it took a club team several days to track down the fact that a pin had contacted a built-in power connector in the end of a baseboard section.

The complete lack of power in a section is normally a clear indication of a broken connection, of which a common cause is a dry joint. Soldered joints can crystallise over a period if poorly made in the first instance. The second possibility is a loose or even broken wire. Thankfully most breaks occur at the ends of wires and can frequently be seen on close inspection. Usually the connection can be remade with the aid of a soldering iron, but occasionally the broken wire is too short and has to be replaced. In theory one should remove the offending wire and replace it, but more often the simple get-out of looping another wire around the broken section is adopted. This is fine for the occasional break, but where this happens several times on the same section, you should look further afield.

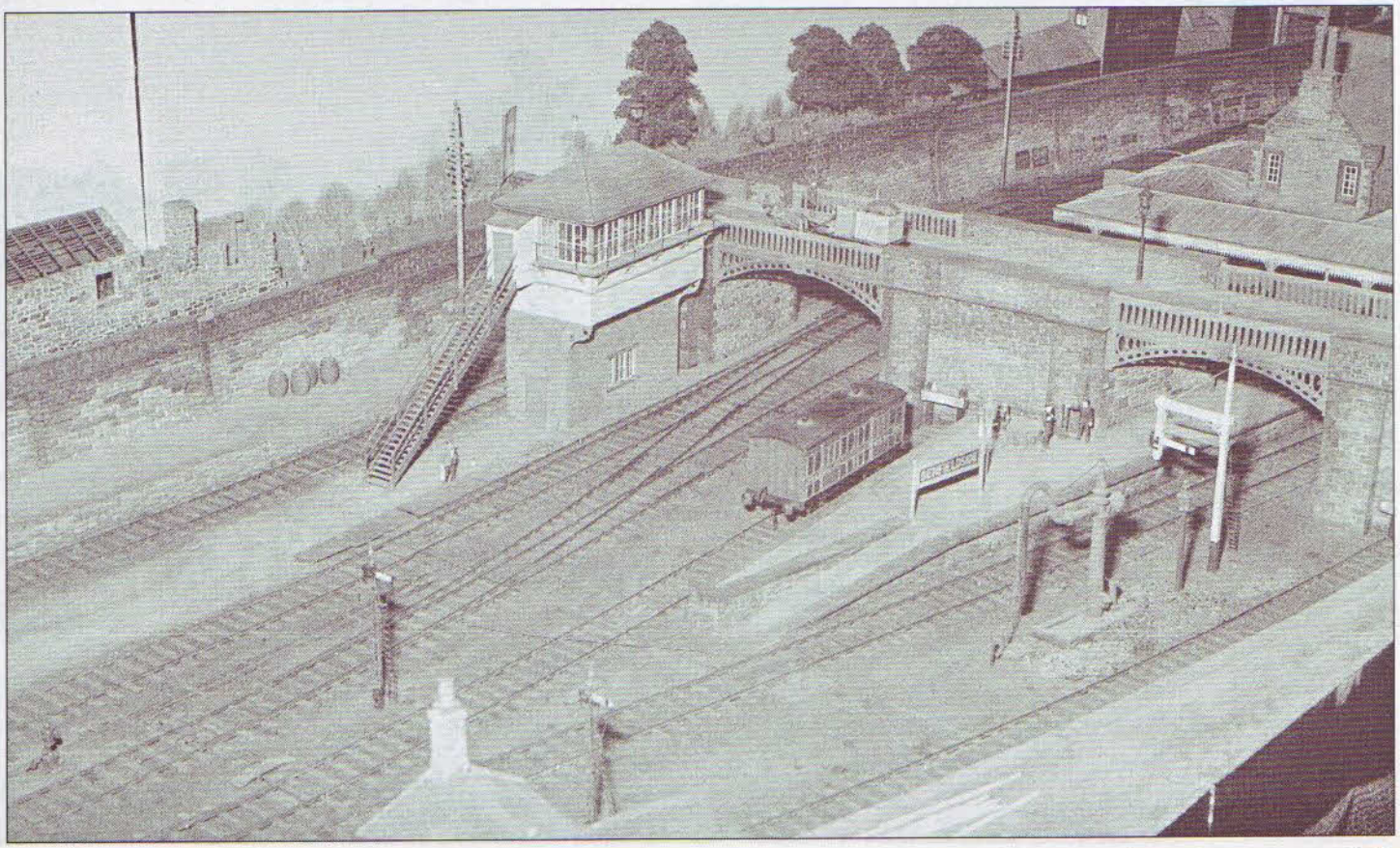
To break one wire is unfortunate, to break several suggests that the cable is flexing more than it should. Breaks along a wire are always caused by excess movement. Wherever a cable needs to move, multi-core (flex) wire must be used. Even this can be damaged by excessive bending, usually close to the plugs on a jumper cable if the cable is not correctly secured by the cable clips.

General wear and tear

Although most railway models are robust enough to withstand normal wear and tear for quite considerable periods, accidents do happen and over the course of time bearings wear out. On commercial exhibition layouts, where trains run for upwards of eight hours a day for six or seven days a week, rail heads are worn away and wheels either develop grooves or the flanges are worn to less than half their initial width. This sort of wear is unlikely on most model layouts, but I have had reports of this problem with intensively used club layouts. Clearly, when the track is laid with scale section rail and finescale wheel profiles are chosen, there is far less allowance for wear than with coarser standards, a point not mentioned by the proponents of these disciplines.

As well as wear and tear (and accident), other forces are at work. There are the effects of temperature changes, which can affect track alignment. Even well seasoned timber will alter its size with changes in humidity. Built-in stresses can over a period gradually distort material; rail is particularly prone to this since the process of manufacture inevitably stresses the metal. Warping is another hazard. This is an inherent property of timber, and it will also occur in hardboard and plastic sheet. Above all, the effect of sunlight on models is never benign, and it has been known to warp plastic body shells. This is not so much a catalogue of potential disaster as a reminder that anyone who believes that because a model has been carefully built and installed securely on the layout, it is going to stay that way indefinitely is an unabashed optimist. A little controlled cynicism is required. Murphy's Law (if a thing can go wrong, it will go wrong) is not a joke, it is a fact of life. To paraphrase a little, the price of reliable operation is eternal vigilance.

Benfieldside, *John Wright's superb EM gauge (4mm scale, 18.2mm gauge) layout, based on North Eastern Railway practice. The period is prior to World War I and although the station is imaginary, all the railway details are based on actual prototypes. While much of the model is scratchbuilt, full use has been made of commercial kits which are appropriate to the scene. The old North Eastern was a very distinctive railway, with its own design philosophy. Happily, several specialist concerns are now providing authentic NER kits, D&S Models are the principal suppliers, with an excellent range of coaches, wagons and lineside fittings. However, the cast iron overbridge, which looks absolutely right, is a slightly modified Wills kit.*



