Physical Investigation of a Building

National Trust

Technical Bulletin 9.1

PHYSICAL INVESTIGATION OF A BUILDING

TECHNICAL BULLETIN 9.1

An Approach to the Archaeology of Standing Structures.

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1. INTRODUCTION

THE OBJECTIVE

One may wish to investigate a building for a variety of reasons – to establish its date, to work out how it has changed or grown over time, to find out whether there are technically interesting aspects about its construction, to see what light it sheds on the life styles of former occupants, or to provide information for the purposes of restoration. And if restoration is the objective there is a major distinction between the information you need for the structural restoration of the building and that for the restoration of its decorative finishes. For the purposes of this discussion I will assume that we are concerned with all these aspects.

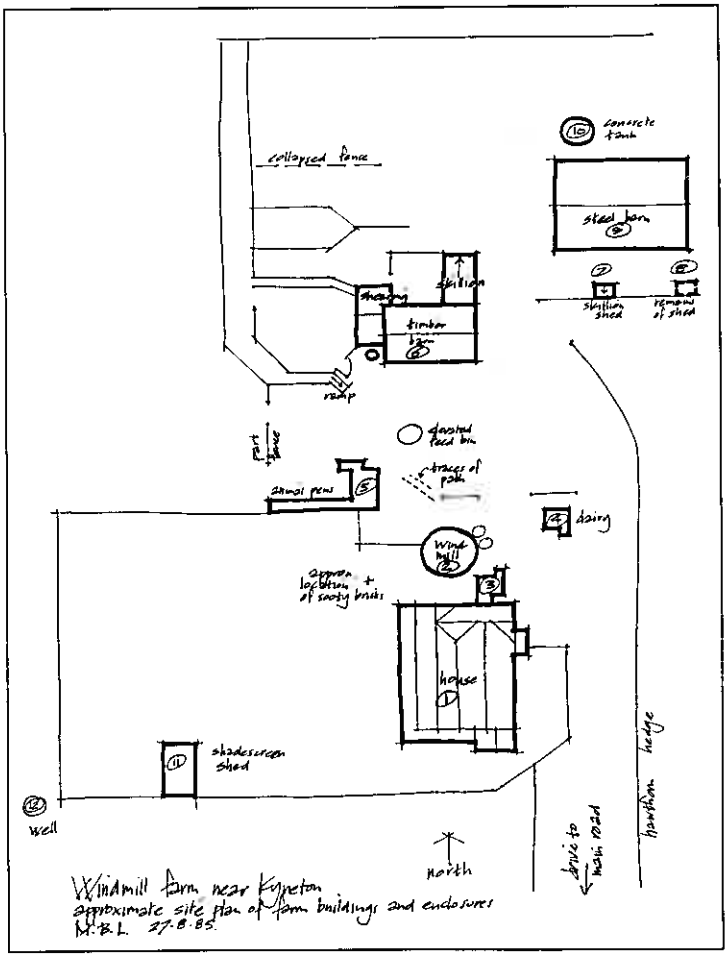
LIMITATIONS

First of all, some cautions. Physical investigation is rarely conclusive in its own right. If your documentary research has proved fruitless and cannot be used either to guide or to confirm your physical investigation, then your results are more likely to be best guesses than hard facts. Moreover, physical investigation is really a very specialised field, and is done at a professional level by architectural historians, archaeologists, and specialists in aspects such as decorative finishes. Amateur probing may not seriously damage the building, but it can destroy or distort the evidence that a future investigator would need. So, if the building shows any signs of being a really important one, be very careful what you do to it.

2. A General Survey

2.1 Site Plan

A useful start is to get a general picture of the overall shape of the building, and to do this it is worth taking the trouble to prepare rough sketch plans. First it may be wise to draw a site plan, particularly if you are dealing with a complex of buildings, but in any case if you are going to be considering the location of demolished structures, former lanes or rights of way, outside lavatories which have been moved in, and so on. You should also note the orientation by including a north point – especially if your information is to be used by someone else, or if you yourself do not have continuous access to the site but only visit it occasionally.



Sketch site plan: Windmill Farm, Green Hills near Kyneton.

2.2

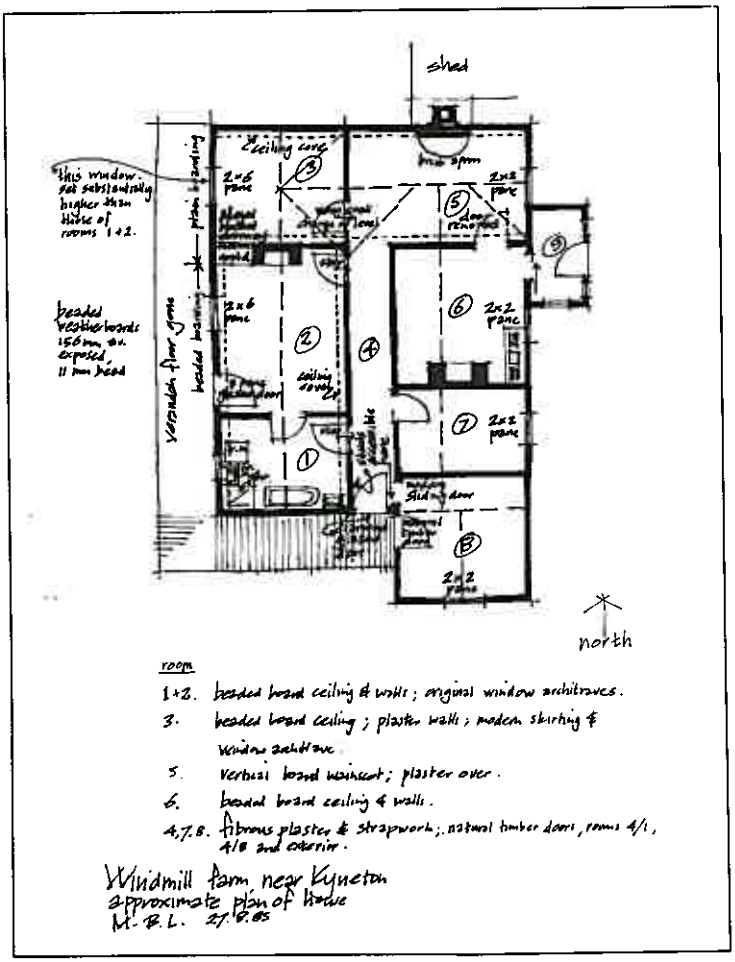
Floor Plan

When you sketch the plan of the building itself the exact dimensions of rooms may not be critical, but the overall relationships of walls, fireplaces and chimneys, and changes of level are likely to be important. It is a good idea, if you plan a really detailed survey, to number every room, including passages, large closets or pantries, &c., not in order of importance, but roughly in sequence as one might inspect the interior from front to back. This lets you record details, such as decorative finishes, in a separate list against the relevant room number.

2.3

Roof Plan

You should also if possible sketch a roof plan, including all the ridges, hips, valleys and gutters. If you can accurately superimpose the roof plan onto the floor plan you may gain immediate insights into which parts of the building seem to have been built as separate stages, which may have been open verandahs or other areas subsequently built in, why the ceilings are lower in one part rather than another, and so on.



Sketch floor plan with roof plan superimposed: Windmill Farm, Green Hills near Kyneton.

2.4 Elevations

Normally there is no need to draw the elevations – that is, the direct side-on views of the building – but if your information is to be used by someone else, or to be kept as a record of how the building looks, then it will be worth taking elevational photographs, so far as this is possible. These will give an indication of relative measurements with the least distortion, and will provide a key to the location of detailed photographs of points of interest such as those discussed below.

2.5 Photographs

Often photos get mixed up, or the purpose of them forgotten, so they should be labelled immediately ('north face of building'; 'east wall of room 10'; 'door of rooms 9/7 seen from 7', and so on). If you have not made a proper note when you took the photograph, but know the orientation of the building or have it marked on your plan, you can often work out the direction of the photo from the angle of the sun, especially if you remember at what time of day it was taken. It's not a bad idea to number your photographs and mark the numbers on the plan with little arrows showing the direction of each shot. If you need to take many interior photos you will need a wide angle lens and a flash. All photographs should be dated as soon as they are received from processing to avoid subsequent confusion.

2.6 Measuring from photographs

If your photographs are to be useful as a record of building details they should contain an indication of scale, such as a coin, matchbox, or better still a ruler. More general photos may actually be the means of measuring areas you cannot reach or otherwise work out by simple geometry, or by counting brick courses. Simply place within the photograph an object of known size, best of all a pole marked clearly into measured divisions like a surveyor's staff. To minimise distortions, place it immediately against the part to be measured, make sure it is truly placed in the direction of measurement, usually vertical or horizontal, and take the photograph from a viewpoint as near straight on as possible, even if this means standing well away and/or climbing a ladder. But remember that the result is still only approximate.

2.7 Specialist photogrammetry

Highly specialised stereophotogrammetric equipment can be used to measure buildings with very great accuracy, but this is only practicable for major projects. You can get cameras like the Nikkorflex which rectify the distortions of perspective, but this is only reasonably accurate when dealing with a single plane, and if you do your own processing you can achieve just the same correction by tilting the enlarger. Generally you will probably be better off with your marked staff carefully placed in front of your box brownie.

2.8 Excavations

Archaeological excavation is a highly specialised task, and is the last thing you should attempt yourself if you have any reason to believe that the site is significant. Not only will you obtain results which may be difficult to interpret, but you will destroy the evidence required by any future investigator. Inevitably, however, there are some situations where digging is done, even if only for functional reasons like installing drains or new foundations.

There is no general guide that can be given here except to say that at a shallow level below lawns and paths you may find useful traces which would not have survived under a cultivated flowerbed. If you find gravel, bitumen or consolidated earth surfaces, or terra cotta edging tiles such as commonly ran along the edges of flowerbeds, you may be able to deduce something of the former layout, and sometimes the location of a path will indicate a former entrance to a building. Even below flowerbeds you many find remains of the footings of buildings, gas or water pipes, wells and tanks &c.

3. SIGNS OF CHANGE

3.1 Shape of the building

You now have a general picture of the building, and perhaps already some ideas as to how it may have grown. If you haven't already done so, look at its overall form and see what it suggests, but don't be deceived by aspects like lower back wings, which are standard anyway. Apart from the simple addition of rooms, or wings, likely changes are the addition of verandahs and/or the subsequent building in of verandahs in whole or in part; the building in of a covered way or open space between a house and a wholly or partly detached kitchen; and the relocation of plumbed areas like lavatories and laundries following the connection of reticulated water supply or sewerage, the date of which you may already know from your documentary research.

3.2 Architectural character

It is difficult to generalise in notes like this, which are meant to apply to buildings of various types and dates, but if you have a feeling for architectural style you may sense that decorative details have changed from one part of the building to another, that floor to ceiling heights seem wrong for the period, or that windows are of an unlikely shape or design.

3.3 Physical indicators

You will now examine more closely the actual fabric of the building. Depending on the materials and construction, issues like the location of cracks and the nature of the wall surface may be of critical importance and they are dealt with in more detail in section 4.

3.4 Chimneys

It is worth looking at the chimneys. Chimney tops or pots will often have been removed or replaced, but there will not be much to be deduced from this. Of more significance is the extension of a flue by building it higher, a change which is often visible even from ground level. Usually this has been done because a higher part of the building has been put up, or a higher building next door, interrupting the air flow and stopping the chimney from drawing properly. Thus you have an unusual means of deducing from one part of a complex how another quite different part has changed.

3.5 Roof space

The two least altered parts of the building will frequently be the roof space and the sub-floor space, particularly the former, so leave no stone unturned until you can get into them. There will usually be hatches in the ceilings used by electricians and others to get into the roof, but if not there is no great problem, in the case of an iron roof, in raising a sheet or two and carefully replacing them afterwards, even re-using the same nails.

3.6 Roof frame

If the building has been extended, the roof may have been rebuilt, either at that time or later, and show no evidence of the change. Often, however, the new roof framing has been built onto the old, and you should be able to discern the junction if you are careful. Bear in mind that in a complicated roof shape it is natural to frame up the largest element (usually that culminating in the highest ridge) first of all. The fact that subsidiary sections seem to overlap onto this doesn't necessarily mean a thing. Commonly this first section will have been completely built with rafters – that is, the sloping timbers usually spaced about 450mm apart – on all the faces. This is despite the fact that the rafters will not have to carry any roof cladding material in those parts where a subsidiary section of roof butts in and overlaps them.

A clearer indication is obtained from the battens, which are the lighter pieces of timber running transversely, to which the roof materials are directly fixed. These are never placed in a part which does not carry roof cladding, and which is therefore not an external surface. If you find an area of the frame carrying battens within the present roof space, it is almost certainly a former roof surface. To be quite sure, check the upper surfaces of the battens. Unless they carried tiles, which were tied on with wire, they should have the nails used to fix the cladding, or at least the holes from these.

3.7 Ceilings and partitions

You will find that the lines of walls are generally clearly visible at ceiling level, and the patching where an internal partition wall has been removed can be clearly seen. The ceiling is usually carried by joists – pieces of timber spaced typically about 450 mm apart and measuring something of the order of 40 x 100 mm, placed on edge. These often continue across more than one room, so don't assume that a partition wall below them is a later insertion.

3.8 Interior walls and ceilings

We are concerned with the rooms at this stage only for what they can show us about major changes in the form of the building. The most common signs of all are lines or irregularities in plaster walls or ceilings, where a partition wall has been removed and patching has been done. These are best picked up by shining a light obliquely along the surface. Be quite sure that your are not picking up the line of a joint in fibrous plaster sheeting, a change in an earlier decorative finish, the traces of a piece of built-in furniture, or a structural crack which has been patched. Particularly characteristic are the sloping lines on a wall where a staircase has been removed. If the ceiling has been lowered, or simply re-sheeted on top of the older surface, there is almost certain to be information to be got from looking above it, provided that there is a means of access, or you are prepared to countenance the damage involved.

3.9 Floors

Usually less drastic is the raising of floor coverings to look for changes in boarding. The clearest indication you can hope to find is when one set of boards runs in one direction and one set in another, with an interval between filled with a different size or timber species. This of course is where a partition has been. Even if the information is not so clear there may be indications in the finish of the floor boards, or the amount of wear.

3.10

Floor coverings and finishes

Wall-to-wall floor coverings were virtually unknown in the nineteenth century. A corridor would be likely to have a central strip or runner of carpet, oilcloth or linoleum, with the boards exposed on either side. A room would similarly have a rectangle of floor covering, and a margin of exposed boarding. If fragments of the floor covering remain they may show borders – not only carpets had borders surrounding the main body design, or along either side of the runner, but so did the equivalent floor cloths, so if you find a fragment with a section of border it is likely that you are something like 30 to 80 mm from the wall of the room or 20 to 60 mm from the wall of the passage.

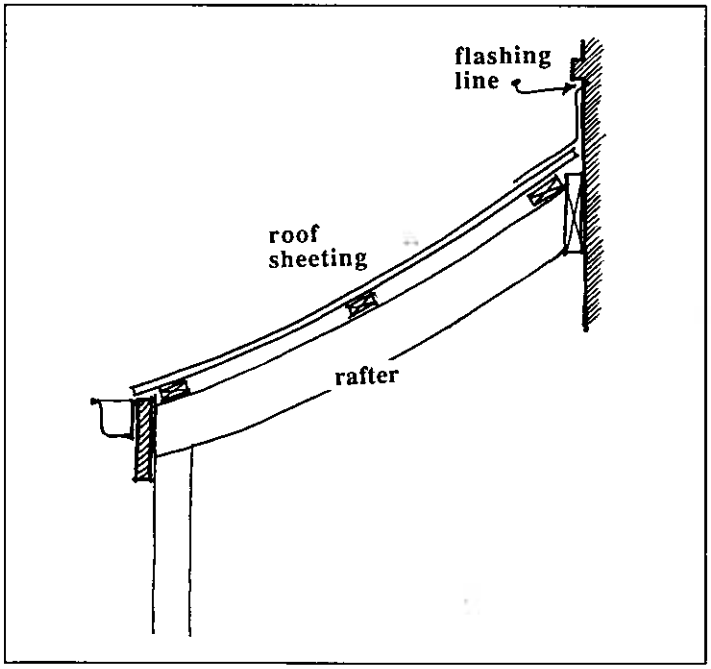
Moreover the exposed boarding itself tells a message. Commonly it was painted thickly in a dark paint of good wearing properties, while the boards beneath the floor covering were unpainted. Even if the margin was not painted, the exposed boarding will have been waxed or otherwise finished, will have been worn, and will have darkened in sunlight, by comparison with that under the floor covering.

