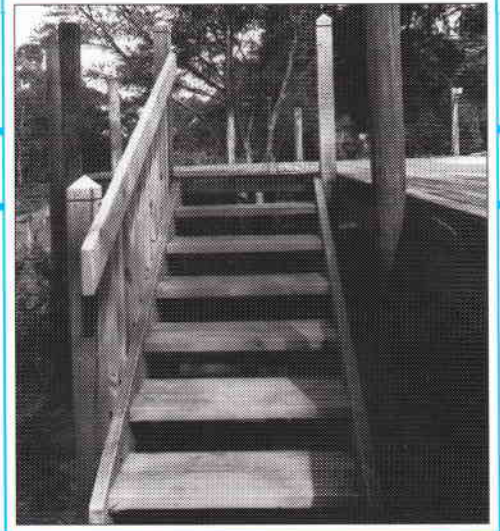


Outdoor Timber Stairs

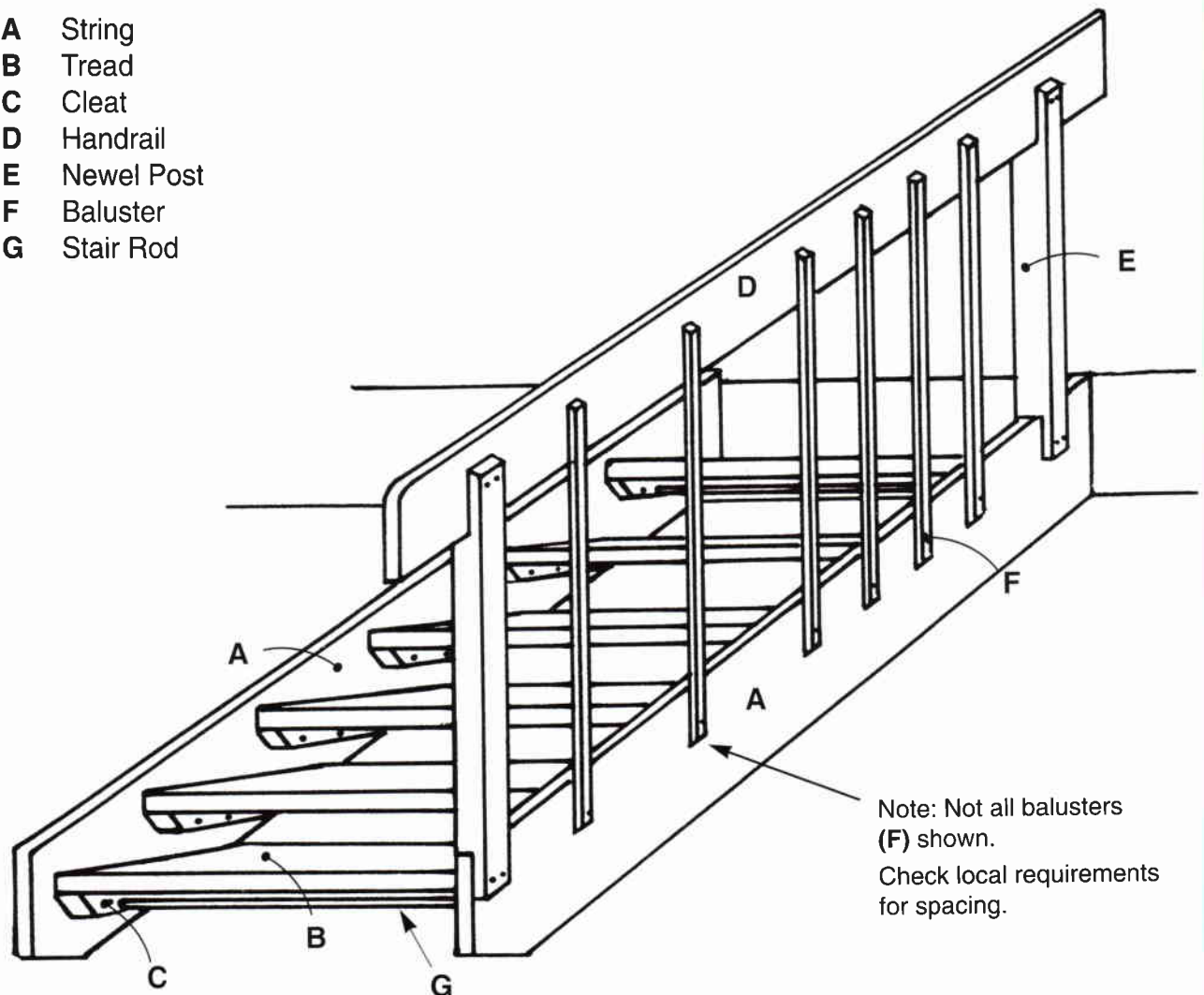
The staircase shown in our example was constructed for access to a deck around an above-ground swimming pool, but the principles apply equally well to any outside steps, such as those up to a verandah. The design of stairs is covered by Building Regulations, and before starting work you should check that the information given, which complies with Victorian regulations, is valid in your State.