Chapter 17

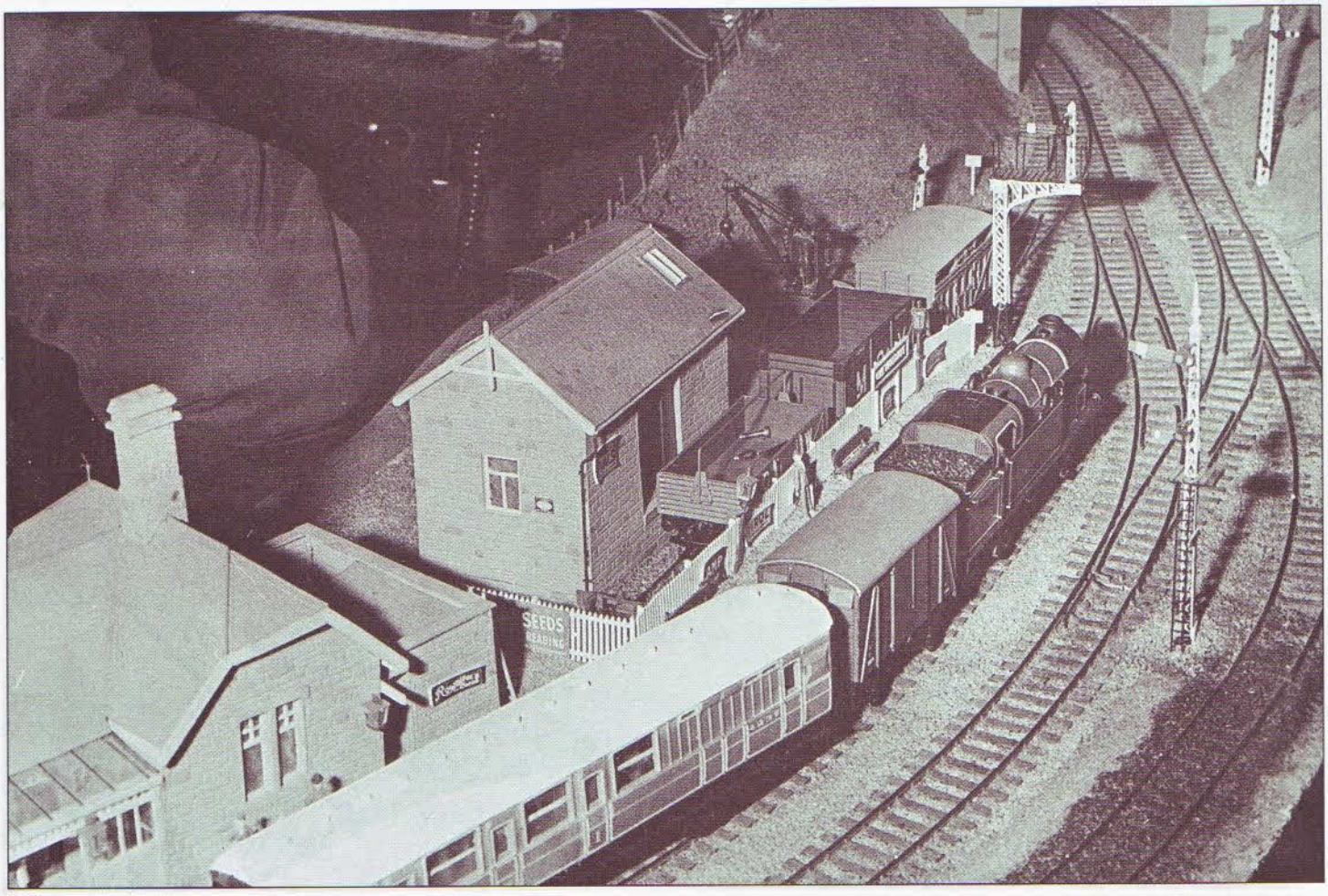
Where do we go from Here?

As I said at the outset, railway modelling is a very wide-ranging hobby so to suggest that it can be thoroughly explored in one book is asking a great deal. I have concentrated on the practical aspects of layout construction, describing techniques I have used over the years which I know give good results for the majority of enthusiasts. I feel confident that I have provided sufficient information to allow anyone with a modicum of determination to create a realistic representation of a full size railway that will provide years of satisfaction.

There is a great deal more that can be said about the subject. Indeed, there is one important aspect I have hardly mentioned, operation. This is because it is completely independent of the actual building. Some railway modellers have enjoyed the hobby to the full without

Peter Denny's Buckingham has inspired more people to make good model railways than any other model I know. It is a unique effort, almost completely scratchbuilt by a man with no specialised craft training,and using only a simple tool kit. What is even more to the point, most of the principles which have been rediscovered by finescale modellers over the past 20 years were put into practice on this layout in the late 1940s. As a full account of the railway, and the methods he used to build the model are to be found in his two-volume book The Buckingham Branch Lines. Further generations can learn from this pioneering model maker. This photograph shows the intermediate station, Grandborough Junction.

I doubt if another layout will ever be built in this way in 4 mm scale because it is not just the amateur side of the hobby that has finally caught up with Peter Denny. The trade now offer ready-to-run models and kits which achieve the standards of accuracy and detail found around this model. While there is nothing to stop any young enthusiast from building just such a model from scratch, it would either call for a great deal of self denial, or be based on so obscure a prototype that even the specialist kit manufacturers are unaware of its existence.



Alan Wright's diminutive Cheviotdale, *an OO gauge continuous run branch line model based on the North Eastern railway in LNER days, was a good example of a sensible marriage between scratchbuilding and commercial equipment. The track and buildings were made in the home workshop, the signals were built up from kits, while the locomotive and rolling stock in this photo are all straight commercial products, carefully chosen as appropriate for both prototype and period.*

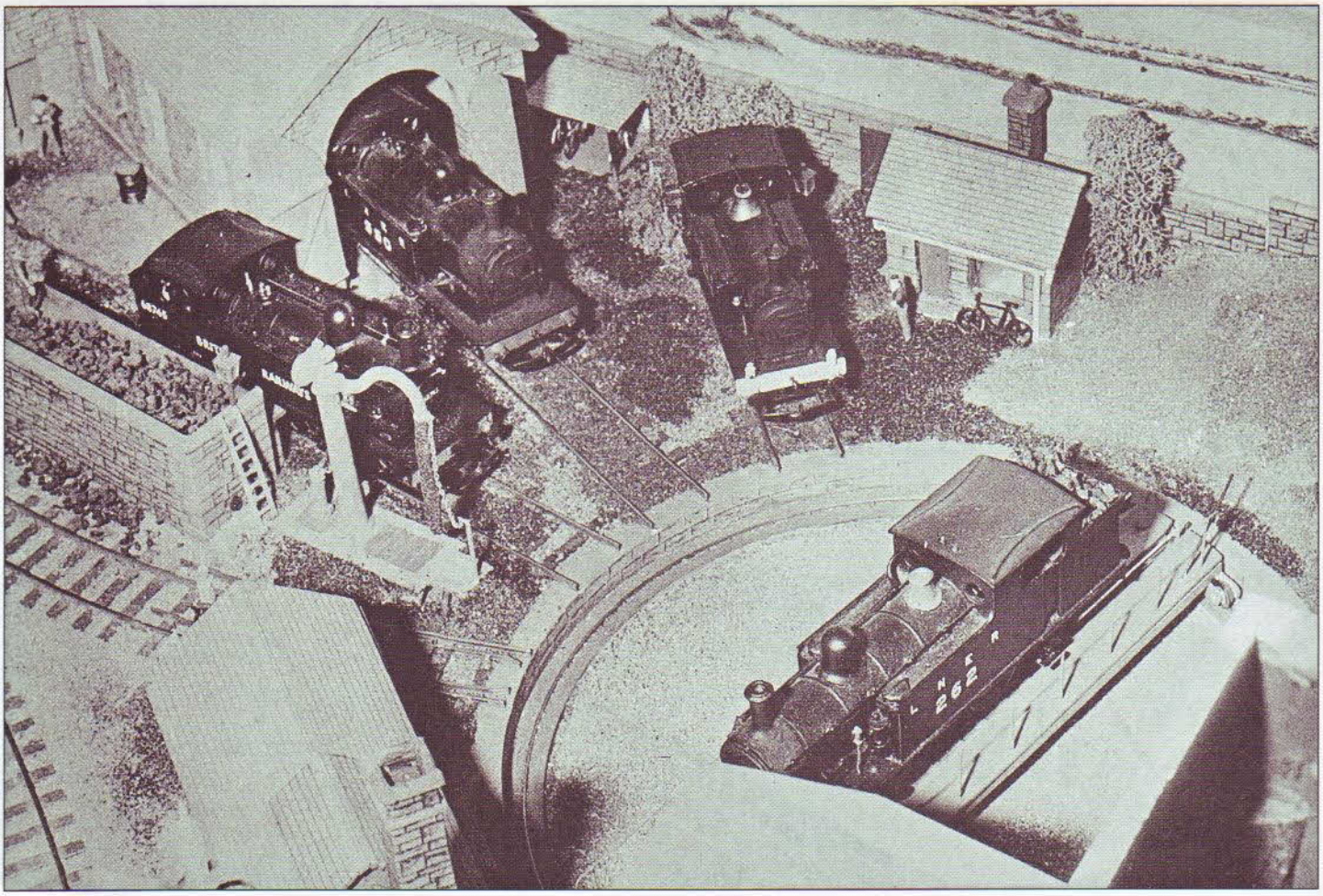
ever indulging in anything more demanding than running trains around the tracks to test that they work. For them, modelling is all that matters and even before the project is finished they begin to think of the next challenge. Nevertheless, operation to a prototypical schedule is a very enjoyable part of the hobby and so I do recommend that you read my book *Model Railway Operation* (Patrick Stephens, 1993) to find out what can be achieved with pencil, paper and a good deal of thought.