3.11

Verandahs: wall junction

Whether a verandah has been added to a building, rather than being a part of the original, is often impossible to determine, but it is not so hard to tell whether a verandah has been removed. A building designed to take a verandah commonly has a reasonably clear strip where its roof will meet the wall, and a string course or projection underneath which will be inserted the flashing (the strip of lead sheet which covers the top edge of the verandah roof and then turns up the wall surface a little way to waterproof the junction).

The presence of these features does not of course indicate that a verandah was actually built. If it was, then there should be traces of the groove for the flashing, even if it has been subsequently filled, and of the fixings which held a timber plate to the wall surface to carry the ends of the verandah roof joists. Occasionally, if they butted directly into the wall, traces of the joists themselves can be seen.



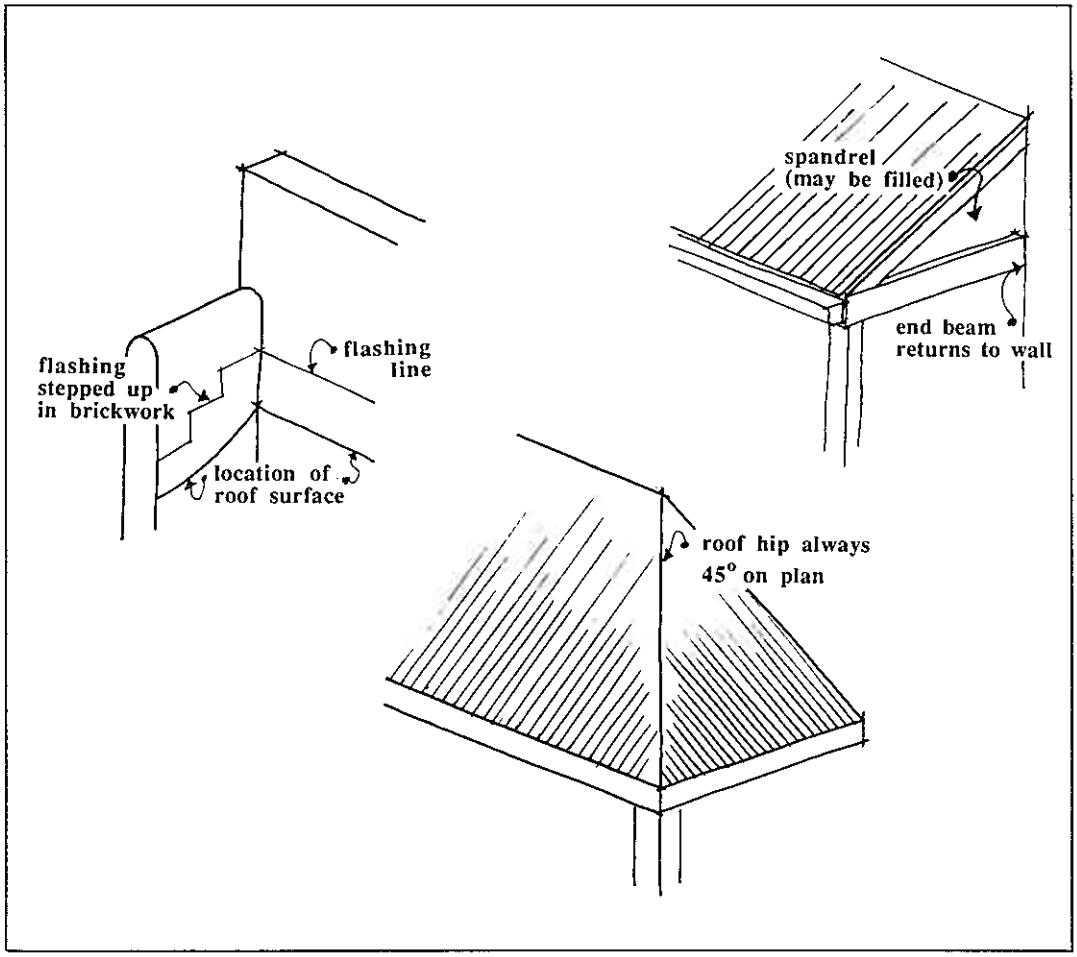
Flashing of a verandah roof.

3.12 Verandah plans

There will be other signs at the wall surface which will help to indicate the roof slope and the structure of the verandah. There are three main possibilities at the ends of a verandah. The first is that it ends against a projecting wall at right angles to the facade, so that the whole profile of the roof is potentially imprinted here, though the groove for the flashing will commonly rise up in steps (so as to fit into the joints of the brickwork or stone) rather than follow the roof profile.

The second possibility is that the verandah simply ends by itself. In this case a small beam commonly runs horizontally from the front edge back to the wall, with a spandrel filling the more or less triangular space above it, and the mark made by the beam will indicate the height of the front edge. If you have been able to locate the position in plan of the front edge, from surviving verandah flooring or column bases, you will have a reasonably complete picture.

The third possibility is that the end of the roof is hipped, and the hip is invariably at 45° on plan, so that the profile of the return is the same as that of the main verandah roof, and this profile, again, is potentially reflected on the wall surface.



End treatments of verandah roofs.

3.13 Shop verandahs

Street verandahs supported by posts, commonly those of shops, leave similar traces at the junction with the facade wall, though the plan is usually just a single slope to the front edge, and the horizontal beam and spandrel at the end is more the exception than the rule. If the posts were wooden they may not have left much trace. But in 1868 a standard iron columned type was prescribed in the City of Melbourne, and as all the main foundries made it, it was widely stocked and was used in the suburbs, country towns, and even interstate, often complete with the Melbourne coat of arms.

The base of the cast iron column bears lugs on two or three sides through which it is bolted down, and if the original base stone survives, then the marks of the bolts, and occasionally the whole profile of the base, can be seen. These base stones are square in plan and wider than the ordinary kerbstones, so they can be easily picked out when they survive. This is still quite common, even though some councils have zealously replaced all the kerbing in concrete. While the bases may have been displaced, this is usually obvious when you look at their spacing and arrangement in relation to the building.

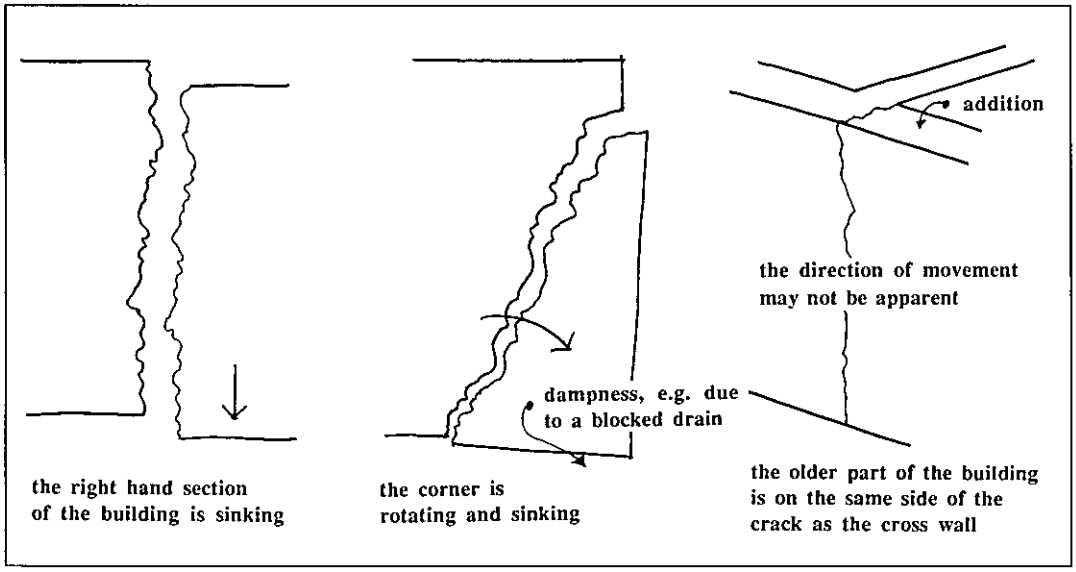
These stones are sometimes even more distinctively marked because the columns were hollow and were used to discharge rainwater from the verandah roof, so a small groove was cut in the surface of the stone to carry the water across to the street channel. Much less commonly the stones are drilled so that the water actually passes down into them and out sideways into the channel.

Base of a shop verandah column.

4. WALLS

4.1 Types of cracking

Often external cracking provides useful clues in a brick or stone building. Your first task will be to distinguish those cracks which, all too commonly, have resulted from structural problems like the saturation of the foundations or the damage caused by tree roots at a particular spot. These tend to run diagonally and, because they are usually caused by the rotation of a section of the building, to be wider at one end than the other. Stages in the development of the building will be reflected by substantially vertical cracking, and are likely to be of uniform and small breadth. Sometimes this cracking will be due to the fact that one part is much heavier than the other, say two-storeyed, and this will not necessarily indicate a different date of construction.



Forms of cracking.

4.2 Cracking at junctions

Where a vertical crack occurs in a building of reasonably uniform height, it may be because one part has been given much less substantial footings than the other, and so has subsided more. This in itself tends to be an indication that the two are of different dates, as it was not common to greatly vary the size of footings in one building unless the load itself varied (due to thicker or higher walls). If it was the earlier part that had inadequate footings, it would be likely to have subsided to its fullest extent before the addition was made and no crack might occur, so you are more likely to find a crack when the addition has subsided. Indeed there may be such a crack even when two parts of the building have similar footings, but one has already subsided before the other was added.

4.3

A. Detail of Falconer Terrace , 36-52 Napier Street, Fitzroy: the location of cracks in this apparently uniform facade indicates the different dates of construction. The crack or discontinuity at the junction of numbers 42 and 44 is to the right of the party wall, indicating that number 44, to the left, is the earlier portion.

B. Facade of Falconer Terrace, crack 1 is to the left of the party wall line and crack 2, as shown in the detail, is to the right of its party wall. This shows that part B is earlier than parts A and C. This is confirmed by documentary evidence which indicates that A [no 50] dates from 1870, B [nos 48, 46, 42] from 1866, and C [no 42] is from 1872. Numbers 38 and 36, off the picture to the right, date from 1880 and 1884 respectively.

Location of former exterior wall

Now, supposing you have found a vertical crack that seems to be the real thing, but you can't see that one side is lower than the other, there remains an absurdly simple test which even professionals overlook. The addition has usually been made against the existing wall, rather than a new wall being built against the existing one. If the addition has moved, then the wall will have stayed with the original portion. So if you can determine on the face of the building where the cross-wall is located, and if the crack is immediately to one or other side of that position, the addition is the section on that same side.

4.4 Stucco and cement render

When looking at a wall which may have been extended, don't underestimate the skill with which a later workman – plasterer, bricklayer, stonemason or carpenter – may have matched his new work to the original stucco, brick, stone or weatherboard. In the case of stucco there will probably be a change of colour and texture, and perhaps a fine crack where the new work has shrunk away from the old, but often much of the old work has been cut away well back from the junction of the new and old structure, so the line is not where you might expect it. Moreover it has usually been painted over, which is enough to camouflage it completely. In fact there may be no joint at all if the old work was not originally stuccoed. All the same sorts of considerations apply to the evidence of former door and window openings which have been blocked and stuccoed over.

4.5 Stonemasonry

Stonemasonry can be roughly divided into three categories:

- Ashlar, or smoothly dressed regular stones with fine joints, is rarely found in private buildings. Extensions to it done by a skilled mason in the same stone will be virtually impossible to distinguish once the new stone has weathered to the same colour.
- Regular masonry in axed stone or regular squared and coursed rubble, of which there are various sorts, may be equally hard to pick, but commonly the work of the second mason will differ in the range of sizes used, or even in the course height. This sort of distinction can often be made in a bluestone church. Frequently also there will be differences in the detailing or the tooling of elements like window sills or quoins (the larger or more regular blocks at corners of the walling).
- The less regular forms of rubble are unlikely to be extended homogeneously, because the centre of the wall is filled with limey rubbish, and tends to collapse if an attempt is made to cut into it. So an extension is quite likely to leave the original corner treatment unaltered.

4.6 Brickwork

Brickwork can be extended homogeneously when the bricks are hard and well-burnt, as is common after about 1870, but with earlier and more variable bricks a change is likely to show up. Even when the new bricks match well, there may be differences in the colour or texture of the mortar. A distinction is hardest to make when the work has been tuckpointed. In tuckpointed work the mortar is coloured red, or whatever colour suits the brick, and it is grooved to take a narrow strip of fine white (or later occasionally black) mortar, giving the impression of very fine and regular jointing, even cutting across the surface of the bricks themselves if necessary for regularity. This makes it very difficult to study the work underneath. Often there are clearer signs in a brick wall of former doors and windows, for these have been built in leaving the arched head or lintel in place.

A particularly common feature of this sort is on detached privy buildings on the side or back boundary of the site. On the outer or public side of the privy will be found the traces of a small square opening near ground level. This was the means by which the nightman would remove the cans at regular intervals, and it was required to be properly sealed once sewerage was connected (see 12.2 & 12.3).

4.7 Weatherboard

The problem in locating changes in weatherboard walls is that even when the boards differ in size or profile, as they often do, the carpenter has often found it easy to strip off a large area and re-clad it rather than leave a vertical joint showing. Sometimes shorter boards resulting from the change are placed in alternate levels, giving a keyed-in effect, and thus showing two broken lines of vertical jointing, only one of which is the structural junction. In other examples, however, the old wall has been left intact even with its corner stop – the narrow rectangular strip at the corner against which the boards of both faces finish – and this survives as a vertical division in the extended wall face.

5. EXTERIOR DETAILS

5.1 Roof

The roof has often been re-clad, but there may be remains of the earlier finish. Shingles or palings are often covered by corrugated iron, and the edges can be seen even from the outside (palings are the same as shingles but longer – from 0.9 to 1.5 m as opposed to about 0.45 m). Where nothing can be seen from the outside, it may well be that the old material has been stripped, but there will usually be fragments of shingle or slate in the roof space. Don't make the mistake of assuming that corrugated iron must be modern, for it was in common use from the 1850s. See sections 9.3, 9.11 and 10.7 for the question of dating roofing materials.

5.2 Parapet

In a Victorian building the parapet can be a very important element, and is very rarely completely intact. It may have been surmounted by urns or spiked balls of cast cement, or occasionally of cast iron, and these affect the whole appearance of the building. However, those of cement commonly break up because they have an iron rod as a core. Once water gets to this it rusts, expands, and causes the cement to flake off. Even where this hasn't happened, these ornaments may have been removed at the insistence of an over zealous or over nervous building inspector. You can easily tell by looking at the top of the parapet for marks of the urn bases, but you will have much more trouble working out what they looked like, and replacing them. A balustraded parapet will also contain iron rods in the balusters and in the top coping, and may have deteriorated in the same way as the urns, but it is less common for it to have disappeared entirely, so that the task of investigation is easier, even if the task of restoration is not.

5.3 Blinds and shutters

Another decorative element which makes a big difference to the facade, but has usually disappeared, is the blind hood. Victorian exterior blinds were of various sorts (Venetian, Dutch, Florentine, wove wire &c.), and commonly retracted into a hood or wooden box which fitted at the top of the window but within the depth of the recess. Sometimes it also extended part or all the way down the sides. Look for the marks of fixings and interrupted paint layers at the sides. At the same time look for the marks of hinges which may have carried shutters. When the shutters were open, and folded back against the wall surface, they were held by hooks or by flat stays which rotated on pins, and you should be able to find traces of these as well.

5.4 Glazing patterns

The windows themselves may have had glazing bars removed. Contrary to common belief, large sizes of glass were easily available by the 1850s, though they were much more expensive than the smaller ones. It was quite common, for example in a terrace house from the 1860s to the 1880s, to have three sorts of sash – the front ones would be glazed in a single sheet, the back windows of the front part of the house had each sash divided into two by a single bar, and the sashes of the back wing would be each divided into six in the traditional way. By the Edwardian period it became fashionable to have a lower sash glazed in a single sheet but the upper one closely subdivided.