Having the Newel Post material cut to the correct length by the supplier will avoid the need for "double-cutting", and an Extension Table or Triton Roller Support Stand will be very helpful with larger stairs.



Stair Components

- A String
- B Tread
- C Cleat
- D Handrail
- E Newel Post
- F Baluster
- G Stair Rod



Tool Requirements

- 1. ESSENTIAL** Triton Workcentre and your power saw; electric drill and Triton Woodbits; spade bit(s) for counter-bores; small G-clamps; socket spanner for coach bolt nuts; measuring tape; large square; pencil; timber for battens.
- 2. USEFUL** Triton Extension Table or Roller Support Stand. A length gauge (see the Triton Jig Guide) is useful for the repetition cutting of treads and balusters.

Construction Details

Component Specifications

All dimensions are in mm.

Part	Description	Qty.	Width	Thickness	Length
A	String	2	250	50	2150
B	Tread	12	130	50	900
C	Cleat	12	45	35	268
D	Handrail	1	140	45	2150
E	Newel Post	2	90	90	900
F	Baluster	12	45	35	900
G	Stair Rod	2	10mm diam x		1000

Note: These dimensions are given as a guide to component sizing only. Stairs should be designed individually to suit requirements.

General Points

1. For safety reasons, the design and construction of stairs is closely controlled by building regulations. The principles given below for determining the height and width of steps, and the height of handrails should be followed exactly. The dimensions of timber components can be obtained from appropriate Timber Engineering Codes, but as a guide the type of steps described will comply with most building regulations if the treads do not exceed 1200mm in length, and the unsupported span of the strings does not exceed 4.2m.

2. Steps 7 and 8 relate to cutting rebates on left-handed and right-handed newel posts. Triton Workcentres manufactured prior to 1991 were supplied with double-sided protractors that would swivel 45 degrees in one direction only. This meant that when cutting mirror imaged rebates it was necessary to cut one in the crosscut mode, and the other in the tablesaw mode, as described in Steps 7 and 8 and Figures 5 - 10.

Post 1991 Workcentres have protractors that swivel from zero to 45 degrees in **both** directions making it possible to cut both rebates in the crosscut mode if preferred. Earlier Workcentre owners can upgrade to this model protractor if they desire.

Material Shopping List

1. WOOD

Regulations require a durable timber for outdoor steps. This requirement means that only Durability Class 1 timbers such as Jarrah, Cypress or CCA treated Pine are suitable, and that other species of lower durability are unacceptable, no matter how they are painted or stained.

We chose rough-sawn Treated Pine for our steps, due to its cheapness and wide availability. Some stockists also carry specially shaped handrail profiles in Treated Pine, if required.

2. FASTENING

All bolts, nails and rods used should be at least zinc-plated, and preferably hot-dip galvanised to resist corrosion. It is also a wise precaution when nailing softwoods to use twisted shank nails, such as 'Timberdeck' galvanised decking fasteners. Galvanised stair rods with threaded ends are available from stair manufacturers and some builder suppliers; a more widely-stocked substitute is "allthread" threaded rod, available in 900mm lengths in hardware stores, or cut to order in longer lengths from engineering suppliers.

3. OTHER

A pad of concrete, in effect the bottom step, is a good way to finish the lower edge of an outside stair. Masonry anchors through the timber strings or short galvanised angle brackets fixed to the concrete secure the bottoms of the strings against movement.

Definitions and Regulations.

The slope of a stairway is fixed by the relationship between the RISE and the GOING.

The RISE is the vertical distance between each tread. A RISER is strictly speaking the vertical component supporting the tread (not used in open stairs such as our example), but the two terms are often used interchangeably. The maximum rise permitted is 190mm, and all risers in any flight of steps must be of similar height.

The GOING is the horizontal distance traversed at each step, and it should be understood that this is not necessarily the same as the tread width — extensions of the tread underneath the front edge of the step above are not included (**see Figure 1**). The minimum going permitted is 240mm.