There are many other books worth reading and so in Appendix I have prepared a list of recent publications which I have read with enjoyment and profit. There are also some I have written. The list is not exhaustive; it is confined to British books and only three publishers are mentioned.

There are also many magazines on the market. *Railway Modeller* is now the longest established British journal, since its two predecessors are no more. *Model Railway Constructor* ceased publication some years ago, while *Your Model Railways*, successor to *Model Railway News*, folded as this book was being written. Of the others, only *Model Railway Journal* has been around long enough to have established a track record, and of all the magazines on the market it is the least suited to the relative newcomer since it is wholly concerned with advanced modelling techniques. *Continental Modeller*, from the same stable as *Railway Modeller*, deals with overseas modelling.

Upgrading your layout

Through the magazines you will be introduced to many different aspects of the hobby, and inevitably, some will give you cause to think, to adjust your approach to the hobby. This can be all to the good, but making too many changes will only result in a lack of progress. It is never a good idea to scrap a workable model railway in the belief that next time it might be better. A policy of steady improvement will yield excellent results with less hassle and in a



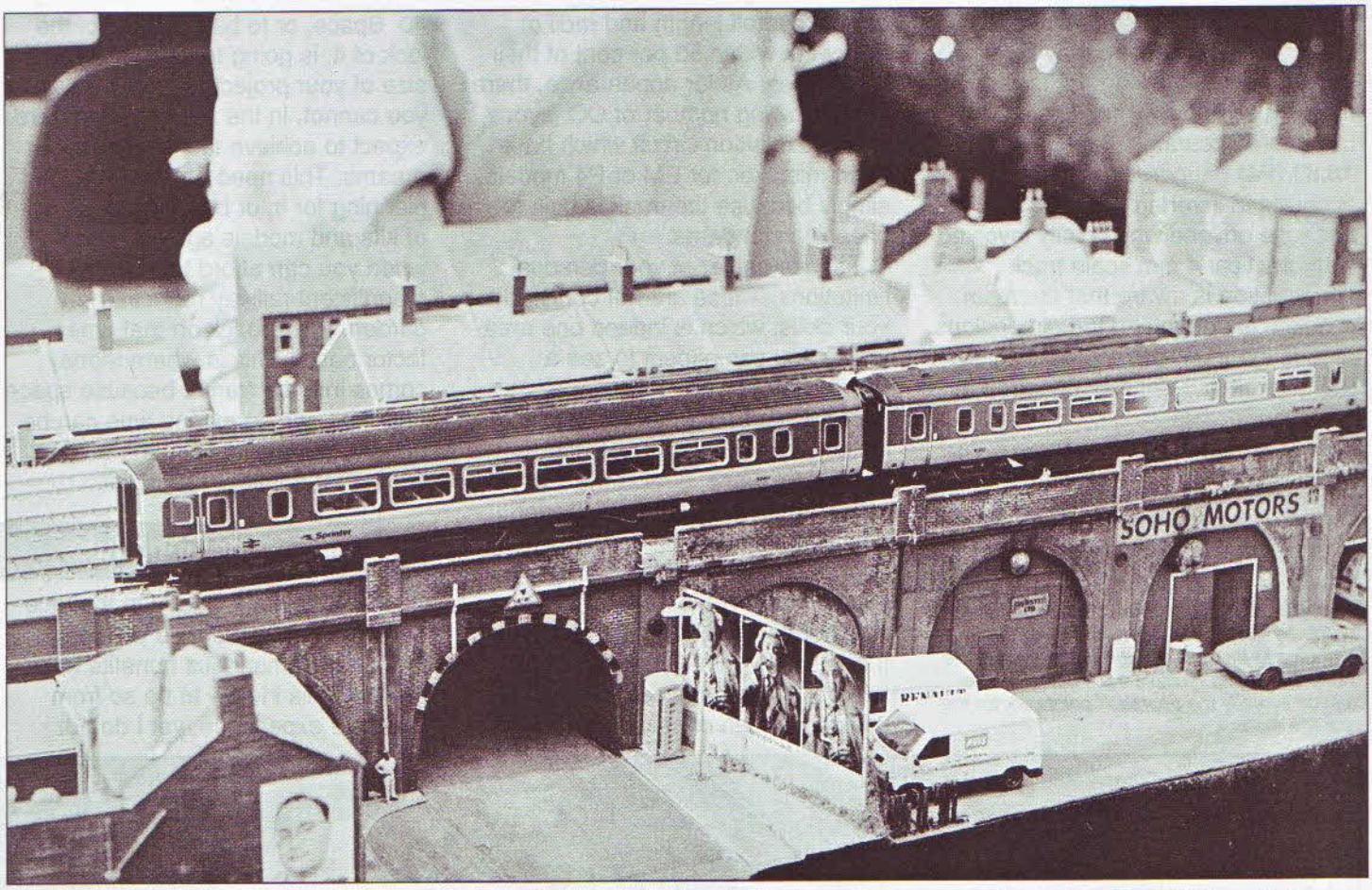
Cheviotdale *boasted a small loco depot tucked into a corner. It was close to the traverser storage yard and provided a place to hold spare locomotives which could be backed on to trains to provide variety. The four locomotives seen here were based on cast white metal kits, suitably modified to represent, with considerable fidelity, some of the once numerous types of small North Eastern Railway locomotives. Unlike* Buckingham, *this fine model is no more. One day workmen arrived, without warning, to repair the roof of the outhouse in which it was situated. They spilt tar on the model, and despite valiant attempts to repair the damage, it proved impossible to get the stuff off the tracks. Reluctantly, it had to be scrapped. There's a moral there somewhere.*

shorter time. One of the best ways to improve a layout is to look for the features that offend you and ask yourself what best to do about them. It is really a matter of asking the right question, and when you do this you frequently discover you already know the answer.

One important thing to keep in mind always is that it is your layout and that what you do on it is of no consequence to anyone else. True, I have suggested that you should initially work in one of three scale gauge combinations, OO, HO or N because these are well provided with ready-to-run models at affordable prices and backed by a wide selection of components and ready-to-lay track. But once you have some experience and have a reasonable idea of your own capabilities and, more to the point, your limitations, you can consider something more adventurous than going along with the majority.

The most straightforward option is to select a specific prototype and time band, then ensure that everything within the layout conforms. While this has often been presented as a 'scrap it and start again' process, it is best treated as a 'replace and upgrade' option. Moving a layout back in time is fairly straightforward. Road vehicles are often the biggest giveaway but they are easily swapped, with the Ford Mondeo becoming a Model T, or even a horse-drawn trap. Modern buildings are demolished and replaced by older structures, road signs and posters are modified and the signalling converted to an earlier pattern. Above all, the female figures will need modifying, as will some of the males. Meantime, anachronistic locomotives and rolling stock are replaced or repainted one by one. The whole process will probably take several years.

An alternative upgrade path open to anyone who builds the layout on sectional baseboards is piecemeal replacement. This has the advantage



Many modern secondary passenger services are now operated by diesel railcars and, once again, these are obtainable from the trade in ready-to-run form. Although rather dull on their own - there is little one can do with them except shuttle them back and forth – they are invaluable on a larger layout.

Here we see a Class 156 'Sprinter' set in original condition running towards Hayley Mills *station. The brick viaduct is worthy of attention. The road arch has a restricted height sign, and to improve visibility the arch has been picked out with alternate black and white chequers. Alongside, the arches are occupied by Soho Motors. The `missing' pier in the parapet wall is actually a refuge, but the steel tube handrails are barely visible in the photograph. This part of the model represents a residential enclave between the industries on either side. This is a fine example of how careful observation of the prototype creates the illusion of reality in the model. With a modern layout, the prototype is there to be observed.*

that you can still operate the original set-up while building the new and improved units. The old units can be then stored, sold or cannibalised.

Changing scale or gauge is another option, best exercised at a fairly early stage in the hobby. This is clearly a scrap and replace process, but of late a halfway house has been recognised as the best option. You begin by building a very small trial layout to the new standards. The simple shunting yard described in Chapter 3 is a good example; it involves the absolute minimum of equipment, but incorporates all the basic elements of a model railway. By the time you've finished it you'll know if the system suits your temperament, your spare time, and above all your pocket. If you don't finish it, you'll know that whatever its adherents might claim, it is not for you.