5.5 Glazing bars

All of this means that you can't assume that any discovery about one sash applies to all the others, though there should be some consistency about all those of similar status or function. Your means of investigation is simply a close inspection around the inside edge of the sash: if you find the signs of earlier glazing bars you will know that a modern glazier has found it simpler to strip out the bars and re-glaze with a single sheet. If in doubt as to whether you have found the genuine mark of a glazing bar you should of course check the equivalent point on the opposite side or opposite end of the sash. If you are going to restore the original glazing pattern on the basis of this information, beware: modern glazing bars are generally far fatter and coarser in design than Victorian ones, and this apparently trivial difference makes them look quite unconvincing and positively ugly. This is partly because they are crudely made, and partly because they are based on Georgian patterns, which tend to be wider.

6. DATING OF BUILDINGS

6.1 General

Accurate dating of a building on the basis of materials and components is usually impossible, as nearly all of these are marketed over at least a period of years. Later components may be inserted into an earlier building, as is obviously true of new services, like electric lighting: it is perhaps less obvious in the case of ventilators, which were inserted into many Victorian buildings to meet health regulations of the twentieth century. Even materials which were only manufactured for a short time may be stored by a retailer or an owner and used much later, or indeed may be recycled in a subsequent building. Because of this the best one can hope for is to find an original component which can be dated by, say, a patent, and to be able to deduce at least that the building is no older than that date. Only very occasionally can the reverse be achieved, and a latest date set on a building, but this has sometimes proved possible by reference to regulations.

6.2 Regulations

The *Melbourne Building Act* took effect from 1850 in the central part of Melbourne and what is now South Fitzroy. In the 1870s its control was extended over other parts of the municipality, and equivalent regulations were introduced in most other inner suburbs. Controls spread gradually to other surburbs and to country towns, but many shires had virtually no controls until quite recent times. The Act was concerned mainly to prevent the spread of fire from one building to another. Timber buildings were prohibited entirely unless they were isolated – that is kept back a prescribed distance from all the site boundaries. Iron-clad buildings had not been envisaged at all when the Act was framed, but it was soon clarified to treat them in the same way as timber ones. Shingle and paling roofs were prohibited on other than isolated buildings. Rows of buildings in separate occupancy, such as terrace houses, had to be completely separated by party walls rising right through the roof and appearing above as parapets. Likewise fireproof wing walls had to come out between adjoining verandahs and balconies. Timber cornices or eaves could not project out over the street, and window frames and other timber elements had to be set back from the wall face. The result of this is that when one finds a terrace of houses in Carlton, for example, with a single continuous roof, it can be no later than the beginning of the 1870s. The problem with this approach is that it is often very hard to find out when regulations were introduced in any given municipality.

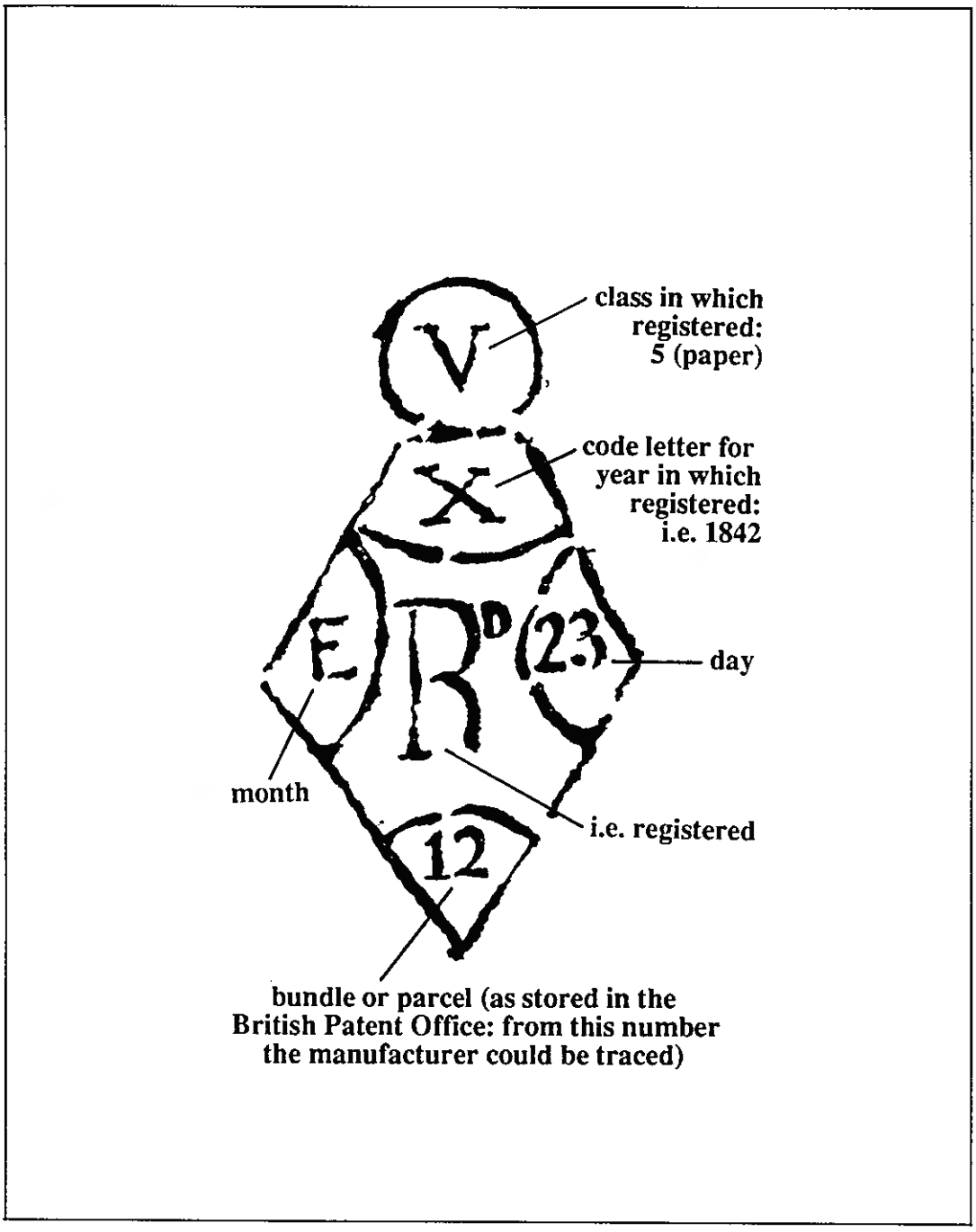
6.3 Patents

British patents were generally held to apply to the Australian colonies in the early part of the nineteenth century, and in the 1850s Victoria began to issue its own local patents. After Federation the issue of patents became a Commonwealth responsibility. The State Library holds full printed sets of the British patents, though they are stored off-site, and must be ordered in advance. By chance the Library also holds the manuscripts of the Victorian patents, but it is easier to refer to these in the printed edition which the Commonwealth produced retrospectively after Federation. New patents after Federation will be found in the *Journal of Patents*.

A word of caution is required. Some of the ideas which were patented were quite minor improvements on standard objects, and unless the object you are studying has the patent number on it or is otherwise clearly identified, you may not be certain that it is a specimen of the patented invention. Moreover, although most patents expired after fourteen years, manufacturers would go on labelling them as if the patent were current.

A patent ceiling ventilator found in the roof space of 'Glenfern', St. Kilda, designed to extract hot air fumes and water vapour from above a gas light fitting, and labelled as 'Murphy's Patent'. It was made by J. Murphy of Sandridge (Port Melbourne) in accordance with his patent of 1873, and dates from the installation of gas in the house in the 1870s.

6.4



Design registration mark. After E A Entwisle, *Wallpaper of the Victorian Era* (F Lewis, Leigh–on–Sea, UK, 1969), p11.

British registered designs

Whereas inventions were the subject of patents, designs, such as those of wallpapers, were protected by registration. The one system of registration covered designs of all sorts, for crockery, cast iron and so on. The British system from 1842 to 1867 used a diamond-shaped mark, within which were zones for letters and numbers to be entered to indicate the class of product, the day, month and year of registration, and the parcel number of the design. From 1868 to 1883 the same shape was used but the zones were swapped around.

Registration data 1842-1883

Months		Years 1842-1867				Years 1868-1883			
A	December	A	1845	N	1864	A	1871	V	1876
B	October	B	1858	O	1862	C	1870	W	1878
C/O	January	C	1844	P	1851	D	1878	X	1868
D	September	D	1852	Q	1866	E	1881	Y	1879
E	May	E	1855	R	1861	F	1873		
G	February	F	1847	S	1849	H	1869		
H	April	G	1863	T	1867	I	1872		
I	July	H	1843	U	1848	J	1880		
K	November	I	1846	V	1850	K	1883		
M	June	J	1854	W	1865	L	1882		
R	August	K	1857	X	1842	P	1877		
W	March	L	1856	Y	1853	S	1875		
		M	1859	Z	1860	U	1874		

From 1884 the whole scheme was abandoned in favour of a simple series of numbers.

Registered numbers

1	1884	205240	1893	*385500	1902
19754	1885	224720	1894	*402500	1903
40480	1886	246975	1895	*420000	1904
64520	1887	268392	1896	*447000	1905
90483	1888	291241	1897	*471000	1906
116648	1889	311658	1898	*494000	1907
141273	1890	331707	1899	*519000	1908
163767	1891	351202	1900	*550000	1909
185713	1892	368154	1901	(*approximate)	

6.5 Colonial registered designs

There was an equivalent system of design registration in Victoria from 1870, which has yet to be properly researched. The late Dr E G Robertson investigated those for ornamental cast iron balustrades, brackets and friezes, which comprised the majority of the 161 designs for ironwork registered between 1870 and 1900. He reproduced all but those which would not photograph well in:

E G Robertson, *Ornamental Cast Iron in Melbourne* (Melbourne 1967), pp. 41-43.

These will be found very useful, but it must be borne in mind that some cast iron was imported from Britain, many local designs were not registered at all, and some designs were made by more than one manufacturer (presumably under licence, or when the design had not been registered, or when the registration period had expired).

6.6 Brands, trade marks and catalogues

Brands and trade marks were also protected in Britain by registration, but the situation in Victoria has not been investigated. Provided the company's name is specified, one can use the directories (Sands & Kenny, Sands & McDougall, &c.) to find over what period the company was active under the name or style found on the brand. These directories are available at the La Trobe Library, State Library of Victoria, and the Baillieu Library, University of Melbourne.

There is no systematic collection of manufacturers' price lists and catalogues, but some important individual examples do exist. There are a number of catalogues of the roof tiles and terra cotta ware of the Wunderlich company available in various collections, and an important set of the company's records and patterns in the Power House Museum in Sydney. An undated catalogue, perhaps c1880, of the giant Melbourne ironmongers, James McEwan & Co., has been reproduced in modern facsimile edition. The 1901 catalogue of decorative cast iron balustrading, friezes, &c., of William Stephens's Excelsior Foundry, South Melbourne, is in the Architecture Branch Library, University of Melbourne, and is reproduced in full in Robertson's *Ornamental Cast Iron in Melbourne*, previously referred to. There are many others, but they are difficult to locate.

The best collection of British catalogues is a very rare multi-volume bound set collected from exhibitors at the Great Exhibition in London in 1851, held at the State Library. Smaller collections were made in connection with some of the colonial exhibitions. The official catalogues of the exhibitions themselves of course list the exhibits, and even where the maker's name or brand does not appear, they can at least clarify the period when a given product was likely to be used.

There are also many trade publications. *Ramsay's Architectural Catalogue*, covering a wide range of building products by a variety of companies, was published regularly in Melbourne from 1931 onwards. Although there are plenty of important advertisements and articles on particular products in building trade journals and other publications at earlier dates, there is no simple way of locating references to any specific brand or even category of product. The nearest to an earlier equivalent of the *Ramsay's Catalogue* is the price book published every few years by C.B. Mayes, then by his son C.E. Mayes, and finally by his grandson Philip Mayes. The first, the *Victorian Contractors' and Builders' Price Book*, was published in 1859, then the *Australian Builders' Price-Book*, in 1862, and subsequent editions with slight variations in title. These can be found in the State Library, and are useful not just for the advertisements, but also for the materials and products which appear in the price lists, as a guide to what was in current use, and for the editorial comments which are made about some of them.

6.7

External inscription and symbols

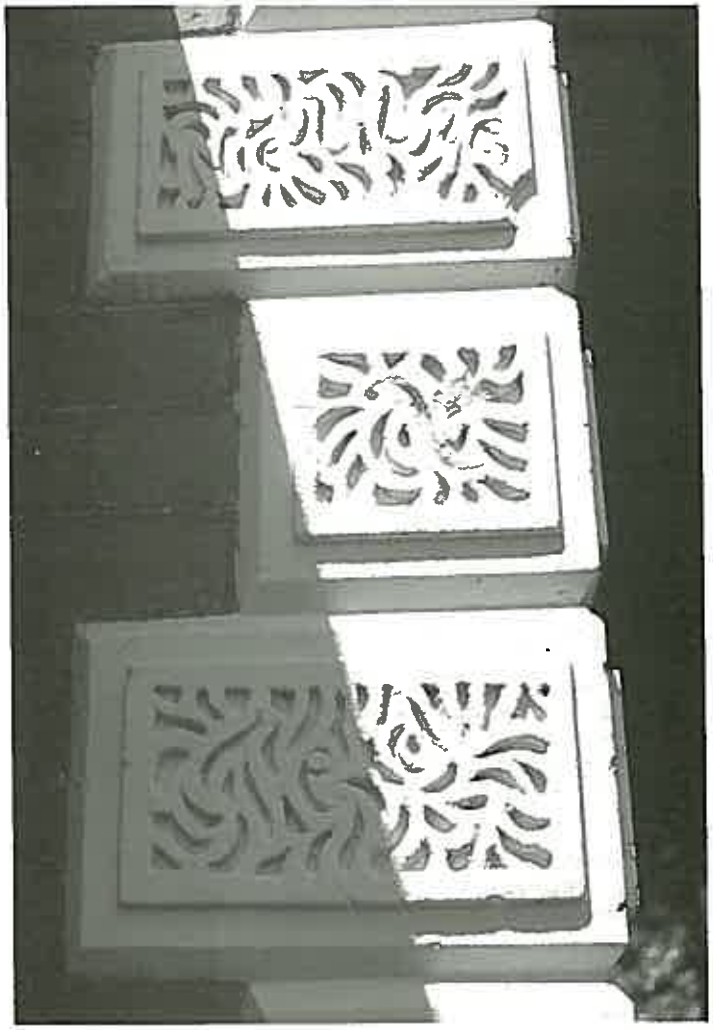
Many buildings carry a date or nameplate on their facade, most commonly at parapet level. The date is not always accurate, for sometimes it represents the foundation of the business, not the construction of the building. The year 1888 in particular should be viewed with slight scepticism, for being the country's centennial year it was popular for buildings conceived, designed, begun, finished or first occupied in that year, so that one rarely finds a building dated 1887 or 1889.

The name of a building is much less likely to convey useful information, but may at least provide a lead worth following up, such as that 'Tarrangower Cottage' was built by an ex gold–miner from Tarrangower, or 'St. Crispin House' was a shoe factory (St Crispin being the patron saint of bootmakers) and 'Caxton House' a printery. Then there are symbols like the square and dividers of the masonic hall, the burning bush of the Presbyterian church, and the horseshoe or horse's head on the farrier's

The foundation stone in the early to mid-nineteenth century was generally not an inscribed stone, as is commonly assumed, but a totally anonymous one. The fashion for inscribed stones come later, and because of this it is not uncommon to find the confusing situation, especially in the case of a church, of having one or more visible stones commemorating additions, but none giving data on the original bulding.

Signwriting of any age does not often survive intact except in the very useful case, when an adjoining building is demolished to reveal a sign on the flank wall. For most purposes, however, this is too drastic and expensive a means of investigation to contemplate. In shops a new parapet or hoarding has often been built in front of the old Victorian parapet, and the originals signs may have survived underneath.

Finally, there are in rare instances in which more personal inscriptions are either incorporated in the original design or added later by way of graffiti.



A detail from the house 'Dominica' at Ararat, showing what at first sight seem to be conventional vermiculated quoins, but containing the names 'Ted' and 'Nellie' for the original owners, Theodore and Eleanor Grano. The names of their children are in the quoins rising above.

6.8

Fire marks

A fire mark is a small metal plaque bearing in relief the name and/or the symbol of a fire insurance company. This dates from the period before the 1890s, when insurance companies maintained their own brigades to attend fires only in buildings insured by them. Few marks now survive, as they have been regarded as collectibles for many years, and they usually tell little more about the building than an approximate *terminus post quem* for the date.