Both these regulations act together to fix the maximum angle of slope of a stairway, but they do not define a minimum, or the relationship between the two. It is therefore quite possible to construct a stairway that is perfectly legal, but uncomfortable to use.

Experience has shown that the average person's step length is about 580mm, and it is estimated that it takes about twice the effort to climb vertically as to walk horizontally. Application of this information gives the following 'Rule of Thumb' which has been found to work well: "Twice the rise plus the going equals not less than 600mm and not more than 625mm". Steps constructed according to this formula are easy to climb.

The minimum width of a stairway is 750mm, and as this gives a rather narrow stair it is best to be more generous with this dimension; we made ours 1.0m wide. There is no maximum height, as such, although there must not be more than 18 consecutive risers without a landing and/or a change of direction. Such a stairway is best left to professionals.

Balustrades and handrails.

These are required when the height of the stairway exceeds 600mm above ground level, or three risers. Two (one each side) are required on stairways more than 1m wide. Handrails without balusters are used when one or more sides of the stairway are bounded by a wall. The term BALUSTRADE refers to the assembly of handrail and upright supports; BALUSTERS are individual vertical components that connect the handrail and string, and should have a

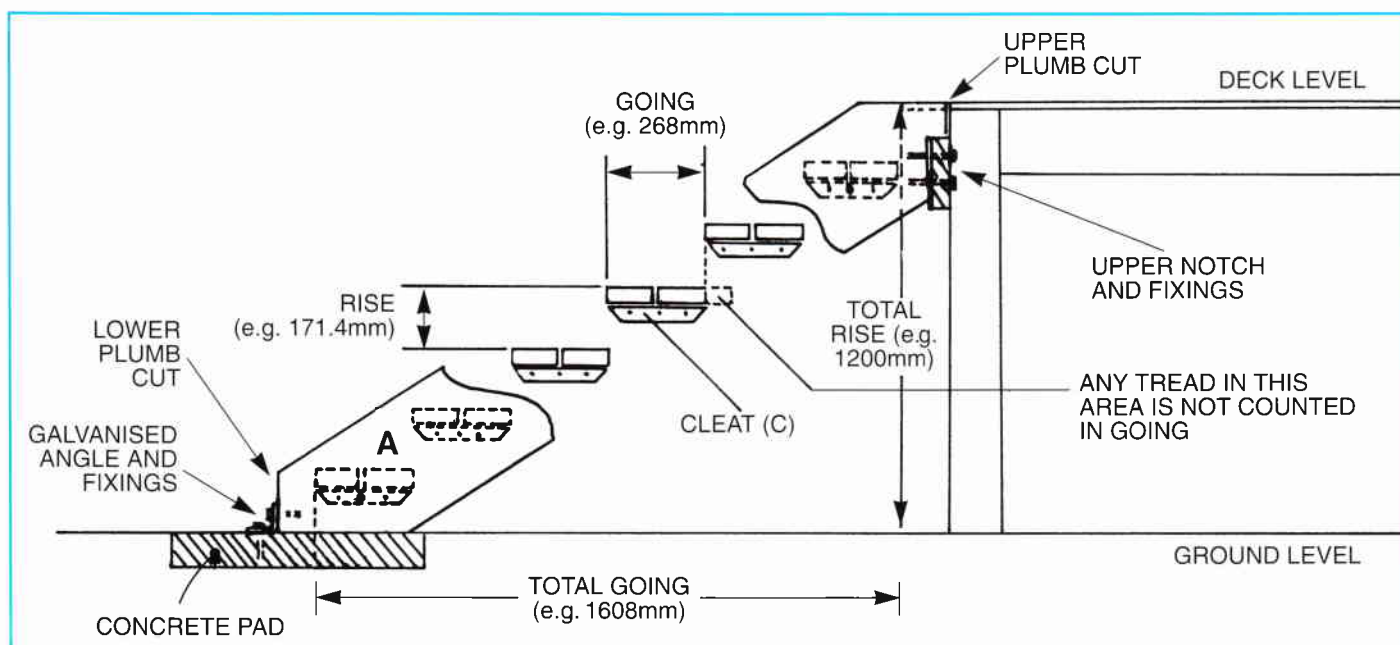


FIGURE 1

maximum spacing of 120mm. Metal mesh is often used instead on outside stairs. The minimum height of a handrail or balustrade is 865mm measured vertically from the top surface of the tread or landing.