However, most railway modellers remain faithful to one of the fully developed commercial scale/gauge combinations, possibly supplementing the initial ready-to-run locomotives, coaches and wagons with kit or scratchbuilt products. This is sometimes regarded as taking the easy option and to be deplored. Why this should be so is beyond me. After all, work is a four-letter word. What is not always appreciated is that the vast range of commercial models now available for the popular scales has made it easier for a modeller to specialise in a narrow field where his, or her expertise is fully exploited.

Working to your limitations

Say, for example, that you like building track and are good at it. This doesn't mean that you have the skills needed to build your own chassis, or regauge wheels, let alone that you want to break off

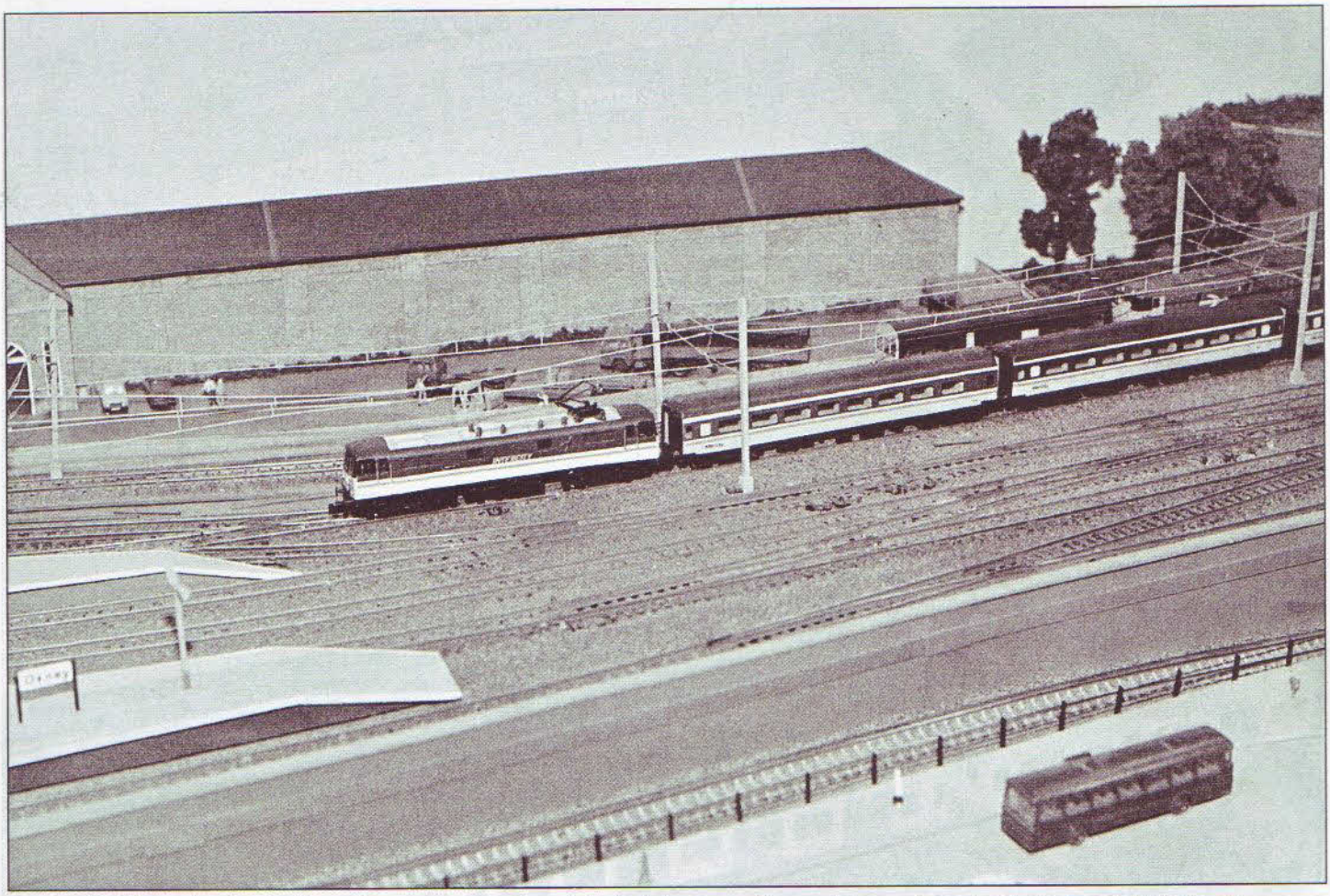
work on a complex station throat in order to do so. Yet you may be pressured into thinking, for instance, that you should in 4 mm scale adopt the `more accurate' 18.2 (EM) or 18.83 (P4) gauges. I put more accurate in inverted commas because anyone who is fully involved with practical 4 mm scale track construction is aware that the main problem is not getting the dimensions across the track correct, but finding the gigantic railway room needed to get the overall length and radii of trackwork within 50 per cent of their scale sizes. As for appearance, there are a growing number of OO layouts on the exhibition circuit which have been mistaken for EM or P4 models, simply because the track is built to finescale standards.

I spoke earlier of your personal limitations. These are not confined to your skills, which is indeed one area where you can expect to see a steady if not spectacular improvement. The more crippling limitations are time, space and money. Of these, time is the least regarded, yet the most significant obstacle. It is not just how many hours you can reserve each week, it is how many years ahead you can confidently plan. Putting it bluntly, there is little point in starting a 25-year project on your retirement, unless you can contrive to retire at 40. Space, or to be more exact the lack of it, is going to limit the overall size of your project and may mean you cannot, in the foreseeable future, expect to achieve the layout of your dreams. This need not prevent you planning for it, or building up a stock of kits and models against the time when you can afford to build that magnificent railway room in the garden. We're back on that time factor again. This is where money comes into the frame, because space and, to a certain extent, time can be bought. Budgeting is sound sense; hoping for a lottery win is not.

All that can be seen of Hayley Mills *passenger station are the ends of the platform poking out from beneath the massive road overbridge. The train in the foreground comprises coal hoppers, headed by a coal sector Class 56. At the back a parcels sector Class 47 waits with its train, whilst a Class 37 is just emerging from under the road. On the model, the station buildings and impressive town hall hide the entrance to the rear storage roads – the fiddle yard. In fact, the multiple track entry into the station is really the approach pointwork for the storage roads.*

Railway modelling clubs

Should you join a club? On the face of it the answer must be yes, as there are tremendous benefits to be gained. This I know to be so from personal experience, yet I do not



A train of Mk II coaches, headed by a Class 86 electric locomotive, coasts into Oxney *station.*

suggest that it is either essential or, in every case, advisable.

Membership of a specialist society that caters for your own specific interests is certainly worthwhile, since these groups usually publish a journal or newsletter, and typically offer support in the way of kits and components. In such cases your involvement need not extend beyond paying your dues, reading the society's publications, and making good use of any other facilities you find of value. This only involves taking the effort to write a letter and cheque, and then making a detour to the most con-venient post box next time you go out.