For more detail see:
A. Chitty, 'Fire Insurance Offices and "Fire Marks" in Australasia', *Victorian Historical Magazine*, vol.VIII, no. 31, pp. 81ff; no. 32, pp. 113ff.

6.9 Signatures

Occasionally artisans sign and date their work in a building. The more eleborate stained glass windows are sometimes signed by the artist (or branded by the company – there is no clear distinction). Built–in furniture or joinery work is occasionally signed on the rear or built–in side so that it cannot be seen until the piece is dislodged. More useful are the signatures of painters and decorators, which commonly occur high up towards the ceiling of a room, or even within the cove of a cornice or on some flat upper surface out of the direct line of sight from below.

6.10 Monograms, coats of arms and biographical scenes

The monogram or coat of arms of the first owner appears sometimes on the facade or within the exterior decoration, but most commonly inside, in a stained glass window or on a painted ceiling. Although many of Victoria's wealthier familes were not entitled to coats of arms, this did not inhibit them from borrowing or creating something appropriate, and of course research based on these factitious arms can prove to be frustrating or misleading.

The interior decoration sometimes includes painted scenes of a biographical nature, such as those at 'Mintaro', Monegeetta, where Robert Gardiner's drawing room has scenes of his days as a whaler, gold buyer and so on. Such scenes rarely convey useful factual information, but they do add personal interest to the building and shed light on the previous owner's values and preoccupations. They also establish during which owner's time the decoration was done.

The monogram of the Wilson brothers, from the staircase window of Woodlands, near Crowlands, Western Victoria.

7. STONES AND CEMENTS

7.1 Freestone

Freestone is a term for those sandstones and limestones of sufficient quality to take fine carved work, but we use it here more loosely to mean sandstone and limestone generally. There is little high quality freestone in Victoria and the search for a stone for Parliament House, which had to be local for patriotic reasons, occupied the best part of a quarter of a century. Thus, while in country areas the stone is almost certainly local, in Melbourne, and especially in public or more pretentious buildings, one may find a rough ferruginous (or iron-bearing) sandstone which was quarried on the south bank of the Yarra from about 1839; sandstone imported from Sydney; limestones from Geelong and Point Nepean; sandstone from the Barrabool Hills near Geelong; and Kangaroo Point sandstone from near Hobart. Imported stone such as that from Sydney is often confined to those details requiring dressed stone, like sills and lintels, or to carved components of the building.

In 1859 stone from Bacchus Marsh began to be used for the Treasury Building in Spring Street, and became available commercially. By the end of the year quarries were opened at Darley, ten kilometres from Bacchus Marsh, for facing the east or library facade of Parliament House.

It was at the Treasury that Victoria's first stone sawing machine was installed in 1859, but in 1862 all sawing was again being done by hand. In the following years the range of available freestones was enlarged by a second type from Kangaroo Point and other Tasmanian stones from Point Ventenat and Bruny Island, then by Oamaru stone from New Zealand, and finally by the Stawell or Grampians freestone used for the main front of Parliament House from the 1880s.

Even when one can identify the type of stone in a building, or the actual quarry, this does not often give an exact indication of date, nor does it shed much light on any other aspect of the building. It is not possible here to give any useful guide for identification purposes, but the best reference is:
R.T. Baker, *Building and Ornamental Stones of Australia* (Sydney 1915).

7.2 Bluestone

'Bluestone' is the local name for basalt, and is not to be confused with the schist known as bluestone in South Australia. It is very widespread in Victoria from Melbourne westwards, and to some extent in northern Tasmania. It is very hard for anyone but a connoisseur to identify it to a particular quarry or source, though it does vary in texture from very fine and dense to bubbly and porous, and in colour from near black to a red brown. It is the denser and darker stone, such as that from the Malmsbury quarries, which is the best.

The manner of using bluestone is a more useful question to pursue. Firstly, bluestone was very little used prior to 1853, though from 1849 a few churches were built of it, mainly in the form of coursed rubble. There was a sudden boom in bluestone building in 1853, and it was mostly laid as random or coursed rubble or rough axed rectangular blocks. At the beginning of the 1860s the stone disappears again except for churches, warehouses, prisons, and of course the footings and plinths of buildings of all sorts. From this time onwards it is for most purposes covered with cement or replaced by brick.

A very widespread but little known use of the stone continues into the 1890s in the divisions between shops at ground level, where it is used at the front edge of the party wall to carry the considerable load of the upper part of the building. It is used here in alternating long vertical blocks and short horizontal blocks tying in to the brick wall, but is always rendered or tiled over and not seen until the building is demolished.

7.3 Slate

Apart from some inferior slate from Willunga in South Australia, all roofing slates were imported from Britain, a green type from Cumberland, and the much more common blue type from Wales. Both types have been available from the 1840s to the present day, and they are of no specific help in dating or analysing buildings.

Roofing slates come in a number of traditional sizes called 'duchesses', 'countesses', &c., and occasionally with curved or other shaped ends. Though none of these are characteristic of any particular period, fancy roofs with bands or diapers of different shaped or coloured slates tend to be more common in the 1870s and 1880s, especially on churches. Slate flags for paving were quarried in Victoria from the 1850s at Barker's Creek near Castlemaine; at Maldon; and later at Avoca and elsewhere, but they tend to appear in Melbourne only after railway connections make this economically feasible – in about 1861 in the case of the Mount Alexander & Murray Valley Line through Castlemaine and Bendigo. The use of local slate in enamelled chimneypieces will be mentioned in section 13.2.

7.4 Paving stones

A certain amount of paving stone was imported from Britain in the 1850s and early 1860s. The York stone, which was brown, has yet to be positively identified in any local context, but the Scottish sandstones from Arbroath and Caithness were reddish, and what is thought to be the Arbroath stone has been identified at sites in inner Melbourne, Sandringham, Point Cooke and Port Fairy, the common factor being access to the sea. These were presumably displaced from the market once local slate and bluestone were able to compete. In the case of bluestone, this seems to have been in the mid-1860s when stone sawing works were set up on the Maribyrnong, but the major phase of sawn bluestone begins in 1874 with the opening of the new works of the Footscray Steam Stone Cutting Company. These works used bluestone brought direct by rail from the Malmsbury quarries.

7.5 Lime

Victoria, unlike New South Wales, had adequate sources of lime, which were exploited from within a few years of settlement. These were decomposed shell lime from Point Nepean and rock lime from Geelong, and they were not hydraulic (that is, capable of setting under water, and capable of resisting the effects of water once in use). Nevertheless their availability, together with the lack of a good freestone, seems to have been the reason for the characteristic use of stucco facades in Victoria in the 1840s and to a lesser extent in the 1850s. This is to be seen in Melbourne, Geelong, and to some extent in the ports of Western Victoria, but in the inland lime was far harder to come by and walls are often built with a mortar of loam containing only a token proportion of lime.

To estimate the date when lime came into more general use in a country area one needs to know when effective railway or other communication was established or when local lime production began. Lime burning began at Mount Franklin near Daylesford in the later 1850s and soon after on the Bet Bet Creek (both supplying Bendigo); on the Leigh, 30 kilometres from Ballarat, in 1861; and at Mansfield by 1866. Meanwhile a better, mildly hydraulic lime, was produced at Geelong from about 1858, and quite significant amounts of hydraulic lime were imported from overseas. While it is not hard to distinguish a soft lime from a hard cement, it is very difficult to distinguish the intermediate gradations of hydraulic lime and Roman cement.

7.6 Cement

So-called Roman cement was not only imported to Victoria during the 1850s but actually manufactured locally, near Mornington, in 1862-5. Portland cement, effectively the same material we use today, was also imported, but was not made in Victoria until 1890, and at almost exactly the same date in the adjoining colonies.

It is important to understand that Portland cement was used very little for structural purposes like mortar and concrete before 1890. Its main function was cosmetic: it could be used to face buildings in a texture and colour resembling the better English sandstones (like Portland stone – hence the name), and it was resistant to weathering even when moulded and cast in elaborate shapes. Thus it was the basis for the elaborate facade treatments which are especially characteristic of the 1880s. It also seems to have been used for mortar in important facades, particularly in the high quality red face brickwork which became fashionable from the mid-1880s under the influence of the so-called Queen Anne style.

Portland cement is not easily distinguished from Roman cement or even hydraulic lime when it is used in weak mixtures: the basic chemical components of these materials are similar, the most important distinction being the temperature at which they are burnt during manufacture. When they have degraded over time even chemical analysis will not always clearly distinguish them.

7.7 Mass concrete

Concrete is the forgotten material of the nineteenth century, partly because it is misunderstood. The reinforced concrete with which we are familiar today is a sophisticated structural element, but the mass concrete which preceded it was almost a primitive building material. There are references to concrete cottages in Melbourne in the 1840s, and a handful of specimens survive from the 1850s. Generally they are made from lime, though one surviving example seems to be of Roman cement. Concrete was also used for the foundations of buildings – that is, as a solid top layer of the ground onto which the building would be put – not for footings in the modern sense, which are the reinforced concrete strips forming the bottom part of the building itself.

Mass concrete may contain a proportion of fencing wire or hoop iron to reduce cracking, but this will not be mistaken for proper reinforcement. The material is made from lime or Roman cement and is softer. Often it is so crude as to more resemble a mass of rubble or gravel with a weak lime mortar binding it, and often the soft cement has so eroded from the surface as to reveal the aggregate (or stone content) completely. Nothing much can be deduced from the discovery of such a wall except that it is almost certainly of the nineteenth rather than the twentieth century.

7.8 Reinforced concrete

Reinforced concrete was effectively a totally new material, dependent upon a calculated combination of high grade Portland cement and steel. It was introduced in engineering works in Victoria in 1899, and in conventional buildings in about 1905. Until the 1914-18 war the dominant type was that of the Monier Company, which tried to maintain a monopoly, and modern reinforced concrete, which has grown out of that type, more or less resembles it in the nature and placing of the steel reinforcement.

Before the Great War there were other types which are of very great interest, and they are characterised by reinforcement such as spirally-wound wire or bars, containing a core of parallel bars; expanded metal (metal sheet which has been perforated with a myriad regularly placed slits then pulled apart sideways to turn into a diamond lattice); and Kahn bars (which were initially rolled in a sort of T-section, then the flanges slit longitudinally on a shallow angle, to form strips which would remain attached but which could be pulled out from the bar and placed at angles to it or wrapped around adjoining reinforcement).

It is impossible to describe these systems adequately here, but they are of the greatest interest, and specialist advice should be sought if an example is located.

7.9 Cement blocks and tiles

Cement blocks of various sorts were made in Victoria during the nineteenth century, but no surviving examples have ever been located. For practical purposes they can be taken to date from about 1905, when American block-making machinery became readily available in Victoria. These early blocks are almost invariably cast solid, with the face in imitation of split, vermiculated or other textured stonework, unlike more modern Besser and similar blocks, which are hollow cored and smooth faced. If you are in any doubt as to whether a wall of textured blocks is of cement or stone, look at the textured pattern carefully and you will see that the same one or two designs recur in every block, though this may not be so apparent if some are placed upside-down. The only other material which shows this repeat of patterns is pressed metal cladding (see 10.9).

Cement pressed bricks, that is, blocks of the same size as a clay brick, seem to have been made with machines available from the 1920s, though the high fashion for what were called sand-lime bricks seems to date from the 1950s. 'Mack' cement blocks for internal partitions were of a quite different character, measuring typically one foot by seven (0.307 x 2.150 m) on the face by 51 to 70 mm thick, and they seem to have been available by about 1908. Cement roof tiles become reasonably common from the 1920s, at this stage usually in a cruder imitation of the popular Marseilles pattern terra cotta tile, and sometimes pigmented red as well. Other and simpler shapes are likely to date from after World War II.

7.10 Concrete walling

The difference between mass and reinforced concrete has been discussed above, and in practice there is rarely any confusion. Reinforced concrete contains carefully designed and placed steel bars, and in older examples some proportion of these have usually been exposed due to spalling (or flaking off) of the concrete covering them. Even if the surface is intact it is usually apparent that the material is of a higher grade, made from hard Portland cement, and is more carefully constructed. In theory one may learn a certain amount from the marks left by the formwork or casing within which the concrete was cast, as there were certain patent types available in the nineteenth century – but in examples dating from this period the surface is rarely sufficiently intact to be interpreted.

In the twentieth century there were a variety of specialised or patented methods of masking concrete walls, some of which became quite widely used for housing after the Great War, and culminating in the pre-cast panels of the Victorian Housing Commission, which were made under factory conditions and used to build individual houses, low-rise flats and tower blocks. Types which may be found in ordinary houses include panels which were cast in the horizontal position and then tilted upright to become walls, and walls which were cast in place but were made wholly or partly hollow by including steel cores which could be pulled out from the top as the concrete set.

7.11 Asbestos cement

French-made asbestos cement 'slates' were being imported by James Hardie & Co from the Fibro-Cement company of Poissy from about 1903-4. The material was known locally as 'fibro-cement', and it seems that larger sheets for cladding purposes were introduced within two or three years. The slates were laid diagonally, and give a roof finish of diagonal squares, though each slate is in fact slightly longer than square with the overlap. They come in purple, blue, red and grey, and in various thicknesses and sizes, most typically sixteen inches (410 mm) square. Later black and green became available, the latter being slightly cheaper.

The sheets were in sizes up to 12 by 4 feet (3.686 x 1.229 m), and were used for internal as well as external wall finishes. By 1914 British 'Poilite' asbestos cement in similar sizes was being sold by Noyes Bros, and Sanderson's by John Sanderson & Co. By this time corrugated roofing sheets were also available, but of which brand is unclear. Asbestos cement fillets to cover external wall joints were possibly a somewhat later development.

In 1917 asbestos cement sheets began to be manufactured locally, by Wunderlich's at Cabarita, Sydney, and by Hardies at Camellia on the Parramatta River. Hardies called their product 'Fibrolite'. By 1927 the available brands were 'Asbestolite', 'Durabestos', 'Eternit', 'Fibrolite', 'Fibro-cement', 'Herculite', 'Poilite' and 'Titanic'. There were also 'Robertson' asbestos coated corrugated steel roofing sheets.

8. Bricks and Tiles

8.1 Handmade bricks

It is impossible to give a simple guide to all the brick types that may be found in Victoria, but a few traps can be indicated. The term 'handmade brick' is often used in a very vague way. There are bricks made totally by hand, bricks made in small machines which are powered and operated by hand, and bricks made by large machines driven by steam, and later by other means.

Handmade bricks were formed in a mould like a bottomless box, and in Victoria they were slop-moulded – that is, the mould was regularly wetted to prevent the clay sticking to it. Thus handmade bricks in Victoria often show slight ripples and marks of the sloppy surface, unlike Sydney bricks which were sand moulded and have the corresponding sandy finish on the sides. The top of a handmade brick will show the marks where a wire or blade has been used to scrape off the excess clay across the top of the mould. The bottom of the brick will have rested on a 'stock' fixed to the brickmaker's table or 'stool', and this may have been shaped with an upward projection, leaving an indentation or 'frog' in the finished brick, and/or with the maker's name or initials.

The common assumption that these features cannot occur in a handmade brick is totally incorrect, but it is true that they tend to be of a more rudimentary character. Early colonial bricks, especially convict-made ones, frequently have identification marks such as hearts or diamonds, rather than lettering. The presence of finger or thumb prints almost always indicates that the brick was hand moulded.

8.2 Extruded bricks

Machine made bricks are of two basic types, extruded and pressed. Contrary to common assumptions, extruded bricks may be quite early in date, and are commonly weaker and more primitive in appearance than those which are hand moulded.

Extrusion machines may have been imported to the Australian colonies even before 1840, and before 1850 some were manufactured locally. These machines were often used by non-professional brickmakers such as farmers, who did not require the best quality bricks, and who could use the same machine (with a different die) for other products such as drainage tiles. Accordingly the extruded brick is found more commonly in country areas.

The extrusion machine squeezes out a strip of clay, and brick-sized pieces of this are sliced off with wires. Because the clay has been subjected to even less pressure than in hand moulding, it is less dense and therefore weaker, and because it requires a high moisture content it tends to distort more in the process of drying and burning. However, it is only by looking at the surfaces that such a brick can be definitely identified, as wire cutting produces much sharper arrises or edges than in other types of brick.