Staircase design

2 The first step is to determine the total vertical height of the required stairway. In our case this was 1200mm. Since the maximum height of a riser is 190mm it can be seen that seven risers will be required (6 x 190 gives only 1140mm). Because all risers must be equal we divide 1200 by 7 to give a riser height of 171.42mm, which we can round off to 171mm.

Taking the minimum going of 240mm we apply the formula as above ($2 \times 171 + 240 = 582\text{mm}$) which is less than the minimum of 600mm recommended. In order to achieve this minimum we would need a tread width of 258mm, which is not a standard timber size. We can achieve the desired tread width in this instance by taking two smaller widths of timber, say 150mm wide, ripping them down and assembling the

two components with a small gap between them. Thus we obtain the necessary total width of tread, with the advantage that the narrower widths are less prone to warping, and better drainage of the tread surface is likely. In our case, we made the treads a little wider than the minimum, so that applying the formula gave us a result in the middle of the range, 610mm. (Two treads at 130mm with an 8mm gap between them total 268mm. Applying the formula; $2 \times 171 + 268 = 610\text{mm}$).

Marking Out

3 Accuracy in marking out is important, particularly in longer stairs, because an accumulated error can leave the final step several millimetres above or below the upper floor level.

An easy way to mark the tread positions onto the strings is to clamp a batten across a large framing square as shown in **Figure 2**. The lower edge of the batten must be exactly on the appropriate rise and going dimensions; the slope of the batten is then exactly the slope of the staircase. The batten is slid along the string and the position of the treads marked out.

Note that the number of treads is always one less than the number of risers (the last tread is the upper floor level), so our example has six treads. Do not forget that the two strings are mirror imaged.

4 Remembering that your marks represent the upper surface of the treads, lines can now be marked parallel to these to indicate the thickness of the tread material. You will need to extend these horizontal lines across the full width of the string.

Mark out the position of the treads about midway between the opposite edges of the string, unless you want them to be level with its front edge. (see **Figure 3**)