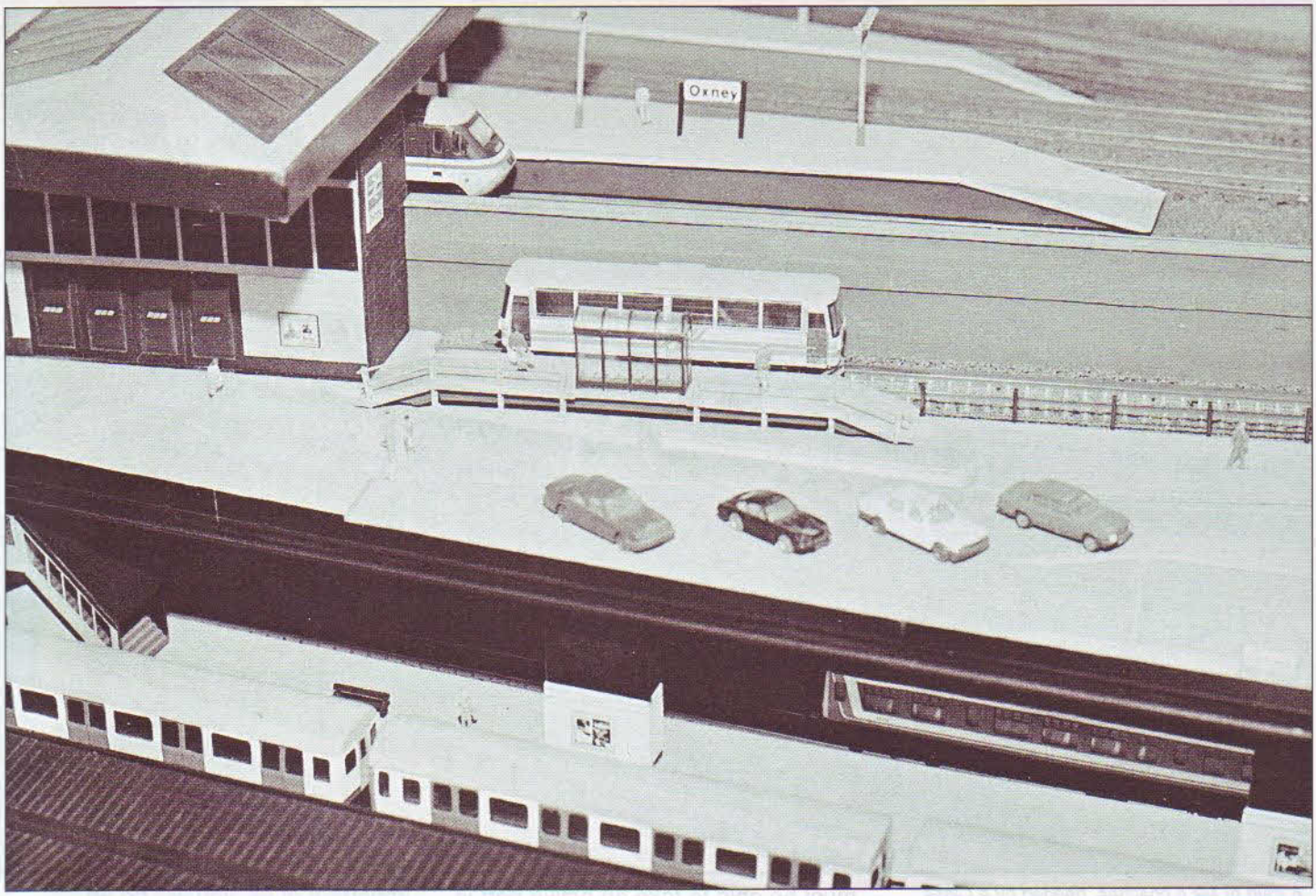
If you are to profit from membership of a general society, you must be able to take an active part in its activities. To do this it must hold its meetings in a place you can reach and at a time you are normally free. In addition, you have to be prepared to put something into the club yourself. At the start this need be no more than a willingness to listen to the club's more expert modellers and to accept constructive criticism of your efforts. Make this first step and you will soon be drawn into more interesting activities.

As most clubs hold annual exhibitions, this is a good time to find out about their activities and take out a membership. Better still, join just before the annual exhibition and take part in setting up, stewarding and dismantling. Not only will the club welcome you with open arms, but by the end of the show you will have made a lot of new friends and, most important of all, you will be an integral part of the society.

Buying equipment and materials

Finally, throughout this book I have mentioned certain merchandise and manufacturers. I have had dealings with these firms over many years and have found their products useful for my purposes. They do not constitute the whole of the trade, nor do I wish to suggest that they are any better than other concerns whose products and services you will find advertised in the model press.

The products I have mentioned are, *at the time of writing*, in production. This does not mean you can probably find them all in any High Street store, though a model shop worthy of the name will either



The light railway train waits by its platform at Oxney. *The model is of Continental origin. The nose of an HST power car pokes out from behind the BR station building .*

The light railway is complete with a dummy shrouded third rail, as on the Docklands Light Railway. The low level LUL lines are complete with the prototypical outer and centre electrified rails. This attention to detail is important if the correct effect is to be achieved.

stock them or be able to obtain them on order. They, or their close equivalents, will certainly be on sale at larger exhibitions. In any case, they can be obtained by mail order, either direct or through concerns advertising in the model press.

Mail order can be fraught with difficulties. Many are inadvertently created by the shopper, and this is one area where the customer can easily be wrong. Failing to include a return address, sending the wrong amount and, above all, giving an incorrect description of the goods required are commonplace errors. It is vital to read the advertisement with care, noting such matters as post and packing charges and any other information set out in the small print. These are the terms and conditions you will be accepting by placing an order. If you don't agree your only option is to go elsewhere.

When problems arise with mail order, it is essential to refer to your original order. Therefore you must keep an exact copy, together with the cheque, money order or postal order counterfoil. To ask 'Why haven't you sent me my models?' is not making a complaint, it's starting a bout of fruitless correspondence. Any mail order concern gets hundreds of orders a day, and they can only investigate when you provide full information to allow them to find the original letter.

Don't send cash, and don't place an order against an advertisement more than six weeks old. If you want something that isn't advertised in a current magazine, phone first.

Mail order is not inherently difficult, but it is less straightforward than a friendly face to face transaction. It is also subject to the vagaries of the carrier. Personally, I prefer to get most of my modelling requirements at exhibitions. They're also the best places to pick up good ideas for future projects.

Appendix I

Gauge and Scale

Anyone who feels inclined to calculate the scale equivalent of standard gauge, 4 ft 8½ in or 1,435 mm for his chosen gauge will find that there is an error. But what else can you expect when the basic dimension of Standard Gauge came about when George Stephenson adopted, without too much thought, the 4⅔ ft gauge of his local collieries and then, to get round some early difficulties, threw in an additional half-inch for good measure? Looked at from this angle, the weird and wonderful combinations of gauge and scale we use are merely following prototype principles to their illogical conclusion.

The following survey attempts to provide a snapshot of each established scale/gauge combination. It is divided into two parts, standard gauge and narrow gauge.

Standard Gauge

1 Gauge

45 mm gauge, 10 mm to the ft, 1:32 scale.

In Edwardian days, Gauge 1 was the preferred size, yet paradoxically there are more serious users of this scale today than when it ruled supreme. This is a mark of the hobby's growth over the last 80 years. Gauge 1 lies on the division between railway modelling proper and true model engineering, since live steam in this scale is a straightforward proposition, as can be seen on the Gauge 1 Association's layout at IMREX every Easter.

Although in its early days it was extensively used indoors, few people today live in such spacious houses and it is largely a garden railway gauge. After a long period of decline, its fortunes in Britain were slowly reversed by the stalwart work of the Gauge 1 Association, whose members encouraged the establishment of small cottage industries supporting the scale.

Its return to mainstream railway modelling was confirmed when Märklin re-launched ready-to-run models, mostly of German prototypes. This was less surprising when you discover that there has always been a market on the Continent for very highly priced, hand-built Gauge 1 models of extremely high quality.

It is not a gauge for the outright beginner, but it is one that should be considered by anyone who has a leaning towards model engineering and wishes to produce models with little or no compromise in scale. It is also a lovely size for a wealthy collector, and there are some superb models around for four figure sums. On this note there was a case some years back where thieves broke into the home of a well-known enthusiast, stole his collection of Gauge 1 models and left the family silver!

O Gauge

32 mm gauge, 7 mm to the ft, 1:42.5 scale.

An American writer once said that O gauge was like the waltz, always about to make a comeback. As anyone who knows the slightest thing about dance is aware, the waltz has never gone away, which makes the comparison very relevant.

O gauge suffered a slight eclipse in Britain when Bassett-Lowke ceased trading as model railway suppliers and Meccano Ltd., went out of business, but there were sufficient specialist manufacturers and, much more to the point, a large stock of existing models, many of which came on to the market following the death of their original owners, to keep the scale alive among serious modellers.

In the USA the gauge has suffered from the unfortunate retention of the inaccurate ¼ in scale, resulting in not only the introduction of Q gauge (13/16 in gauge) and 17/64 in scale to confuse the issue. The continued existence of Lionel 'tinplate' O gauge models has kept that side of the gauge in a flourishing condition, but as this has its own track standards this provides further confusion.

O gauge is not quite suited for real live steam, because too many compromises appear to be needed. It is a true model maker's size, since most parts of the prototype can be rendered to scale and still remain visible. So far as the scratchbuilder is concerned, the time involved in producing a high-class model is, if anything, less than with the smaller scales. I have noticed a steady procession of serious scratchbuilders from 4 to 7 mm scale over the years, and every one has expressed complete satisfaction

with the move. It is less suited for serious operation for reasons of space. Having said that, one of the best operating layouts ever built was in O gauge, though as it began life when O was the predominant size, this is understandable.