As the top and bottom faces are both cut by wire, they are alike in appearance, neither ever containing a trademark or frog such as may occur in either a hand moulded or a pressed brick. The four side faces have all been formed by the die through which the clay was extruded, and though they are not necessarily very different in appearance from the faces of a hand moulded brick, any lines caused by pieces of grit or irregularities in the die will be repeated uniformly on a number of bricks in any one batch.

8.3 Pressed bricks

Pressed bricks vary enormously in character according to the water content of the clay and the amount of pressure to which they have been subjected. The first pressing machines of the 1840s and 1850s were powered only by hand, and the bricks they produced were only moderately dense. But before the end of the 1850s the steam-operated machinery was available in Melbourne, and could exert enormous pressure. This meant not only that the brick was very dense, but the clay could be used in a dry, even a powdered state, eliminating the need to dry the bricks before firing them, reducing the amount of fuel consumed, and virtually eliminating distortion during burning. Such machinery, however, was exceptional until about the 1890s, by which time also the Hoffmann kiln (introduced in 1870) had resulted in much more uniform burning.

In general pressed bricks tend to be denser, of higher strength and quality, and smoother on the faces. Where they show a frog or trademark this often contains the impressions of the screws used to fix the die into the moulding box. More modern pressed bricks often show round marks where the mould was provided with spew holes out of which any excess clay would be squeezed. Occasionally pressed bricks will have a frog on both the upper and the lower surface, and this is a definite diagnostic, because such a thing is impossible in a conventional hand moulded or an extruded brick.

8.4 Brick colours

While colours in the orange-red-brown range are the norm in early bricks, it is not uncommon to find examples approaching a cream colour from the 1850s. The earliest of these, however, tend to be fire bricks, used for ovens and retorts rather than for ordinary building purposes. They are often well-pressed and bear brands identifying them as having been imported from Scottish or Staffordshire manufacturers. Later they may have been made locally by the South Yarra Fire Brick Company or, from the 1860s, by companies such as Knight Brothers of Lal Lal, and they will be branded accordingly.

The first 'fancy white bricks' for building purposes were made by John Glew of Phillipstown (West Brunswick) in the later 1850s. They are commonly branded 'J G' and are used in copings (the tops of walls) and string courses (horizontal projecting bands), and more extensively in some government buildings. The well-known Hawthorn browns also seem to first date from the 1850s, but were perhaps not valued aesthetically for another decade or two.

It was in the middle 1860s that polychrome, or multi-coloured brickwork was first introduced, particularly in churches, although it was not common in domestic buildings until the late 1870s. Now a number of makers, amongst whom Glew remained prominent, produced a range of clearer contrasting colours, browns, blacks, rich oranges, creams and whites. During the currency of this fashion, common red bricks were confined to inconspicuous locations or were covered in stucco, but in the early 1880s the English Queen Anne fashion caused a revival of red brick, and by the middle 1890s red had become the dominant colour.

8.5 Cavity walling

Developments in the appearance of brickwork only became possible because of the introduction of cavity or hollow walls, which prevented water penetrating even when the surface was not covered by stucco. Although these walls are difficult to investigate without taking them apart, they are of great technical interest, and any example dating from before 1880 should be examined carefully.

As they are difficult to discern, some clues may be helpful. If the wall is laid partly or entirely in brick on edge, rather than on the flat (that is, the courses are 115 mm or $4^1/_2$ inches high rather than 77 mm or 3 inches) it may well be one of the proto-cavity types. If its thickness is not a multiple of the standard brick width (again, 115 mm or $4^1/_2$ inches) it may contain a true cavity. You may even be able to see the cavity by shining a torch into a ventilator, or feel it with your hand, or it may be visible at a door or window opening. On occasion the ends of hoop iron straps used to tie the two sides together will be visible on the wall face.

The walls referred to above as 'proto-cavity' appear in Victoria from the 1850s, especially in dairies and coolstores where insulation is desirable. They were built by laying the brickwork in one of the various patterns which leaves voids in the middle of the wall, but they differ from a true cavity wall, which is more like two quite separate walls with only a minimum of ties connecting them.

The true cavity wall first appears, so far as our present knowledge goes, in about 1868 at Bendigo and Stawell. The two parts of the wall (or leaves of brickwork) are linked by metal ties such as hoop iron straps, which might be tarred and sanded to inhibit rusting. A wide variety of more elaborate patterns of wrought and cast iron tie are known from overseas sources but have yet to be identified locally. The galvanized wire or 'Morse' tie still used today was an American invention, probably introduced to Victoria in about the 1890s.

Another way of tying these walls was with a special form of glazed bonding brick, which sloped upwards from the outer to the inner leaf of brickwork, so that water would not pass across. The ends were normally concealed by shallow false bricks matching the surrounding surface, so that walling of this type is difficult to identify. The bonding bricks, on an English patented design, were made by T H Widdicombe of Portarlington from about 1870, and were used in a number of buildings around Geelong from this time. By the later 1870s cavity walls of both types were becoming common in Melbourne, but it was only towards 1900 that they became the norm in most houses.

8.6 Brick veneer

Brick veneer construction possesses a similar technical interest, because it is virtually unknown overseas, except for a markedly different version on the west coast of the United States, and even in some Australian states is not normally used. In brick veneer construction the real frame of the building is of timber, and it is surrounded by a leaf of brickwork so as to give the appearance of a solid brick structure. Experimental versions dating back to as early as 1903 have been found in country areas, and houses partly of brick veneer were built in Melbourne from about the time of the Great War. It was only in about 1928 that brick veneer became widely accepted by municipal councils and lending institutions, so that any example earlier than this will be of special interest.

8.7 Paving tiles

From the 1850s, soft red paving tiles described as 'Chinese', and possibly of Singapore origin, were quite commonly used in areas like laundries and kitchens. They were normally fifteen inches (384 mm) square. Stourbridge tiles from England were also available in a nine inch (230 mm) size, and were probably harder, but no examples have yet been identified.

From the early 1860s, tiles were made locally in nine and twelve inch (230 mm and 307 mm) sizes. It is not uncommon to find verandah floors of the 1860s and 1870s finished in six inch (154 mm) square tiles of red and cream in a diaper pattern, and these were probably of local origin. In the later 1870s and 1880s these earlier types were commonly replaced with imported tessellated tiles, but these in turn gave way in the 1890s to various smaller red tiles, very smooth and well-pressed, and probably of local manufacture.

8.8 Tessellated and encaustic tiles

The smaller tiles of various colours and shapes which are assembled into patterns on the floors of churches, public buildings and house verandahs, are generally referred to as 'tessellated'. They were produced by applying extreme pressure to dry powdered clay, so that they did not distort in burning, and they fit together almost perfectly. Those that contain two colours – for example – a motif such as a fleur-de-lys in white on a blue background – are made with clays of these two colours, not by means of a printed surface pattern. These are referred to as 'encaustic'. Small quantities reached Victoria by the early 1860s, but they did not come into wide use until the 1870s.

A local manufacturing company set up in 1870 by Henry Cawkwell of Malvern was manufacturing encaustic tiles in the following year, and achieved a quality not much inferior to the imported tiles. A Cawkwell floor may include a two inch (51 mm) square reddish-brown tile with a yellow inlaid inscription in the corner:

H.A.CAWKWELL
MALVERN VICTORIA

Cawkwell's business went out of production in 1893 as a result of the economic recession.

Cawkwell was followed by a company managed by his former employee Edgar Walker, which reached full production of tessellated tiles by 1887. The name Australian [Brick, Pipe and] Tessellated Tile Company, appears on the reverse of the larger tiles and the initials on the smaller ones: the bracketed words were dropped in 1895. Nevertheless the more prominent early examples of such tiles usually prove to be British, and most commonly made by Minton & Co. or Maw & Co. In some instances they carry markings or code numbers on the reverse. More information can be found in:

J & B Austwick, *The Decorated Tile* (Ontario 1980).

This book also deals with glazed ceramic tiles, which were invariably imported from Britain until the Australian Tessellated Tile Company began the production of ceramic wall tiles in 1895. These are also identified on the rear, and characterised by a 'locked-back' to give a more effective bond with the underlying cement.

8.9 Roofing tiles

Roofing tiles were made locally even in the first few years of colonial New South Wales, and there were a number of makers in Victoria in the 1850s. So far, however, the only ones older than 1888 that have been found have been of the plain flat type known in England as 'crown' tiles, which are possibly of local manufacture. French-made tiles of the Marseilles pattern were shown at the Centennial Exhibition in 1888, and were henceforward imported. Apart from crown and Marseilles pattern roofing tiles, the only other nineteenth century pattern so far identified in Australia is a Roman type, with two semi-cylindrical rolls running down the surface of each tile. These were made by Major & Co. of Bridgewater in Somerset, England. They have been found on only one house in Victoria of 1890, and a slightly later one in New South Wales, but terra cotta ridge cresting by the same maker has been identified elsewhere.

During the decade after the Great War local makers, especially the Wunderlich company, began to introduce other patterns – Mission, Spanish and shingle tiles – as well as brindle, buff, chocolate and blended colours, and full and semi-glazed finishes.

8.10 The Marseilles tile

This is of course the pattern which remains very popular today, and has been imitated in other materials such as cement and pressed metal. Until the time of the Great War these tiles were mainly imported from France, under brands and markings such as:
Guichard Carvin & Cie, Marseille St André [bee, on nose],
from 1889
Antoine Sacoman, 'usine la plata', Marseille St Henry [anchor, on underside],
by 1892
Guichard Frères, Seon St Henri, Marseille [lion, on underside],
by 1908
Pierre Sacoman, St Henry, Marseille [star, on nose],
by 1908
Tuileries de la Mediterranée, Siege Social, Marseille [turtle, on underside],
by 1908
Pierre Amédée, St Henry, Marseille [spade, on underside],
by 1908
Arnaud Étienne et Cie, Marseille St Henri [Maltese cross, on underside],
by 1908
Les Fils de Jules Bonnet, La Viste, Marseille [horse, on underside],
by 1908
Gustavo Gavotti, Lungavilla Voghera [horned animal & anchor, on underside]
Saumati Frères, Marseille [cock, on underside].

There were slight differences in cost between the lion brand, the most expensive, the cheaper bee, and the cheapest star. Any of these types is of potential interest, because importation ceased completely at the time of the Great War.

A few makers seem to have operated in Sydney and Melbourne before the war, but it was only in 1916 that the Wunderlich Company, formerly the main or sole importer, began to manufacture the tiles on a large scale. The locally made tiles are coarser and weigh up to twice as much as the French ones, and some early makers or brands apart from Wunderlichs are:
G Blackburn, Mitcham, possibly by 1893
Goodlet & Smith, Granville, NSW, possibly from 1897
Cornwell's Potteries, Brunswick (Alfred Cornwell) [emu on nose], probably by 1906
Porter & Galbraith, Sydney, by 1909
Wunderlich Limited, Rosehill, NSW & Brunswick [sometimes waratah on underside], from 1916
Kemp Brothers [diamond on underside], Nicolson, Moorabbin.

For more information and illustrations refer to:
R J Varman, *The Marseilles or French Pattern Tile in Australia* (mimeographed report, Sydney, n.d.).
Miles Lewis, *'The Marseilles Tile in Australia'*, Australian Institute of Building Papers, vol.I (1986), pp.67-89.
Susan Bures, *The House of Wunderlich*, Kenthurst NSW 1987, pp.156-9.

8.11

Terra cotta ware

From the 1860s a range of minor terra cotta products such as chimneypots and garden edging tiles were made locally, especially by Henry Cawkwell of Gardiner (Malvern), together with more specialised forms such as tracery for churches. However, the same things were also imported, and there is no obvious way of distinguishing them except where they are branded. Towards 1890 the fashion for Marseilles roofing tiles also brought in terra cotta ridge cresting, gargoyles and chimeras, and the more complicated of these were almost invariably imported. Terra cotta ridging was often fitted to slate roofs in the period before the Great War, and it is wrong to assume that this was the result of a later alteration. After the war there was a blossoming of Australiana motifs, and the dragon-like gargoyles were sometimes replaced by kangaroos and kookaburras of cruder local manufacture.

In the 1890s panels of terra cotta tiling with three-dimensional textures and patterns on the surface began to be used to fill in spaces such as those below window sills, but this was far more common in public buildings in New South Wales than in Victoria. In Victoria terra cotta exterior wall tiling or cladding tended to appear after 1900, and to be moulded in the more subtle and sinuous forms of the art nouveau style. Even this was quite rare, and is almost inevitably a matter of some interest. It is in the same period, about 1900-15, that one finds occasional examples of terra cotta verandah columns.

8.12

Glazed terra cotta or faience

Glazed terra cotta cladding, known at the time as 'faience', makes its appearance in Victoria only a little while after the unglazed, and it was at first used similarly at points of special emphasis on the facade, such as the capitals of columns or pilasters. In 1923 the Wunderlich company established a plant at Rosehill, NSW, and became by far the biggest manufacturer. Its various catalogues and publications illustrate the variety of designs which were produced. By the later 1920s glazed terra cotta was available in the geometric patterns and bright colours of the art deco, but not much of this type is to be found. By the 1930s it was being used to entirely clad the surfaces of major city buildings (such as the Manchester Unity, at the corner of Swanston and Collins Streets).

9. CARPENTRY AND WOODWORK

9.1 Imported timbers

During the nineteenth century imported timber accounts for a surprisingly high proportion not merely of decorative woodwork and veneers, but structural and framing timbers. The local species were hard to saw and tended to distort, and though they were necessarily used in inland areas, they do not seem to have been favoured in the main towns and ports. The few sawmills in existence in the 1840s and early 1850s were located near the Melbourne wharves or at ports like Port Fairy, indicating that their main function was to cut up the 'deals', or large rectangular baulks of imported timber, into the sizes required by the local market.

Some timber arrived already cut to size or formed into more specialized products, and indeed there was a very large trade in American-made joinery and pre-cut shelving. One implication of this is that one cannot establish that a piece of furniture, or even a whole house, was imported just by identifying the timber as foreign, for it may still have been fabricated locally. Even split stringybark shingles and palings, which seem the epitome of local produce, were largely imported from Circular Head in Van Diemen's Land (Tasmania) for the Melbourne market, though in the country they are more likely to be locally made.

Some of the timbers commonly imported were red and white Baltic pine, either in the form of deals and battens, or sawn up into flooring, lining and cladding boards. These timbers are commonly referred to as red deal or white deal, and the sawn products are sometimes confusingly called 'Scotch fir' simply because the sawing was done in Scotland. American timbers such as oregon, tended all to be called pine, except that white timber from either source was called spruce. More distinctive timbers which arrived in smaller quantities were New South Wales and Queensland cedar, used a great deal in the 1840s for joinery, but rapidly running out; New Zealand kauri; and teak and so-called cedar from Singapore, especially in the early 1850s.

9.2 Native timbers

Split and pit-sawn local timbers were used from the first in country areas, but their introduction into the mainstream of the building trade was dependent upon the establishment of steam sawmills, which occurred in the Ballarat area from about 1853; then in 1854-5 on the Ovens and the Loddon, at Kilmore and in Gippsland; and in the next few years across most of Victoria.

Bluegum, from the Otways, was too expensive to work into small sections, but was used for major structural elements like girders and bressummers (beams carrying walls, such as those across shopfronts), and exported to India for railway sleepers. Redgum, though water-resistant, was at first not much favoured except for planking and kerbing. Various types referred to loosely as white gum were used in building framing. Ironbark and what is now known as messmate stringybark (though it then passed under at least three names) were used more as splitting timbers, as was mountain ash until its qualities began to be recognised late in the 1860s. Identifying these timbers in some cases takes considerable skill, and may call for microscopic examination by an expert.

9.3 Split shingles and palings

The use of split timber was widespread in country areas, and the two most suitable and commonly used species for the purpose were ironbark and messmate stringybark.

Ironbark was split tangentially to the annular rings, and produced slabs, posts and fence rails. Stringybark was split radially, sometimes for slabs and other large pieces, but especially for shingles and palings. Other species such as box were also occasionally used for such purposes.

Shingles were often cut to a standard size of four inches by sixteen (102 by 401 mm) but might be longer, and if they exceeded about 800 mm would be called palings. Although shingle roofs have commonly been replaced, or simply covered over with corrugated iron, they often remain visible at the eaves or under a verandah, and the roof shape itself tends to be distinctive – steeper than an iron or slate roof and with virtually no eave projection. The ridges and hips of such roofs were often covered by sawn boards fixed together in pairs to form the angle. Often there was no gutter at the edge, but there might be one formed out of solid timber or boarding (which will almost inevitably have disappeared) or, after 1853, of galvanized iron.