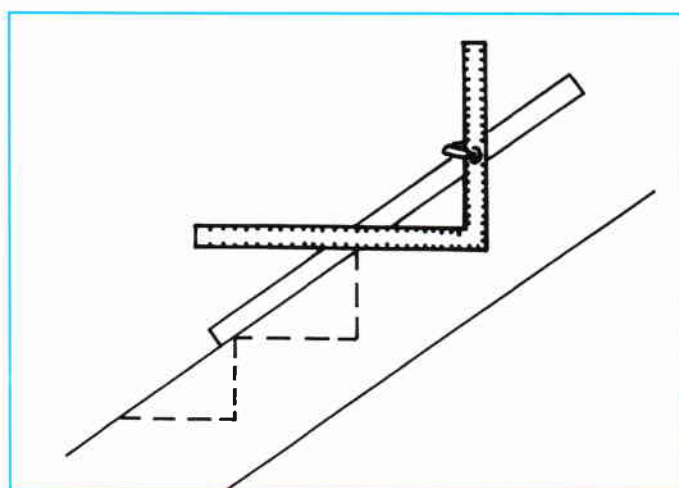


FIGURE 2

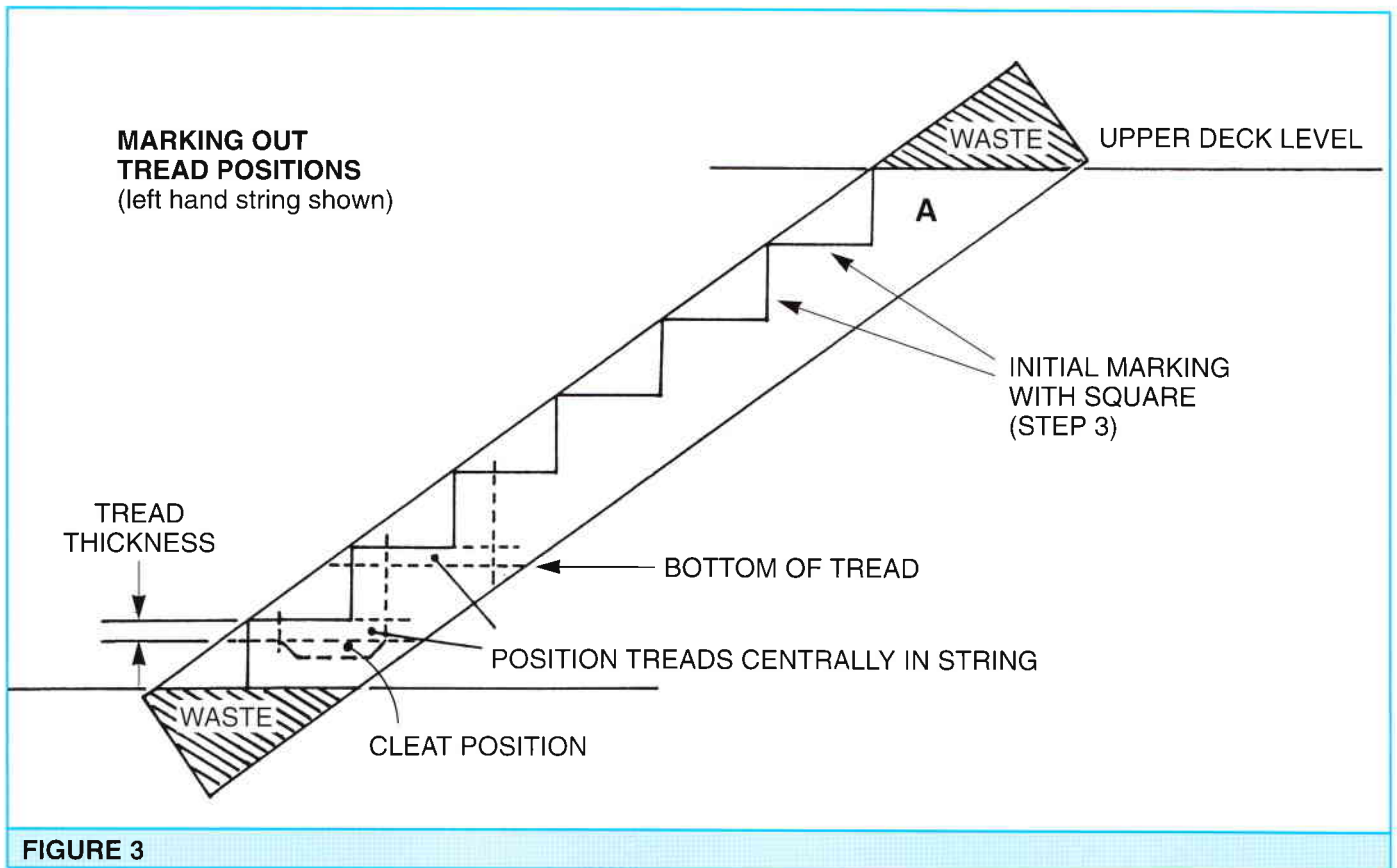


FIGURE 3

5 Cut off the top and bottom ends of the strings to the marked lines representing the ground and upper deck levels. You will need to line these cuts up by eye, with the opposite end of the string supported on your Extension Table or Roller Support Stand. You may need to cut off any extra length of the strings first, to allow the ends to fit inside the Workcentre.

Mark out the upper plumb cuts with a square at right angles to the cuts you have just made. Position the upper plumb cut (or notch, if you are using one) so that the going of the topmost tread will be the same as all the others, allowing for any overhang of your decking material as necessary (see Figure 1).

If you are using galvanised angle brackets to fix the base then the lower plumb cuts are most conveniently made on the pencil mark already made for the first tread (see Figure 3). If you are bolting the stair bottom directly to the concrete pad then you need not make a lower plumb cut at all; in this case drill and counterbore through the upper sloping edge of the string to receive the masonry anchors.

Make the cuts in the crosscut mode, using the protractor as a guide to the correct angle.

If the lower end of the staircase is fixed against sliding, then the upper screws or bolts are only necessary to prevent sideways motion; 10mm coach screws screwed through the rear of the bearer into the end grain of the strings will be satisfactory.

Drill holes through the sides of the strings just below the upper and lower tread positions to receive the stair rods, and make counterbores for the nuts and washers. The rods prevent the strings from moving

apart, thus dislodging the treads. (The purpose of the nails which will be fixed later into the end grain of the treads is not to hold the sides together, but to locate the treads and maintain the small gap in the centre).

6 Rip some cleat material to 45mm x 35mm and crosscut the cleats to the appropriate length (in our case 268mm). The cleats look neater if the ends are cut off at 45 degrees, which can be easily accomplished in the table saw mode. They should be firmly screwed or nailed in position to support the treads; we used two 65mm power-driven Deutscher screws per cleat. (Figure 4).

If you choose to nail, use three 75mm 'Timberdeck' nails evenly spaced. Pre-drilling the screw or nail holes will make it easier to correctly position the cleat and prevent splitting.