Commercial support is mainly through kits and components, but a very limited supply of ready-to-run models by Lima can be tracked down at specialist suppliers. Having said that, there are no problems about supplies, since as well as the handful of specialised retailers there are plenty of small manufacturers who not only supply direct, but who also turn up at exhibitions to sell their wares. Most important of all, the Gauge O Guild not only publishes a high-class magazine, and supplements this with specialised handbooks, but also organises an annual get together, combining their AGM with a public exhibition, where most O gauge suppliers are present and in business.

While O gauge is not for the outright beginner, it is worthy of serious consideration by anyone who prefers making locomotives and rolling stock to running them. In general, the O gauge modeller opts for a small but select array of models.

S Gauge

7/8 in gauge, 3/16 in to the ft, 1:64 scale.

The only truly Imperial gauge left, S gauge is strictly for the scratchbuilder and membership of the S Gauge Society is absolutely essential. This small, amateur organisation effectively controls the manufacture of the few components and kits that are available, but much more to the point promotes mutual support among the members.

Apart from a short-lived flourish in the immediate post-war years in the USA, S gauge has never been commercially developed. There is an apocryphal story that in the late 1920s Meccano Ltd gave the size serious consideration as a replacement of their O gauge range. Had this happened, the history of railway modelling would have been radically different since the then current technology would have permitted both reversing clockwork and electric power in near to scale bodies, whilst the smaller size would have been easier to fit into the majority of homes of the period.

Half-O Gauge

16 mm, 16.5 mm, 5/8 in gauge, scale nondescript (thankfully obsolete).

One of the most unfortunate events in the hobby happened in the early 1920s when the German firm Bing produced a table-top railway by halving the major dimensions of the then smallest size, O gauge. The initial product of 1924 comprised a non-reversing clockwork 2-4-0 tank of imaginative design, four-wheeled coaches and an ingenious track system where the entire track and base were pressed from a single piece of lithographed tinplate. Later, the 2-4-0 appeared with a wound field electric motor with trip reverse. Not surprisingly, it formed the foundation of a new size.

There were two significant features that were to give trouble. The rail had a rounded top and the wheels had a corresponding large root radius. When amateurs built their own track using strip metal soldered to tinplate sleepers, the gauge had to be widened to 16.5 mm. This was not too serious. The main problem was that the Bing electric motor would not fit into a 3 1/2 mm scale model of any British locomotive or, for that matter, most Continental prototypes either.

The British solution was to use 4 mm scale, the Continental was to use 1:80 scale. Only in the USA were any serious commercial 3.5 mm scale models produced, largely because American locomotives were bigger to begin with and had wide fireboxes. The Americans also used 4 mm scale on 19 mm gauge, but this quietly died out.

This historical diversion sets the scene for what follows.

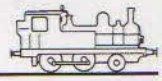
P4 gauge

18.83 mm gauge, 4 mm to the ft, 1:76.2 scale.

This scale/gauge combination is an attempt to get a true to scale model in the popular 4 mm scale. I say attempt, since no amount of juggling with the gauge will overcome the fact that all but the simplest and most uninteresting of standard gauge stations are too large to fit into the normal clubroom, let alone home.

Having said that, many excellent compromises have been achieved, but because it is impractical to use standard ready-to-run models without completely replacing or rebuilding the chassis, progress on any layout must be slow and the builder must not only be dedicated, he must also have a good deal of spare time. A lot of work is done by small groups of like-minded enthusiasts working on a single project.

Although its more vociferous proponents have claimed it is no more difficult than OO, this is based solely on advanced kit construction and scratchbuilding, and is in any case questionable in view of the higher level of craftsmanship implicit in the standards. As currently practised, many of the techniques rely on precision parts produced by small, specialist concerns and are beyond the limits set by all but the most elaborately equipped of home workshops.



EM gauge
18.2 mm gauge, 4 mm to the ft, 1:76 scale.

EM gauge was specified in the last days of the war as a more accurate standard for 4 mm scale. The initial specification was for 18 mm gauge and narrower wheels than for OO. Peter Denny tried the effect of pushing commercial OO wheels out on their axles, and found that it worked. A little later it was realised he had added an extra 0.2 mm to the track gauge. When the Denny standards were officially adopted, EM gauge began to vie with OO among serious workers, since conversions of commercial stock were quite straightforward and in many cases could be done on a desk, or, to demonstrate their simplicity, on a trestle table at an exhibition.

Development of the gauge has been in the hands of the EM Gauge Society who publish a magazine and a loose-leaf manual for members and organise several ExpoEM shows in various areas of England. The pragmatic outlook of the society has encouraged many OO gauge modellers to come along to see 4 mm scale modelling at its relaxed best.

OO gauge
16.5 mm gauge, 4 mm to the ft, 1:76 scale.

Although the gauge for OO is considerably underscale, most users are completely unaware of this. This 'error' has to be viewed against the fact that on any layout laid with commercial track the gauge is the most accurate measurement on the permanent way. The errors in the track length and radii are much greater, while the rail is overscale and the sleeper spacing correct for 3.5 mm scale.

The overwhelming advantage of OO is that one can take a locomotive, coach or wagon out of the box, put it on the track and set it rolling. While this is scorned in certain circles, I smell the odour of sour grapes. It is by far the best starting point for the British enthusiast. In my opinion, until you have built a successful working OO gauge layout, no matter how small and simple, you should not consider EM, let alone P4 because you are going to encounter far more problems in the more accurate gauges.

Furthermore, many OO gauge layouts laid with scale track components have been mistaken for EM. I certainly cannot be sure at exhibitions. The only reliable way I know is to look in the guide or ask the operator. In this case you should say, 'Is it EM or P4?'; this can only flatter the builder.

HO gauge Continental models will operate over most OO gauge layouts without any bother. Many USA prototypes simply will not squeeze between British high platforms, or else foul low set overbridges and tunnel mouths.

HO gauge
16.5 mm gauge, 3.5 mm to the ft, 1:87 scale.

Apart from in Great Britain, HO is the international standard. By pure chance the scale gauge ratio is almost correct and so it has never been bedevilled by that argument. However, wheel standards are divided between the coarser Continental European NEM and the finer NMRA standards, though the NMRA RP25 profile, which combines a good appearance with the ability to stay on all but the most badly laid track, is slowly gaining ascendency.

The reason HO has never developed in Britain, despite several valiant attempts, is that most purchasers complain bitterly that it is 'too small'. The fact is, for many people, HO is what foreigners call OO. This confusion is not helped by the common habit of manufacturers of labelling their products OO/HO scale.

TT gauge
12 mm gauge, 2.5 mm to the ft (USA), 3 mm to the ft (GB), 1:120 (Continental Europe).

TT is the only gauge that originated wholly in the USA. The initials stand for Table Top. It began as a kit-based US system, emerged as German ready-to-run and then was for a short while produced in Britain by Triang. As a purely commercial range, it only lingered in East Germany as the Berliner Bahn system. This seemed to have survived the fall of the Berlin Wall, but was last reported to be in trouble.

In Britain it was rapidly taken up by the serious enthusiast, but as the toy train end lagged, Triang dropped the range. However, the 3 mm Society has kept the size afloat. It is the ideal scale for the true model maker who likes not only to have a fairly extensive system, but also is anxious to add a convincing townscape to his model. There is a good supply of basic components and a growing selection of kits, but what examples of Triang TT stock remain are now collectors' items and prohibitively expensive. Membership of the 3 mm Scale Society, whilst not absolutely obligatory, is advisable.

2mm scale
9.5 mm gauge, 2 mm to the ft, 1:152.4 scale.

2 mm scale is a purely British size, devised in the 1930s when OO was halved by a few expert model makers. It languished, as much because it was then impossible to

obtain small enough motors to fit into even the largest prototypes. Some progress was made in the post-war years, but it was not until the advent of N gauge that it began to make any real progress as the British fine scale branch of the commercial scale. Most workers in this scale do a fair amount of scratchbuilding.

It is supported by the 2 mm Scale Association.

N gauge
9 mm gauge, :160 scale (2 1/16 mm scale, 1:148 British N scale).