The fixing of the shingles was of critical importance, because they twisted and warped, and could not be held by cut brads, which were the cheapest form of nail. Either wrought nails, or Ewbank patent nails (which became available during the 1850s) were used.

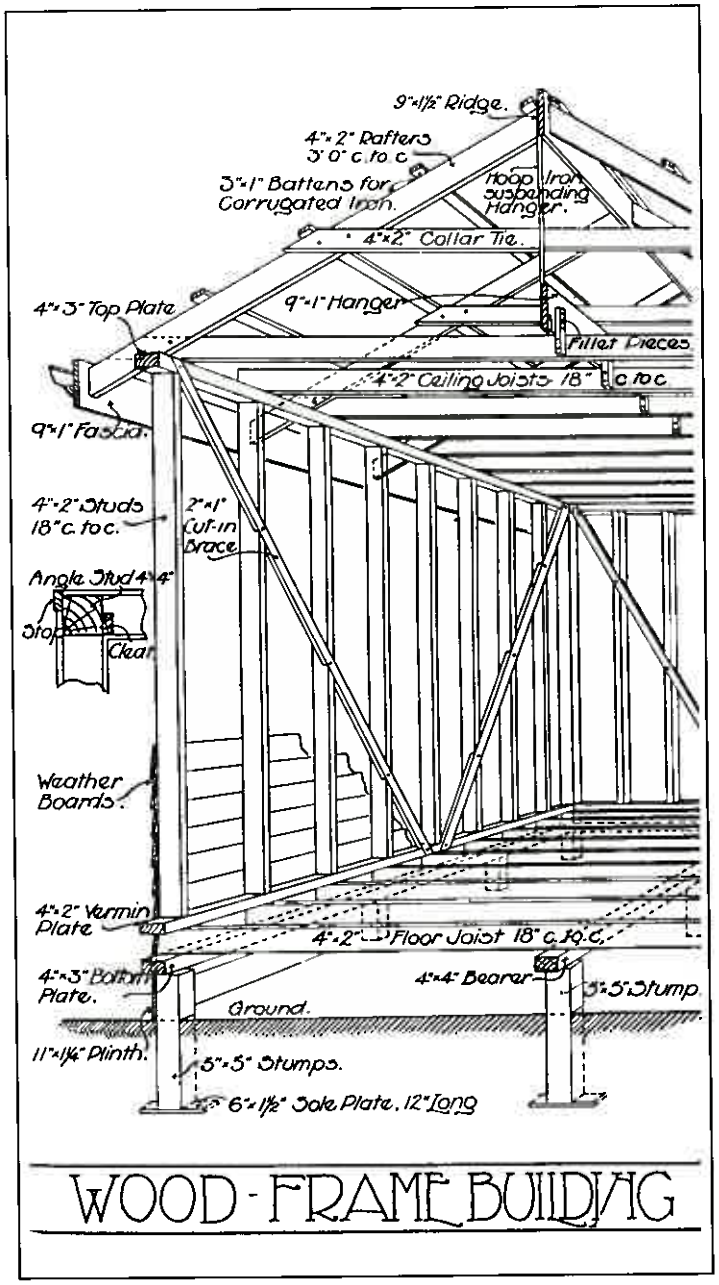
9.4 Sawing and dressing

In rural areas it is not uncommon to find timbers dressed by hand, using an adze. This can produce a remarkably smooth finish, although the strokes are visible on close examination. In the first years in Melbourne, and long after in many parts of the country, timber was sawn by hand in a sawpit. The strokes show on the timber as more or less straight, but angled across the surface, and somewhat irregular.

Steam sawmills, which appear in Melbourne early in the 1840s, and in the country generally during the 1850s, were very occasionally of the bandsaw type, producing regular straight strokes at right angles to the line of the timber. Far more commonly they used circular saws which left regular circular marks.

Moulding Mills, producing the complex forms of skirtings and architraves, were operating in Melbourne before 1860. As the timber used for such purposes was inevitably imported, there is no way of determining in a particular case whether the moulding itself was carried out locally.

9.5



'Wood Frame Building', showing the Australian stud frame, from Robert Haddon, *Australian Architecture* (Melbourne 1908), p. 321.

Timber framing

The evolution of timber framing is one of the most interesting aspects of Australian building, but it is not easy to explain in brief. We inherited the English tradition of framing, in which relatively large sections were used, and strong diagonal braces, all connected with the most elaborate joints, mortised and tenoned or double tenoned, dowelled and so on. The work involved was more of the standard we would today call joinery rather than carpentry, and few if any nails or other metal components were involved. The panels in such a frame might be filled with light sawn sections running vertically, and known as studs or quartering: these had no structural function but provided support and fixing for the surface cladding of the wall.

During the 1840s and 1850s the increasing cost of labour tended to make this framing expensive. The availability of machine-made nails offered a simpler and cheaper means of jointing, and the availability of machine-sawn timber made it feasible to use more but lighter pieces in one or two standard sizes. The new joints required nothing more complicated than in some cases rebating a piece, or halving two together. The studs now ran the full height of the wall and were an integral part of the structure. Rather than the studs being cut above and below the bracing, the bracing was a much lighter piece which was simply let into the faces of the studs. Instead of being a frame, in which each timber had a defined structural purpose, the new wall worked more like a diaphragm, and window or door openings could be made anywhere within reason without compromising its integrity. Another development after about 1850, not necessarily associated with the new form of framing, was that the bearers carrying the floor were placed on their narrow edge, rather than their flat side, which made them much more structurally efficient.

For more than fifty years, until well into the twentieth century, the older tradition persisted in more substantial and better quality work, and only gradually did what we call the 'stud frame' become universal. It greatly resembles what the Americans call a 'balloon frame', but to what extent it was due to American influence remains a moot point, for it may be that analogous technical and industrial factors had a similar effect in both places. There are some differences: for example, in the Australian version the walls are built on top of the floor joists, whereas in the American type the ends of the floor joists run into the wall frame and rest on its bottom plate.

9.6 Weatherboards and claddings

Our weatherboard, running horizontally with each board overlapping the one below, derives from England, and is the same as what the Americans call 'clapboard'.

The most primitive form is that of split palings, and these can be extraordinarily thin. They should be somewhat thicker at the lower edge than the upper one, or slightly wedge-shaped in cross-section, and a pair of sawn boards can be put together, top edge against bottom edge, to recreate a rectangular section. This helps to explain the standard sawn weatherboards, as the typical sizes in Baltic timber were either 'four out' or 'six out', meaning that either four or six were cut from a deal measuring 7 x 2½ inches (179 x 64 mm).

In the 1840s and 1850s the exposed lower edge of the board was often finished with a round quirk or bead, or some more elaborate moulding. This was later dispensed with in Melbourne and most other places, but it persisted for a long time in Ballarat. The simple curved or 'bullnose' edge made its appearance perhaps in the first decade of this century, though it is not really common until the 1930s. The use of unpainted weatherboards, finished in a stain or creosote, began on a small scale in about 1890, and by the end of the Great War they were common in seaside or mountain bungalows, shelter pavilions and other structures with Arts and Crafts overtones.

Occasionally in the 1840s and 1850s buildings were clad in horizontal boards which were rebated over each other so that the surface remained flush, rather than sloping on a zig-zag, but the joint itself was emphasised by a recessed groove. This is a version of English shiplap boarding, and often indicated that the building was a prefabricated one imported from England or America. It is worth investigating the joints beween the boards, because sometimes they are each grooved, and are linked with a flat strip of hoop iron between the grooves.

More pretentious timber buildings are sometimes clad with wider boards which are again rebated over each other at the edges to produce a basically flat surface, but then moulded into shapes resembling masonry blocks with recessed vertical and horizontal joints. This was and is known (really incorrectly) as 'rusticated' boarding, and becomes common from the mid-1870s.

Sometimes one finds vertical boards used for cladding, typically with a tongue and groove joint, or more rarely with a thin timber cover strap over each joint. The latter type is particularly American, but any vertical cladding in the nineteenth century will give rise to a suspicion that the building is imported.

9.7 Skirtings and architraves

Earlier colonial mouldings tend to be narrower and less elaborate than High Victorian ones, but it is difficult to make chronological deductions on this basis, because the simpler forms are just as likely be found in kitchens and servants' bedrooms of the same date as the more elaborately treated reception rooms. Simpler profiles such as the bullnose begin to appear at about the turn of the century and become predominant after the Great War.

A profile cannot be used to give a precise date, because stocks could be held indefinitely in a timber yard, and individual carpenters with their own planes and cutters could continue making the same forms throughout their life. However, a comparison of profiles from one room to another may help in sorting out a building which has been constructed in stages or has undergone alteration. This is best done by using a strip of lead, or a profile gauge which can be bought commercially, to record the various profiles and transfer them onto paper (especially if you are restoring the building and need to find sections to match).

Your first attempts will look rough, but you can tidy them up if you remember that every curve is almost certainly a part of a circle. Bear in mind also that deep skirtings may be made up in two or more pieces, so that sometimes the top portion is the same section that has been used for the architraves.

Don't be tricked by plaster skirtings. They were very common in the latter half of the nineteenth century, and are difficult to pick at first sight – however they chip in a different way, so it is sensible to look for damage at the tops or the projecting corners. They are made of Keene's or Martin's cement, hard plasters which could be polished and/or tinted to resemble marble, but more often were simply painted, or grained in imitation of wood.

9.8 Plywood

Three-ply veneer in plain and special woods was advertised in 1914, but plywoods of something approaching the modern character and quality were first produced after 1920 using the newly available urea glues and synthetic resins. As the grain in each layer is at right angles to the next, they are always combined in odd numbers – three-ply, five-ply and seven-ply – so that the outer layers run in the same direction and any forces in them are balanced.

Hoop pine and Queensland kauri were commonly used, and the fancy finishes were of walnut, maple, silky oak, silver ash, and tulip oak, either sliced or rotary cut. Sheets were of a maximum size of 4 feet by 8 (1.229 x 2.458 m), extendible only by scarfing and gluing them together, so that plywood-lined interiors between the wars have the characteristic grid of strapwork covering the joints. This changed at the time of the outbreak of World War II when Ralph Symonds patented presses to accommodate sheets of up to 7 by 25 feet (2.15 x 7.68 m). The same firm was later responsible for a number of special forms of plywood such as the waterproof 'Res-Ply' and the sheet metal faced types used for special purposes such as vehicle building.

9.9 Building boards

Building boards are difficult to investigate, as they tend to have been proprietary products whose history is obscure, and which have not been the subject of any subsequent study. However, because they are often branded, they will be of interest to the investigator. Some seem to have been imported in relatively small amounts, perhaps at times of wartime or other shortage, and then to have disappeared from the scene, or to have been replaced by a local product. Others have endured, but are nevertheless poorly documented.

'Sackett Board', available by 1914, was made of wood fibre and 'lime cement' according to one account, or gypsum plaster according to another, and in sheets 3 ft x 2 ft 8 ins x ¼ in (921 x 819 x 6.4 mm). It was supposed to serve as a basis for plaster in lieu of laths. Available at the same time and for the same purpose was the Canadian-made 'Beaver Board', also made of wood fibre, and in $^{3}/_{16}$ inch (4.8 mm) sheets 32 and 48 inches (0.819 and 1.228 m) wide by up to 10 feet (3.072 m) long. In 1927 Beaver Board was still in use, together with 'Cornell' compressed wood fibre board in sheets measuring up to 4 x 16 feet (1.229 x 4.915 m). 'Amiwud', available by 1914, was a compressed wood pulp board intended as a finished surface for wall panelling and ceilings. It came in 'golden oak', 'weathered oak', 'jenisero', 'mahogany' and plain, in sheets of up to 10 ft 6 in by 2 ft 8 in by $^{3}/_{16}$ in thick (3.226 x 0.819 m x 4.8 mm), and was finished with 'battens' or cover straps at the joints.

The Colonial Sugar Refining company experimented in about 1936-7 with a hard-board made from Australian hardwood fibre, but did not proceed to full-scale manufacture because the Masonite Corporation of USA was building a factory at Newcastle to produce its own board, 'Masonite'. This was distributed by CSR for a few years until CSR began manufacturing its own version, 'Timbrock', in 1947. In the 1950s Masonite was available in sheets measuring 4 by 12 feet (1.229 x 3.686 m), and had been augmented by 'Masonite Primecote' with a surface prepared for painting.

9.10 Insulating boards

The cane board 'Celotex' was made in the United States, but was well established in Australia by the 1920s. It was promoted as an insulation material for sheathing the outer face of a timber building frame prior to cladding it with weatherboard or asbestos cement, finishing it in metal lath and roughcast, or encasing it with a veneer of brick. As this sort of construction is more typical of the USA than Australia it is doubtful whether examples will be found. It was also promoted for sarking roofs, insulating floors, as a substrate for linoleum, as a base for plastering, and as a self-finishing wall and ceiling lining, generally covered by straps, but otherwise with V- or round-edged butt joints.

In these latter uses, and in various acoustic forms, it seems to have achieved some acceptance, and by 1927 preparations were under way for it to be manufactured by an Australian company. This is presumably a reference to the Colonial Sugar Refining Company's product, made at a pilot plant in Queensland in about 1936-7, and launched into full production as 'Cane-ite' in 1939. While Celotex was apparently made from bamboo or cane fibre, and Cane-ite also from megass, or sugar cane fibre residue (later diluted with waste paper and hardwood pulp), a rival insulating board from wood fibre was available by 1931. This was 'Ten Test', made in Canada by International Fibre Board Ltd.

9.11 Flat roofs

Flat or low-pitched roofs appear in the nineteenth century only in small areas, like the top of a tower or a bay window, or in a belvedere or widow's walk on the top of a mansard roof. They are normally formed in boarding and then covered with sheet metal (lead, zinc or copper) in long strips overlapping at the sides over timber rolls. Occasionally a roof was finished in about 25 mm of asphalt, preferably with a layer of gravel on top.

In the twentieth century the same techniques are found, but the advent of the low-pitched bungalow roof before the Great War is more generally associated with a covering of 'Malthoid', an impregnated felt introduced in about 1910. It was followed shortly by Ruberoid, Ormonoid, Risteroid, Maltha (the Australian version of Malthoid), Kaloroid (coloured Ruberoid), Vulcantile and Ornamentile (a vulcanite bituminous roofing coloured with powdered minerals and impressed with a shingle pattern). After the 1920s the hardboards and insulating boards which have been discussed were commonly used in place of timber boarding as the base for flat or low-pitched roofs.

10. IRONWORK

10.1 Iron and steel

To make any sense of structural metalwork one must first understand the differences in the materials used. Cast iron, which was at first the commonest, is a relatively impure form of iron which is poured when molten into a mould, and is therefore readily shaped into elaborate forms, especially decorative ones. It is brittle under impact or change of temperature, and withstands compression well, but not tension or bending.

The alternative form in the nineteenth century was wrought iron, which is purer, can be beaten by a blacksmith or rolled in a mill, and will take tension and bending. While a blacksmith can curve it and flatten it, this in no way resembles the elaborate relief modelling possible with cast iron, and there should be no difficulty in distinguishing the two. Wrought iron can be rolled into thin sheets and straps, and as even the larger pieces are rolled they are of uniform cross-section along their length.

Steel is basically similar in properties and appearance to wrought iron, and there is no clear means of distinguishing the two except that early steel is often branded. Steel was very little used until about 1890, and was virtually all imported until BHP achieved a significant level of production at the end of World War I. The imported steel was British, Belgian, German or American, and sometimes has painted or stencilled lettering on it.

Less frequently, lettering in relief was applied during the process of rolling, particularly in the case of steel by Dorman Long & Co. of Middlesborough, England. This company established a Melbourne agency, and then a branch in South Melbourne. Dorman Long steel does not disappear entirely at the end of the Great War, and the company was responsible for major engineering constructions in Australia such as the Sydney Harbour Bridge. However, for any given example of their branded steel the probability is that it pre-dates the War.