The holes for the stair rods can be continued through the top and bottom cleats, using the existing holes in the strings as a guide.

Rebating mirror imaged newel posts.

In some stair constructions the newel posts will be part of a timber deck (as in our photographed example), or part of a general construction. However some free-standing stairs will require the newel posts fixed to the strings on both sides. This requires cutting mirror imaged rebates. As pointed out in **General Points (2)**, this requires two separate operations for pre-1991 Workcentre owners. Procedures which apply are detailed in Steps 7 and 8.

The text relating to the general construction of the outdoor timber stairs continues from Step 9.

Construction Details

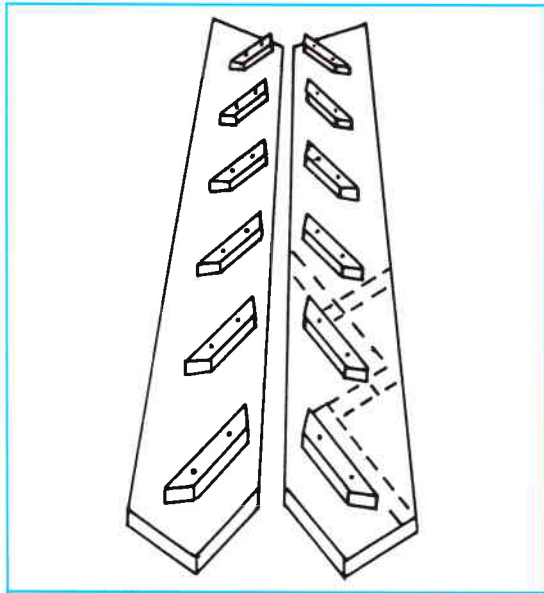


FIGURE 4

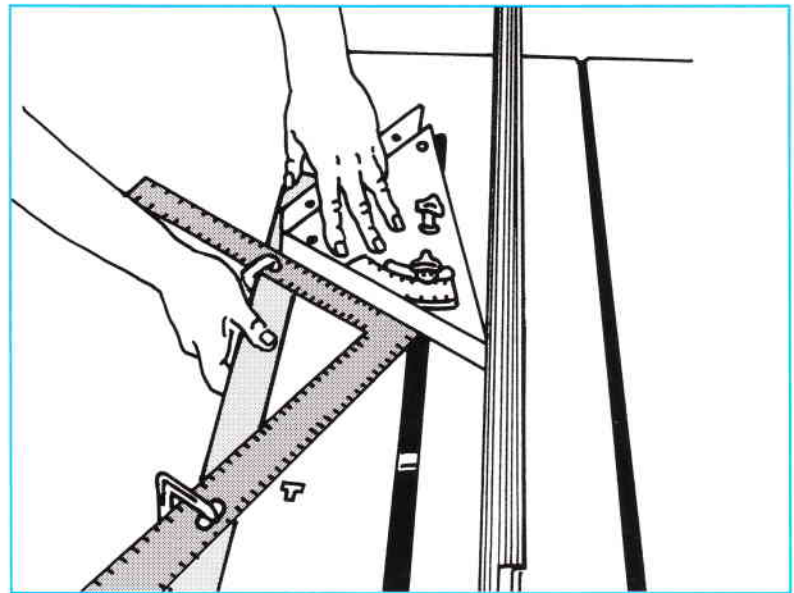


FIGURE 5

7 Cutting mirror-imaged angled rebates for the newel posts requires different operations. Left-hand newel post rebates are done in the crosscut mode and those for the right-hand posts are done in the tablesaw mode.

The lengths of the rebates should be carefully calculated so that the handrail will be the correct height, remembering that the height is measured above the treads, not the top of the string. We suggest you make the lower rebates 200mm long to allow enough overlap on the string for two through-bolts, and the upper rebates 100mm long, with the tops cut off to the same angle as the handrail.

To make the angled rebates for the left-hand post(s), lower the saw table and adjust the blade height to cut half-way through the material (45mm deep in our case). Use the batten and framing square illustrated in **Figure 2** to set the angle of your protractor (**Figure 5** shows the procedure), then reverse the protractor to use as a guide when cutting the rebates. Clamp the protractor in the table slot, and you may want to clamp a batten across the table at the same angle to give more support to your workpiece.

With the post on your right, cut the rebate for the lower end of the post (**Figure 6**), starting on your pencil mark and withdrawing the material to your right as you cut away the waste.