There were several abortive attempts to launch a sub-TT gauge, but it was not until technology enabled really small motors to be produced at a reasonable cost that the gauge became widespread. As with Half-O, the small British prototype loading gauge led to a slightly larger scale being proposed by Peco. While at present the selection of ready-to-run stock for this size is nowhere near as extensive as that provided for OO or HO, it is large enough to allow an extensive layout to be stocked straight out of the box.

Although initially looked at as a means of getting a working layout in a small space, the gauge has really come into its own when applied to a reasonably large area. On the one hand it is possible to get a large operating layout, with several stations and an interesting track formation, into the space of a normal garage, while on the other the railway can be set in a realistic expanse of countryside whilst keeping the baseboard width down to reasonable limits.

While there might seem to be a natural clash between N gauge and 2 mm scale, both happily co-exist, on at least one occasion on the same layout. This was the Model Railway Club's Chiltern Green where the 'fast' roads of this Midland main line model were laid to 9.5 mm gauge and the 'slow' tracks to 9 mm gauge without any viewer being the wiser. Indeed, although on paper the difference in scale is significant, in practice there is really no discernible difference between 1:148 and 1:152 scale models of locomotives, coaches and above all wagons, while buildings can be to the accepted architectural scale of 1:150.

Z gauge
6.5 mm gauge, 1:220 scale.

The German manufacturer Märklin likes to be different, so instead of producing an N gauge range it set up its own even smaller size. Despite attempts to produce British outline stock, it has never really caught on to any extent in Britain, though through the Märklin name it has a good following in Germany. Although it appears to have little spatial advantage over N gauge, the difference on even a modest sized layout can be quite surprising. It has three disadvantages: a very restricted selection of stock and then primarily of German prototypes, the higher cost of the models, and, most significant of all, a very limited availability in Britain.

Narrow Gauge

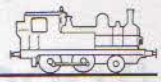
Narrow gauge is defined as anything below standard gauge. This includes the extensive 3 ft 6 in and metre gauge systems which are not only effectively the standard gauge not only for much of the developing world, but are also the principal gauges for Japan and New Zealand. There is also an extensive metre gauge system in Switzerland and large 3 ft gauge railroads once criss-crossed parts of the USA. Gauges between 2 ft 3 in and 2 ft were widely used for feeder lines, mineral railways and industrial networks. With so large and varied a choice of gauges and styles of railway, narrow gauge modelling is an ideal field for the individualist. It is possible to devise one's own scale/gauge combination, since by careful selection of a prototype with a limited amount of stock, the amount of scratchbuilding involved is minimal. Indeed, most of the accepted narrow gauge sizes began as an amateur concept.

There are three distinct themes. In the USA, standard scales are used and the gauge determined to suit. This is aided by the fact that US narrow gauge was generally 3 ft, with a small amount of 2 ft feeder lines. In Europe (including Britain, for once) the practice is to apply a standard scale to a smaller standard gauge. Finally, we have the odd man out, G gauge, the only narrow gauge concept to begin with a fully developed ready-to-run commercial product.

This survey does not cover all the extant scale gauge combinations.

G gauge
45 mm (1) gauge, scale chosen to suit modelled prototype.

G gauge is big, starting with Gauge 1 track and initially a German industrial 0-4-0 tank locomotive, together with a small range of two-axle carriages and wagons which, according to your viewpoint, could be of 60 cm or 75 cm gauge stock. These were produced by Lehmann as the LGB (Lehmann Grosse Bahn) system. LGB then added some models of metre gauge RhB stock and models aimed at the US market to the range. If the system was intended as a superior toy, it was rapidly taken over by adults and the toy end was left to Playmobil, whose products are



more toylike, but sufficiently accurate to be used by serious workers. Bachmann have chipped in with models of USA 3 ft gauge stock.

It is a trifle large for indoor use because you need a space of at least 16 x 8 ft to do anything remotely worthwhile, but it is ideal for garden use. While the more serious workers keep to one prototype, most are perfectly happy to mix the scales and have fun.

SM 32
32 mm (O) gauge, 16 mm scale.

This size is designed for large models of 2 ft gauge prototypes and is mainly the province of scratchbuilders. A decent selection of essential components is provided by specialist concerns. As with much narrow gauge, there are devotees with a casual attitude towards scale, as well as those who use 3/8 scale to model metre or 3 ft 6 in gauge prototypes.

It is very popular with live steam workers. The models are big enough to allow proper engineering techniques to be applied without requiring a small engineering workshop.

O-16.5
16.5 mm (OO/HO) gauge, 7 mm scale.

A compromise size, allowing the use of OO or HO equipment for narrow gauge modelling. It is entirely a kit-based size.

HOn3
10.5 mm gauge, 3.5 mm scale.

Very popular in the USA for modelling 3 ft gauge prototypes, kits and high price ready-to-run models are produced. Supply in the UK is through a few specialists.

OOn3
12 mm gauge, 4 mm scale.

This scale/gauge combination is used for models of the Isle of Man railways and the Irish 3 ft gauge systems. It is making something of a comeback, with an increasing selection of kits.

HOm
12 mm gauge, 1:87 scale.

This size is rapidly growing in popularity for modelling the Swiss metre gauge, largely because there is now a very extensive selection of affordable ready-to-run models. Indeed, the Rhätian Railway is now by a sizeable margin the best supported prototype in the world. All current revenue locomotives and a high proportion of coaches and wagons only need to be taken out of the box and detailed with the parts supplied. The scenery is also rather spectacular.

OO9
9 mm gauge, 4 mm scale.

HOe
9 mm gauge, 1:87 scale.

There is no real difference between these two sizes in practice. This is definitely a case where 'those foreigners' do use a different name for a British system, for the pioneer work was carried out in Scotland. In essence, the system uses 9 mm gauge track, allowing N gauge chassis to be utilised. Various firms have introduced complete ready-to-run systems, though a cynic might suggest this might not necessarily be a good thing. Two companies concerned ceased trading, a third was situated in what was then Yugoslavia, another, still thriving, now concentrates most of its development work on its HOm range.

In Britain, OO9 is well supported by small specialist kit manufacturers.

There is in addition some work being done with Z gauge track and mechanisms in Nm. The models are expensive. At the other extreme, a Gauge 1 layout has a scenic section with a 9 mm gauge working miniature railway. This was remarkably easy to build. The locomotive was a standard N gauge German 'Pacific' with a modified tender to take the 10 mm scale driver.

Appendix II

Further Reading

The following books are recent titles, and if not currently in print are recent enough to be fairly easy to track down.

General

The Buckingham Branch Lines (two volumes), Peter Denny (Wild Swan, 1993-4)
This is an expansion of Peter Denny's earlier book *Buckingham, Great Central* (Peco, 1972), and deals with the development and construction of his EM gauge Great Central model.

This layout has probably inspired more modellers than any other, and set constructional standards which have only recently been surpassed. It is also a railway that is operated correctly, to a detailed timetable. These two volumes show how it was achieved. This is a rare case where one can safely say that given the advances in kits, components and ready-to-run models, anyone can achieve this level of modelling. No serious railway modeller can afford to be without this stimulating book.

Railway Modelling (8th edition), Norman Simmons (Patrick Stephens, 1998)
A sound textbook which covers the subject thoroughly. The text has been frequently revised over the years.

Great Western Branch Line Modelling Vol 3 – Creating a Model, Stephen Williams (Wild Swan, 1993)
Despite the general title, this book deals with the construction of a finescale model of Farringdon station in 4 mm scale. Although this deals with a GWR branch terminus in the steam age, the practical information applies to the latest finescale techniques. It should be read carefully before doing anything more than considering the possibility of working to these standards.

Modelling the Steam Age Railway, C. J. Freezer (Patrick Stephens, 1990)
A general survey showing how to set about recreating the ambience of the British steam age railway.

1001 Model Railway Questions and Answers, C. J. Freezer (Patrick Stephens, 1992)
A series of questions and answers covering the problems most commonly encountered by railway modellers.

Layout design

The PSL Book of Model Railway Track Plans, C. J. Freezer (Patrick Stephens, 1988)
70 varied plans for different sites likely to be found around most homes. Each plan is accompanied by a general description indicating the type of railway envisaged.

A Home for your Railway (2nd revised edition), C. J. Freezer (Peco, 1990)
A small booklet detailing the various ways a model railway can be fitted into the normal home.

60 Plans for Small Railways and *Track Plans*, C. J. Freezer (Peco, 1989-90)
The latest editions of two popular compact plan books, containing designs of layouts for various sites.