Painted brands may be found on wrought iron as well as steel, and may be those of the local fabricator rather than the original manufacturer. The most prominent of these was Peter Johns of Melbourne, who worked in both materials, but his earlier brands, 'Melbourne Iron Works', 'P Johns & Co.' and 'Johns & Co.' can appear only on wrought iron. His firm was converted to a public company known from 1888 to 1892 as 'Johns' Hydraulic and General Engineering Co.', and by 1890 stocked large quantities of steel as well as wrought iron. In 1893 it acquired the Waygood lift interests and became Johns & Waygood: this brand is more likely to appear only on steel. Johns and Waygood imported Belgian and German steel in competition with Dorman Long, and then from 1904, brought in rapidly expanding quantities from the Carnegie Steel Co. of Pittsburgh.

10.2 Structural members

Cast iron came into wide use for columns from the 1840s onwards. They are nearly always basically cylindrical, but with some sort of shaped round or square base, and at least a rudimentary form of capital on top. They appear in cellars, in warehouses and larger shops, and then in verandahs, where they were later to be ubiquitous.

Cast iron beams were used until at least the later 1850s, and large girders of cast iron were made for major buildings, although no surviving examples have been identified. By this time the advantages of wrought iron for such purposes were generally recognised, but it was not rolled in structurally efficient sections ('I' and 'T' shapes) of any size, so that larger members had to be built up of iron plates bolted or rivetted together. Wrought iron took much longer to be used for columns, and it was only in 1887 that Australia's first building to be framed entirely in wrought iron was built in Lonsdale Street.

The introduction of welding is not clearly documented, but it seems that by the end of the Great War oxy-acetylene welding was fairly widely used for purposes such as repairs to castings, and that by about 1930 arc welding was recognised as a means of primary fabrication, more especially of lighter structures. Despite these developments rivetting also continued in extensive use until after World War II.

10.3 Palisade fences

Iron palisade fences are basically of three types, those in which the bars are entirely cast; those in which the bar is a rod of rolled wrought iron, with an ornamental cast iron head attached; and those made entirely of wrought iron. The cast iron type appears first, in the 1850s, but after the 1860s tends to be confined to more elaborately designed fences at the upper end of the market. It is usually possible to tell that the bars either are shaped in a way only achievable by casting (other than the head itself, which may have been fixed on), or at least are not of the round or square cross-sections in which wrought iron bars were normally supplied. Stylistically these early cast iron fences often use Regency or Greek Revival motifs such as the palmette and the anthemion (honeysuckle).

In 1860, iron rolling mills in West Melbourne began to produce round and square bars of small cross-section, which almost immediately became common in fencing. An ornamental cast iron head or spear could be placed on top of the bar while hot, and in cooling would shrink so as to fit tightly. Over the same period more pretentious or specialised works might be made entirely of wrought iron by a blacksmith, and this became a more general fashion in the 1880s and 1890s under the influence of the Aesthetic movement. Bars might be of square section, twisted like liquorice sticks, bent into wiggles, curled over at the top, and beaten or formed at the ends into spikes, leaves or flowers. This trend coincides with the gradual replacement of wrought iron by mild steel, and the so-called wrought iron of the twentieth century is invariably mild steel.

Types of steel fence other than the palisade appear early in the twentieth century, including Hume's rolled steel strapwork and Cyclone woven wire. More details will be found in:
Fences & Gates, Technical Bulletin 8.1, compiled by Richard Peterson. Published by the National Trust (December 1988).

10.4 Decorative cast iron

Decorative cast iron, often referred to by the ignorant as wrought iron, has its heyday from about 1870 to 1890, but persists in minor and more retardataire buildings until the Great War. At first small quantities of ornamental bars and perhaps occasional decorative panels were imported from Britain, but by about 1860 local foundries began to produce patterns (described as 'large honeysuckle pattern', 'plain Gothic', 'very richly ornamented', 'plain diamond'). This form of ornament had become popular by 1870, when the system of registering designs (see section 6.5) began, and it is only from that time that any detailed information survives.

While there is no clear-cut stylistic sequence, the tendency is a development from separate plain bars, ornamented bars, or narrow panels, to wider panels, to panels which meet at the edges to form a continuous design. The overall disposition of the iron on the verandah or balcony also evolves. At first there may be merely a balustrade with no ornament above, or with timber brackets at the head of the columns, and turned drops. Then there may be a shallow fringe or valance of decorative iron fixed to the underside of the roof beam, ending in decorative iron brackets at the columns. Then – and this was the predominant mode in the 1870s – the fringe and brackets may be placed below a timber cross member, and the long rectangular space above it filled with panels of iron forming a frieze, usually of a continuous pattern such as a rinceau. Finally the timber cross member is omitted and the frieze, fringe and brackets join into a continuous curtain of lacy ornament.

The form of the castings themselves can vary as well. At first they are often modelled in depth on both the front and the back, later they are often flat backed, and by the 1890s they are often cast quite thin, with the back hollowed out corresponding to the projection at the front. Alternatively, by this time, some designs are flat on both the back and front faces, rather resembling the timber fretwork which was at that time returning to popularity amongst advanced designers.

10.5 The Angus McLean column

No sooner had iron superseded timber in most verandah and balcony columns than there came into vogue a cheaper type, which is difficult to distinguish at first sight from solid cast iron. It is very useful for dating purposes, as it was invented by Angus McLean in 1873, and began to be used in Melbourne immediately. It reached Sydney by 1880 and was in due course even exported overseas. It consisted of: an outer casing of galvanised sheet iron, with a core in the form of an iron pipe, angle of T iron, the spaces between being filled with cement and clean sharp sand as a concrete; the capitals and bases are of cast zinc.

Such a column is distinguished first of all by the fact that the shaft is a plain cylinder, whereas most cast iron columns in the 1870s are fluted. Secondly, it commonly bears McLean's name in a little relief escutcheon on the base. Contrary to the description quoted, there is often a solid cast iron rather than a zinc capital, and the base is often faced in sheet metal like the shaft – in fact the commonest diagnostic is the split or turned up arrises of the octagonal base.

10.6 Galvanized iron tiles

Galvanized iron tiles are a form of roofing which reached Victoria in 1850 and was much used during the next decade, then rapidly declined in popularity and had virtually disappeared by about 1870. They are good indicators of date because of their relatively short period of acceptance and because of their changing brands.

Typically these tiles were sheets of about 896 x 576 mm including provision for overlap, formed into semi-cylindrical rolls along either long side, where each tile would fit over the adjoining one, and a screw would pass through both into a piece of pine with a curved top, running down the slope of the roof. These timber mouldings alone might support the iron tiles, but sometimes the roof frame was fully sheathed in boarding and the pine rolls were fixed on top of this.

In some later examples, and especially when the tiles have been recycled, the pine rolls are omitted entirely and the tiles are fixed directly to transverse battens. Apart from the large rolls along the sides there may be shallow transverse indentations, both at the top and bottom ends, where they provide an overlocking seal from one tile to the next, and across the face of the tile to give it greater rigidity where it spans between the pine rolls.

The first documented tiles, and the commonest, were those made by Morewood and Rogers using their patent system of galvanizing – 'galvanized tinned iron' – in which the iron was coated first in tin then in zinc, instead of in zinc alone. Examples are foundto be branded MOREWOOD & ROGERS PATENT TILE, sometimes with the added inscription MOREWOOD & ROGERS PATENT GALVANIZED TINNED IRON.

In about 1860 Morewood & Rogers failed financially and was reconstituted as Morewood & Co. Henceforward the new brand MOREWOOD & CO. appears in rivalry with that of their former manufacturing agents at the Gospel Oak ironworks: MOREWOOD'S PATENT WALKER'S G [anchor] O or the same with the words 'Morewood's Patent' omitted. There were other British brands of metal tile, of which insufficient detail is known, and there were also local tinsmiths who made tiles of one sort or another in galvanized iron, tin or zinc.

10.7 Corrugated iron

Corrugated iron effectively came into use in Melbourne in about 1852, but in some instances it was finished in a priming paint or some other coating, rather than being galvanized. The gauge or thickness of the iron was generally greater than is the case today which, together with the better quality of galvanizing, has made these sheets last exceptionally well. The 'pitch' or distance from one crest to the next, varies with date and is a useful diagnostic, which can be summarised as follows.

Five inch (128 mm) pitch, with considerable variation plus or minus, is common only in the 1850s. It remains in catalogues and price lists until well into the twentieth century but is very rarely found except in heavy gauges for special structural purposes or for fireproof flooring, as discussed below.

Four inch (102 mm) pitch could be made by corrugating machinery available in Melbourne in 1859, but no example has been reported. On the other hand a builder's price book of 1862 treats 3¾ inch pitch (96 mm) as being a standard type, and in 1886 3½ inch (90 mm) likewise.

Three inch (77 mm) pitch (actually measuring up to 83 mm, or perhaps up to 90 or 96 mm as above) was also introduced in about 1852, and has been the norm since the 1860s. A pitch as small as 64 mm seems to have been used for street verandahs in the City of Melbourne from 1859.

Two inch (52 mm) pitch (in fact 53mm) is found only in the form of the so-called 'corrugated iron tiles' made by Tupper & Carr, later Tupper & Co. They are simply small sheets, 968 x 567 mm, each with three iron straps rivetted on towards one end in such a way that, if the sheet is placed with this end down the slope and the straps on the underside, these straps can be slipped under the end of the next sheet down. These combine with the overlap of the sheet itself to more or less lock it onto its neighbour. These tiles are rare in Victoria, but were certainly used from the 1850s until well into the 1860s. They bear a brand of a crown over a 'TC' monogram, and the wording: TUPPER & COMP MANUFACTURERS, LONDON [&] BIRMINGHAM.

One inch (26 mm) pitch was introduced for ceilings, perhaps in the 1890s, and was widely used in the first two decades of the 20th century. It is also found in shower screens, and occasionally as an exterior cladding. It should not be confused with corrugated zinc, which is sometimes found in small pitches, but is of course much softer.

10.8

Fireproof flooring

One important use of both plain and corrugated sheet iron is in fireproof flooring, especially for warehouses and public buildings. Typically there would be steel or wrought iron girders, and at right angles smaller secondary beams of 'I' section. Curved sheets of iron would span between the lower flanges of these I beams, and the space on top would be filled with concrete and finished with a flat floor of tile, slate or timber. In 1881 a German form of corrugated iron, Traegerwellblech, was introduced in Melbourne for this specific purpose. It was available in various pitches and was of a heavier gauge (thicker) than normal, with proportionately deeper corrugations, so that it was very strong.

10.9

Pressed metal cladding

The introduction of pressed metal is discussed below in connection with ceilings, for which it was used most extensively. But it was also fairly widely used in the early 1890s for ornamental roofing, and later, mainly after 1900, for cladding. Although there were rival makers of metal ceilings, Wunderlich appears to have enjoyed a monopoly of claddings, of which the three commonest types are roughcast, masonry and brickwork.

The roughcast is the only type that can actually deceive the viewer, for it is commonly used in inaccessible locations such as gable ends and friezes just below eave height. The masonry looks too regular for genuine stonework, and it is not hard to see that the pattern repeats, but it can look quite similar to concrete blockwork of the same style, and it may be necessary to tap the surface or to take a close look at angles and corners.

The brick pattern seems hardly intended to deceive, for the joints are narrow projecting ribs rather than recessed channels, and can at best be read as tuckpointing. It was promoted as a material for internal use, as an impervious lining for areas like medical surgeries, but one does find rural houses and other buildings entirely clad in it, sometimes with evidence that it was painted a naturalistic red with white joints.

11. IRONMONGERY

11.1 General

Ironmongery, or hardware, falls into three broad categories. The sorts of handcrafted products produced by the blacksmith, coppersmith, wireworker, &c, are essentially undatable, and rarely carry the maker's name. Sophisticated manufactured products which were imported (such as locks, as discussed below) are potentially very interesting, but in practice often of not much more help because of the limited or confusing reference material available. Local products dating from the era of protection of native industry, after 1860, can be more helpful (see, for example, the discussion of Murphy's bivalve ventilator, below).

Many of these products are so unfamiliar to the modern viewer that it is hard even to determine their function, and it is therefore useful to consult a good general catalogue. One (though it is American, and therefore of little relevance to the actual brands common in Victoria) is available in facsimile and is therefore a useful general guide:
Russell and Erwin Manufacturing Company. *Illustrated Catalogue of American Hardware.* New York &c., 1865. Facsimile with introduction by L H Nelson, no place, 1980.

The nearest local equivalent is the later though undated catalogue of James McEwan & Co., which has also been reproduced in facsimile, as mentioned in section 6.6:
James McEwan & Co.'s *Illustrated Catalogue of Furnishing and General Ironmongery* (Melbourne, no date). Facsimile, with introductory description extracted from H M Franklyn's *A Glance at Australia in 1880* (Melbourne, no date).

This, however, includes a high proportion of non-building goods, such as kitchen equipment, agricultural implements &c.

11.2 Wrought nails

Nails are a complicated subject, and only a broad account is possible here. For present purposes they can be divided into four main categories, wrought nails, cut brads, machine-made nails and wire nails.

Wrought nails were individually forged by a nailmaker or smith, and show the same properties as other forms of wrought iron, especially the capacity to bend without snapping. This is essential for some building purposes such as fixing shingles: shingles shrink and bend, and can pull out any fixing nail unless this has been driven right through the shingle and the batten and then clenched – that is, the point bent over to one side. The same must be done in a ledged and braced door (which is one made of vertical boards, with cross pieces and diagonal braces on the back). On the other hand wrought nails are expensive, and for this reason many buildings in the first half of the nineteenth century made do with very few nails, if any, and rely instead on mortices and tenons, dowels and trenails.

There is a huge variety in the form of wrought nails, including specialised forms for non-building purposes such as horseshoeing, but all tend to have shanks which are square or rectangular in section along most of their length, though some start round at the top. Although a large proportion of those found in Australia are square, and taper on all faces towards the point, there were many types (mainly dog and barge nails) which were rectangular in section, tapering only slightly in either direction, and finished with a round end rather than a point. These hand-forged nails were only gradually superseded by the machine-made and then the wire type, and the larger and more specialised forms were the last to disappear. The standard British types, applicable in early Australia, are well summarised in an illustrated memorandum issued by the English Office of Ordnance in 1813, and preserved in Canada as *List of Nails and Spikes required for the Service of the Office of Ordnance.*

This is reproduced in: M E Weaver & Susan Buggey, *A Most Significant Reference Document*, APT Bulletin, VIII, 3 (1976), pp. 91-118.

11.3 Cut brads

Cut brads are the commonest nails found in nineteenth century building, and were almost always used for purposes which made no special demands for clenching or flexibility, particularly for flooring. They were mass-produced cheaply by feeding a strip of iron into a fly press and chopping pieces off with cutters of alternating form. Thus the simplest glazing brads, which are simply elongated triangles, were cut head-to-toe off the strip without waste.

More elaborate brads have a sort of head, or at least a slight projection to one side, but in the other direction they are of absolutely uniform thickness, being that of the strip from which they were cut. Sometimes a nail cut in this way would be given some additional working by hand, and a more three-dimensional head might be formed, but usually the general shape is easily recognisable.

11.4 Machine-made nails

The earlier machine-made nails were neither suitable for clenching nor strong enough to drive into Australian hardwoods, but these deficiencies were overcome by the Ewbank patent pressed nail, a British development of the 1840s which was locally available in the later 1850s in sizes from one to six inches (25 to 152 mm). It is like some of the wrought nails described above, with a shank of rectangular section – tapering in the thinner dimension but not the wider one – and with a rounded point. The manufacturing process leaves a slightly raised edge down the angle of the shank, and the head is a shallow square pyramid with the corners rounded off. In the later 1860s, after the original patent had expired, other makers produced similar forms.

11.5 Wire-cut nails

Wire nails were formed, as the name implies, from a wire or narrow wrought rod, which would have a degree of resilience without any further beating or working. Separate mechanical processes were required to form the heads and the points. These nails differ from most other types in that the shank is circular rather than square or rectangular in section, and uniform along its length. Often it is marked with little groups of parallel circumferential lines where it has been gripped during the heading and pointing processes. These nails came onto the market round about 1870, and dominated it by the 1890s. They resemble the common nails used today but for the cruder and more varied heads – usually of the rhomboidal or the rose type.

11.6 Locks and latches

Locks and latches come in an enormous range of styles and from an equally wide range of sources, and although many are patented or otherwise distinctive, their diagnostic value is less than might be expected because, except for simple blacksmith's productions, they were all imported. They were sometimes stocked by retailers for long periods, or were re-used in different locations, and the reference material available is confusing, including many partisan promotional publications. The most prominent British makers were Chubbs, and a useful introductory paper by John Chubb, including a list of all the relevant British patents to 1849 is:

John Chubb, *On the Construction of Locks and Keys*, Proceedings of the Institution of Civil Engineers, IX (1850), no. 852 (also published in reprint).