For the rebate at the top of the same post, slide the workpiece so that it protrudes from the left hand side of the table (**Figure 7**) and after making your first cut to the pencil mark continue to cut away the waste, withdrawing the workpiece to the left. A batten across the table is essential here due to the lack of support at the end of the cut.

If you wish to cut off the top of the post at the same angle then convert to the table saw mode, and use the protractor at the same setting (**Figure 8**).

8 For the rebates on the right-hand newel post(s), convert to the table saw mode and add a high wooden fence and extension to your protractor front face as shown, to give extra support to the workpiece. Set your sawblade height to cut half-way through your material.

Square your pencil marks down the edges of the post and make the first cut on the mark with the workpiece on your left. Continue to cut away the waste, withdrawing the post to the left after each cut (**Figure 9**). This completes the rebate for the bottom of the post.

For the rebate at the upper end of the post slide the workpiece to your right and make the cuts as before, withdrawing the post to your right after each cut. The high protractor extension gives the extra support needed for this operation (**Figure 10**).

If you wish to have a sloping top to the newel post, then convert to the crosscut mode (table lowered) and using the protractor at the same setting cut off the top of the unrebated portion.

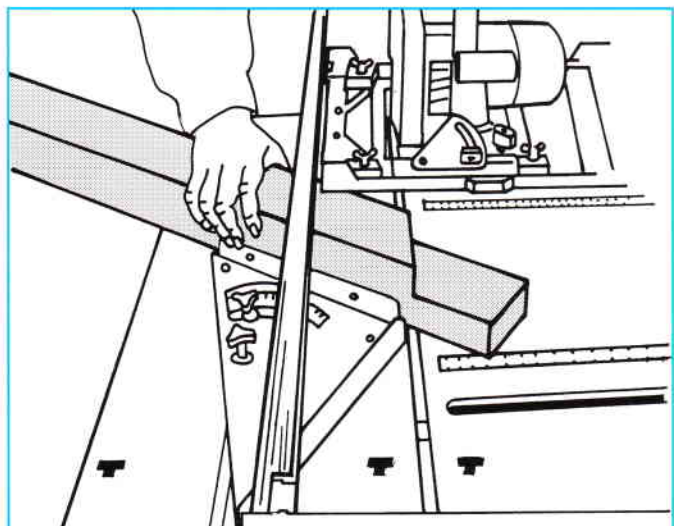


FIGURE 6

Construction Details

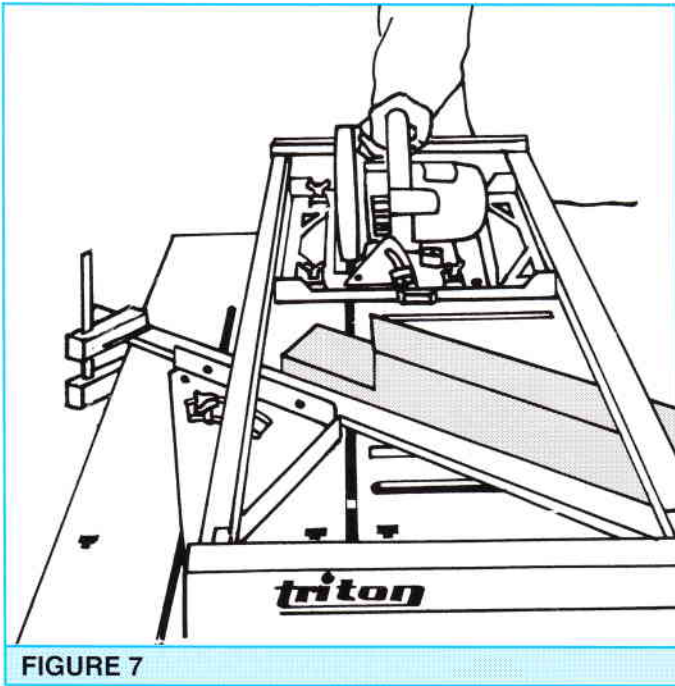


FIGURE 7

9 The balusters are simply made by ripping the material to size, crosscutting to length and drilling as required for fasteners. The tops of the balusters can be crosscut to the same slope as the handrail if desired. Both ends of the balusters can also be bevel cut at 45 degrees for better appearance by tilting the saw; the tops will then have a compound bevel.

10 Before assembling the components you may wish to round over the front edges of the treads, the edges of the handrails, and even the edges of the balusters, especially if you have used rough-sawn treated pine. This is most conveniently done with a rounding-over bit and router, mounted in a Triton Router & Jigsaw Table.