Model Railway Layout Design, Iain Rice (Wild Swan, 1990)
This book is mainly concerned with the design of layouts for rural locations. It is particularly good on the design of the display for exhibition. The emphasis is on finescale modelling.

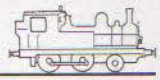
Light Railway Layout Designs, Iain Rice (Wild Swan, 1991)
More rural byways from Iain Rice.

Tracklaying

Finescale Track in 4 mm, Iain Rice (Wild Swan, 1991)
Although this book appears to be concerned solely with finescale track for EM and P4 gauges, the basic principles are thoroughly covered in a wholly practical manner and much of the information is applicable to conventional soldered track construction.

Electrification

The PSL Book of Model Railway Wiring, C. J. Freezer (Patrick Stephens, 1989)
A practical handbook covering the essential features of electrification, with an introduction to the use of relays for automatic control and track detection.



Model Railway Electronics, Roger Amos (Patrick Stephens, 1990)
A broad coverage of the application of electronics to model railways presented in a down-to-earth fashion. Its only drawback is that the various projects are only shown as schematic wiring diagrams, with no guide to their practical layout.

Landscape modelling

Miniature Scenic Modelling, Jack Kine (Model & Allied Publications, 1979)
Although this book is out of print it would be well worth the effort of seeking a copy, since it describes in considerable detail what might be termed the traditional approach to landscape modelling.

Landscape Modelling, Barry Norman (Wild Swan, 1986)
This is an excellent account of the latest approach to the subject, but is built around the author's pet concept, where the railway is on the verge of becoming subservient to the landscape.

Buildings

Architectural Modelling in 4 mm scale, Dave Rowe (Wild Swan, 1983)
A good, all-round, practical guide to the construction of small scale buildings, based on the author's extensive experience in this field.

Plastic Structures Making the most of the Wills Scenic Series, Iain Rice (Wild Swan, 1988)
Although written around the Wills range of plastic kits and moulded sheets, the techniques described and illustrated in this book apply equally to any plastic building kit.

Cottage Modelling for Pendon, Chris Pilton (Wild Swan, 1987)
The buildings in the Pendon Museum, Long Wittenham are generally regarded as the finest small scale architectural models on public display in Britain, if not in the world. This book describes the approach to their construction and the painstaking techniques employed. The standards of modelling are high, but the techniques can be universally applied.

Industrial and Mechanised Modelling, Dave Rowe (Wild Swan, 1990)
Dave Rowe's 4 mm scale dioramas are noted for their incidental operating devices. In this book he describes how he set about creating these ingenious models. While the mechanisms appear to belong in the Heath Robinson school of engineering design, making considerable use of wire, cord, springs and pulleys, they are wholly practical devices that have stood up to hours of continuous operation at exhibitions.

Locomotives and rolling stock

The 4 mm Engine – A Scratchbuilder's Guide, R. Guy Williams (Wild Swan, 1988)
This is in all probability the last word on the subject, for not only is it a very comprehensive and definitive textbook by an accomplished worker in the field, but also the development of etched brass kits has narrowed the scope for the scratchbuilder in this scale. While the newcomer might be put off by the descriptions of fine, intricate detail, the essential basics of chassis and body construction are fully explored. All the information is of equal value to all scales from 7 mm down to 2 mm.

Whitemetal Locos – A Kit builder's Guide, Iain Rice (Wild Swan, 1989) and
Etched Loco Construction, Iain Rice (Wild Swan, 1990)
These two books provide the detailed assembly directions that are not contained in the kit instructions. Anyone thinking of attempting the construction of a locomotive kit should buy the appropriate volume before getting as far as wondering which kit to buy.

The 4 mm Wagon, Geoff Kent, *The 4 mm Coach*, Stephen Williams, and *The Art of Weathering*, Martyn Welch (Wild Swan)
I have not yet read any of these three recent publications, but reports indicate that they maintain the publisher's high standards of informative modelling textbooks.

Operation

Model Railway Signalling, C. J. Freezer (Patrick Stephens, 1991)
This book covers the basic principles of installing signals on a British model railway and covers both semaphore and colour light installations.

Model Railway Operation in Accordance with Prototype Practice, C. J. Freezer (Patrick Stephens, 1993)
A general survey of the basic principles of simulating prototype operation on a model railway.

Index

MODEL RAILWAYS £15.99 / $32.95

THE MODEL RAILWAY MANUAL

This book shows how to build a complete model railway from scratch, starting with the design and construction of a baseboard. It then covers how to plan and construct the layout, including the laying of track, adding the scenery and buildings, as well as the installation of the electrical wiring. The process is taken right through to adding the finishing touches to enhance the realism of the scene being modelled. Today, a comprehensive range of locomotives, coaches and wagons are available that can be used straight from the box, enabling the modeller to concentrate on producing an individualistic operating layout on which they can be run. This comprehensive step-by-step guide takes the reader through all the necessary stages, pointing out potential pitfalls on the way.
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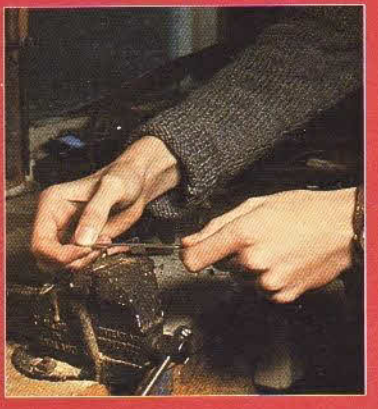

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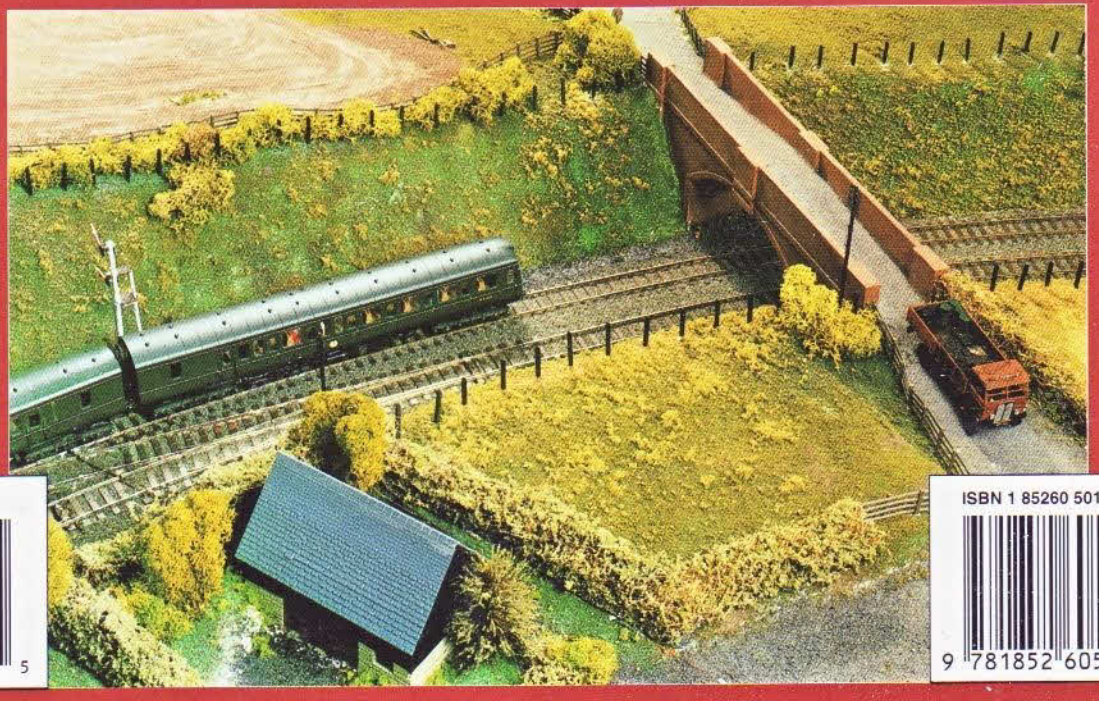
- Making pointwork
- Tunnels and retaining walls
- Adding details
- Modelling landscapes
- Maintenance

Cyril Freezer has been actively engaged in railway modelling for over 50 years. Formerly editor of *Railway Modeller* and *Model Railways* magazines he has written extensively on most aspects of the hobby with several other books published by Patrick Stephens.



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