11 Assemble the strings and treads, nailing the treads into position with galvanised 100mm nails into their end grain. Pre-drilling the strings ensures accuracy. Make sure the treads are firmly in contact with their supporting cleats before nailing. You may find it easier if the staircase is propped up at approximately the correct angle during assembly.

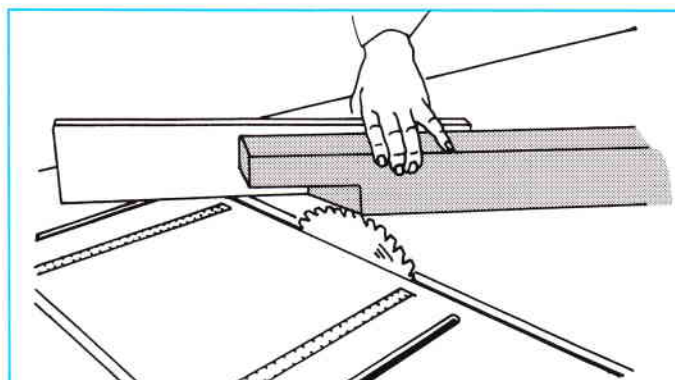


FIGURE 9

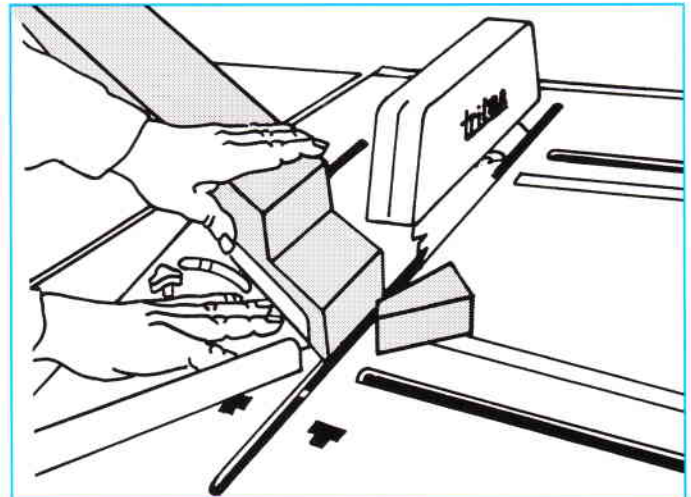


FIGURE 8

Fit the stair rods and tighten the nuts. If using threaded rod, you may wish to cut a piece of plastic conduit or similar to fit between the strings and cover the exposed threaded section.

Clamp the newel posts in their marked positions — if the stair has been temporarily propped at the correct angle then they should be exactly vertical. Drill and counterbore for fixing bolts, using two bolts at the bottom to prevent movement. Mark the length of handrail required and make the plumb cuts at the ends in the crosscut made by using the protractor, set as before, as a guide. Clamp the handrail in the upper rebates and drill for fixing bolts.

12 Rest the assembly in its final position and drill for and insert the upper fixing screws or bolts. Using a masonry drill, make holes as required in the concrete pad for the lower fixings. If using galvanised angle brackets, first screw them to the edge or sides of the string with coach screws, then use the lower holes as a guide to drill for the masonry anchors.

Bolt on the newel posts and handrail. Mark the correct spacing for the balusters and fit them into position. A plumb bob helps to keep them vertical while fixing. The project is completed by carefully sanding the handrail top surface to remove any splinters, and applying a finish if required. Deck or fence stains, and acrylic-based outdoor paints are suitable, but care should be taken if using oil-based finishes on the tread surface.

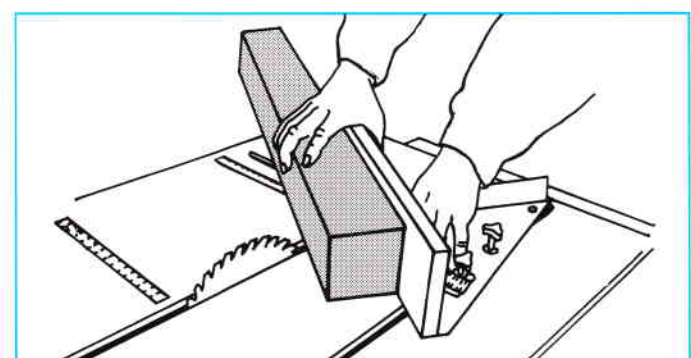


FIGURE 10