11.7 Grates

Grates and stoves were often burnt out and replaced, or were installed in fireplaces which previously contained none at all, so they are very poor indicators of the date of a building. Basket and dog grates, placed within a fireplace to hold the burning logs, are essentially portable items and of no value at all for investigative purposes.

Assemblages which completely line the fireplace with a canopy, and contain a small grate often better adapted for coal than for wood, became common in the 1850s, but they were generally unbranded and presumably imported. It is only with some knowledge of stylistic fashions that one can make any sense of these, but there are one or two points of interest to look out for. Higher quality grates were often of burnished steel rather than cast iron, and/or had ormolu or other fancy metal mountings or ornamental work around the face, so it is worth investigating those which may have been covered with blacking or painted.

The common form has a semi-circular lid which pivots forward to close the throat of the chimney when the fireplace is not in use. There is a special type, 'Wright's patent bi-valve grate', which incorporates a further semi-annulus which can create a wider opening for the purpose of chimney cleaning or increasing ventilation through the chimney. The precise dates of this device have not been established, but surviving examples (but for one which may have been installed in an earlier fireplace) are from buildings of c.1871-1885.

The typical grate assembly has an arched top and straight sides, but some earlier examples actually narrow towards the bottom, or even form a complete circle. This seems more typical of the 1850s, and grates of this sort were shown at the Great Exhibition of 1851. Conversely the influence of the Arts and Crafts movement seems to be responsible for square grates with angled reveals which appear in the 1880s but remain exceptional until well into the 1890s. The opportunity was soon taken to line these reveals with glazed tiles, which often match those of the hearth itself.

11.8 Stoves

In the 1840s and 1850s humbler houses generally had simple fireplaces, one of which might be larger than the others and used for cooking, in which case it might contain a crane with a pivoting arm from which pots could be suspended, or some more primitive arrangement of a bar and hooks. These very occasionally survive in disused country cottages. One has to bear in mind that cuisine was very simple because the range of food was small and far more seasonally controlled than today, and roasting and baking was done in the local baker's oven rather than at home. A number of houses would have a heating stove with a tubular flue standing free in the parlour. These were less commonly of cast iron like the recently revived pot-belly stove, but rather of wrought sheet iron for lightness in transport.

Wealthier houses even in the 1840s and early 1850s might contain an imported British stove, and at least two had a 'Brown's patent cooking stove', but nothing of this sort is known to survive. Following the gold rushes there was a great fashion for American cooking stoves. Most of the prominent brands – 'Leviathan', 'Empire City', 'American Union', 'Our Favorite', 'Union', 'Challenge', 'Pioneer', 'Banner', 'Golden State', 'Superior', 'Oak', and 'Homestead', seem to have been American, as also was the 'Premium' range, and the 'Coral', 'Arts' and 'Melodian' parlour stoves. Some of these might have brands superimposed by the local dealers, notably Wheelocks and Langwills; have some colonial-made components such as the copper fittings of the 'Union'; or incorporate significant colonial modifications such as the flue slide patented by A A Burlingame in 1857, which made it easier to burn bituminous and other fuels.

By 1859 kitchen ranges were being made locally by R J Polglaze of the Crown Iron Works, and there were soon many local stove and oven manufacturers including William Hutchinson, F Wallis, S Earnshaw of the Sandridge Foundry, Thomas Nelson, and others. The local stoves were more particularly adapted for wood-burning whereas most of the British ones were designed for coal.

In the 1860s the colonial oven rose to a prominence which it retained for some decades, especially in the country. It was essentially a sheet iron box with a hinged door, which could conveniently be built into an existing fireplace. This contrasted with the earlier imported stoves, which were mainly self-contained units with their own legs. It was light to transport, and it burned wood, but in full operation it required two fires, one below (where there would be a space if the oven was placed on a normal hob) and one on top. Bars across the top fire provided a place for pots and kettles.

The establishment of gasworks in Melbourne and Collingwood made this another possible fuel, and some sort of gas stove was being marketed locally by 1858; later there was a form of gas cooking stove consisting of a sheet iron cylinder with a ring burner at the bottom, over which a roast could be suspended. Nothing of this sort has yet been identified.

The 'kitchener', a complete assemblage of ovens and hotplates, including boilers for hot water, and requiring a very large fireplace opening, seems to have become common in the 1870s, and by the 1880s McEwans were selling them under their own brand, though it is questionable whether they were of local manufacture. Generally it is difficult to date the more elaborate stoves and kitcheners of McEwans, and later of Metters and other makers. These continue in much the same form, especially in the country, well into the twentieth century.

The bread oven, very large and built of brick, is usually found only in the country, and space does not permit a discussion here, but descriptions of the basic types will be found in:

J C Loudon, *Encyclopædia of Cottage, Farm and Villa Architecture* (London 1833), pp. 720-722.

Alexander Ure, *Dictionary of Arts, Manufactures, and Mines* (London 1839), pp. 183-4.

12. SERVICES

12.1 Water supply

In early Melbourne, water was delivered by carts prior to the establishment of the Yan Yean supply in the 1850s, and a surprisingly large proportion of houses, both in Melbourne and in the country, seem to have had no system for collecting rainwater. Gutters made of cast iron or of wood were expensive and often difficult to fit onto the typical shingle roof, and it is only with the acceptance of galvanized iron spouting in the 1850s that the collection of roof water becomes the norm.

Houses which relied upon deliveries would have a water butt above ground, preferably at the rear, but only if this had street access. Where the roof water was collected it was generally directed to underground tanks, usually of brick with domed tops, from which it was raised by a hand pump as required or, ideally, used to regularly fill header tanks in the roof of the building. These underground tanks should not be called wells, and are easily distinguished from a true well which taps groundwater or a spring: the true well is usually deeper and nearly always much narrower than a tank as it does not require a large storage capacity.

Occasionally it was possible to locate a header tank in a part of the roof space where it could collect the roof water directly, so that it could be used for domestic purposes without pumping it back up again. These tanks are still found in more pretentious houses and other buildings, sometimes made of slabs of slate, or of very thick planks of timber, well jointed and lined with metal.

Another form was the riveted plate iron tank, which was used externally as well as in roof spaces. Although these were sometimes specially made, the typical form was standardised because it was a 'ship's tank' used for the export from Britain either of liquids or of dry goods such as mustard, sugar, &c. Even the dry goods type was suitable for the static storage of water, and these tanks were made in Britain with the explicit intention that they should be recyclable as water tanks, and often with provision for the addition of taps. They are 1.23 m (4 foot) or occasionally 0.97 m cubes, with a circular metal lid in the top face, and may have signage indicating the former contents on the sides. They were used at least into the 1880s.

The corrugated galvanized iron rainwater tank was manufactured in Melbourne by the later 1850s, and spread very rapidly despite claims that the zinc coating would poison the water. Though early galvanized iron generally survives extraordinarily well, these tanks understandably enough do not, and no early example has been identified.

12.2 Sewerage

The disposal of sewage is essentially an urban question, for until the introduction of the septic tank there were no major developments with much impact in the country. In town the cesspit was at first common, an underground storage tank which was supposed to be watertight and supposed to be regularly emptied out by a contractor.

In practice they leaked and overflowed, and proved to be a great public nuisance. New cesspits were severely discouraged from the 1860s onwards, but existing ones were not substantially eliminated in the city until about 1880, and later elsewhere. Although the remains of cesspits survive in central Melbourne, investigators other than professional archæologists will rarely have occasion to deal with them.

Generally cesspits were superseded by the nightcart service, in which the contractor either emptied the pan and put it back or (in the more sophisticated system) removed it and replaced it with a disinfected one. This system has had a great effect on the form of urban areas because it meant that the privy was almost always placed against a boundary of the site and contained a trapdoor through which the pan could be removed from outside. This had to open onto a street or lane or, if necessary, a narrow walkway. These lanes and walkways often remain today and seem puzzling and superfluous. If the privy building survives, the outline of the trapdoor is often visible, though it was required to be stopped up with brickwork once sewerage was connected.

There were alternatives. Some properties had their own private drain or sewer leading to some nearby watercourse, and quite a number from the later 1860s, especially institutions, made use of Moule's patent earth closet. The dry earth was supposed to deodorise the contents, and could be sifted and used more than once before being removed by the contractor and marketed as fertiliser. No intact example has yet been located.

The establishment of reticulated sewerage in most urban areas superseded all of these systems, and as this event is usually datable the physical evidence of the change can be very valuable. This is particularly so in Melbourne where this evidence can be collated with the detailed overall surveys carried out by the Melbourne Metropolitan Board of Works, and with the individual file on the property in question. As a rough indication, the sewerage connections began in the city in 1897, Collingwood was connected soon after the turn of the century, connections were largely complete in the suburbs immediately east of the Yarra by the time of the Great War, and the system continued outwards gradually so that some outer suburbs were not fully sewered until the early 1960s.

Septic (or bacteriolytic) tanks use anaerobic bacteria to digest the sewage and are designed to retain all solid matter and release a harmless effluent. They came into use only very gradually from about 1900, at first in large country homesteads. Two proprietary types were the Excelsior, produced by the Sanitary Installation Company in Sydney, and the Monier, made by Carter Gummow & Co. and later the J.B. Reinforced Cement Co. These were Sydney companies and possibly had little impact in Victoria, but there were many other types, including the Edmunds Sewage Oxidation System by Edmunds Bros. of Melbourne. However, no research has been done in this field, early examples generally do not survive, and it is not possible to specify brands or distinguishing characteristics likely to be found in visible locations.

12.3 Privies

Original water or earth closets and early night pans simply do not survive, except in country areas. One does find early cisterns and High Victorian porcelain lavatory bowls, sometimes elaborately decorated, and it may be possible to trace these through catalogues, though the increasing fashion for recycling such things or installing replicas will make this a more and more risky procedure. Of more help to the investigator will be the actual location of the closet. When the need for nightcart access was removed, new closets were often installed for the first time within the house, and even upstairs. In some city office buildings and inner suburban terraces this was achieved by means of precarious timber structures cantilevered from an upper floor at the back of the building. Although these in their turn have generally disappeared,the traces often remain.

12.4 Ventilation

Many Victorian rooms had no provision for fixed ventilation such as is required by current regulations, and when terra cotta ventilators are found in the external walls of these rooms, or even leading into the sub-floor space, it is usually a fair bet that they have been installed in the twentieth century either at the insistence of an authority or in an attempt to relieve dampness or mustiness.

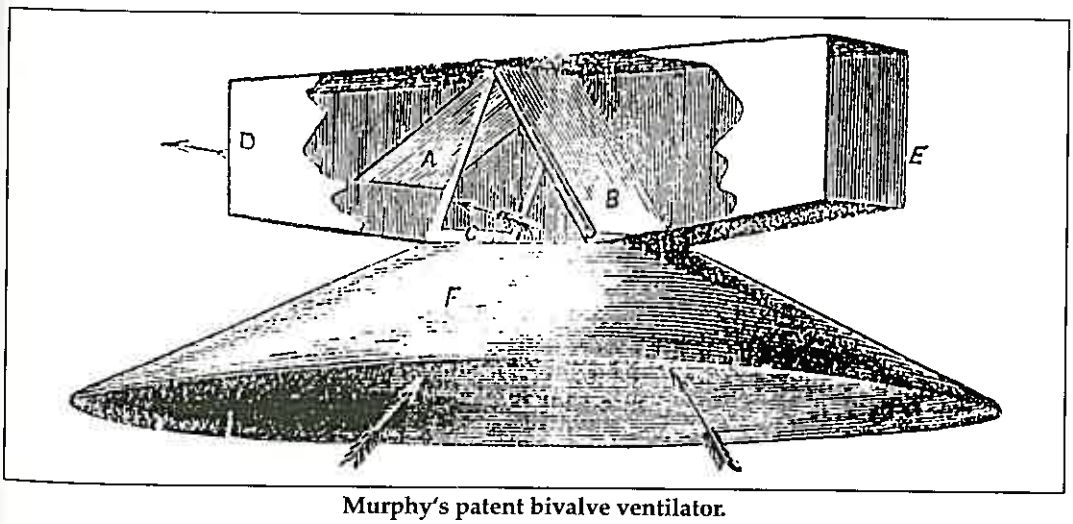
Conversely, such a room may have had some ventilator which has been removed or obscured, or which survives but is inoperative or not understood. One of the commonest types is a vent high up in the side of a chimney breast. This may lead into its own flue running up the chimneystack, or simply into the vacant space of the chimney breast which is in turn open to the roof space. Occasionally it leads into the flue itself, so that the rising fumes will actually drag in more air through the vent, and when there is no fire the air will still rise into it and/or be sucked through by the Pitot tube effect.

Sometimes the cornice around the ceiling contains decorative open plasterwork, and is vented from behind, but much more commonly there is a ventilating rose at the centre, above the main light fitting. It is often hard to see from below whether such a rose is solid or not, but the reason for this common location is that gas fittings generate water vapour and cause humidity and staining on the ceiling if it is not vented.

In some cases there will be a device above the ceiling rose which is designed to ensure the extraction of these fumes. This is Murphy's patent bivalve ventilator, already mentioned in section 6.3. It is a flat cone of sheet metal opening downwards towards the ceiling vent, with a sort of transverse box across the top, and within this box a double metal flap which pivots from the top away from the prevailing breeze, and allows the air to pass out in the opposite direction. Because this device was patented in 1873 it provides a useful indication of date.

Conventional wall ventilators close to the ceiling also occur in late Victorian buildings, usually with a decorative cast plaster face to the inside. Other ventilators are more common in public and institutional buildings, or in some large mansions, than they are in ordinary houses. Lower down the wall there may be a vent of the Arnott type, a sheet metal box with a handle on the face, which can be closed flush with the wall or opened out on an angle, pivoting from the bottom. The permanently exposed face is sometimes finished in imitation leather, or contains a panel within which wallpaper matching the surrounds is placed. The air passage is generally not direct to the outside but leads down through a tube, or into the wall cavity itself, to an external vent at a lower level.

This principle is sometimes taken further where there is a timber wainscot around the room rising to a height of perhaps 1.5 metres. The flat shelf at the top of the wainscot may contain metal grilles to admit air. In the same way, air from a lower level may be brought up to small ventilating grilles on the outer side of the window architraves, and these vents have a sliding mechanism to close them. The Tobin tube is essentially similar: it has an external vent below floor level leading through the wall into a sheet metal duct which rises up internally to a height of 1.5 m or more. It is open at the top, but a handle on the front controls a damper which closes the passage internally. Sometimes such a tube is in the corner of the room, and cuts it off at a 45° angle.



Murphy's patent bivalve ventilator.

12.5 Gas

The date of gas connection to a given building is not nearly so easily established as that for water supply or sewerage. There were competing companies, and detailed records do not survive. There was no compulsion, nor any pressing necessity for a building to be connected once the supply was available. Some buildings had their own gas plants even before there was a reticulated service, though this would be true of few private houses except for the later use of acetylene plants in the country. Despite these qualifications, it will assist the investigator to know that the Melbourne Gas Company was in production at the beginning of 1856, the Collingwood company in 1861, Kyneton in 1858, Castlemaine in 1859 or 1860, and Bendigo and Geelong both in 1860.

Gas stoves, as has been indicated, were rare, and early examples have not been discovered. Gas lights are best investigated through trade literature such as the McEwans catalogue mentioned above.

12.6 Bells

Bells frequently provide useful and interesting information. The bell handles or buttons survive in many reasonably well-preserved Victorian houses, and the bell-board itself in quite a few. What comes between the two often escapes attention.

The favoured location of a bell handle in most Victorian rooms is near the fireplace, either in the adjoining wall or in the side of the chimney breast itself, and in the case of a parlour there may be two bells, one on each side. The handle exerts leverage on a wire which passes up to the ceiling by way of a zinc tube below the plasterwork, or else in the open void of the chimney breast. At the top a change of direction is effected by a crank, which is essentially a horseshoe-like object with a wire connected to each prong, and a pivot at the centre. The wire now continues horizontally, changing direction if necessary by means of horizontal cranks, and then bends over another crank down to a bellboard in the rear premises, kitchen or servants' quarters. The bells hang loosely on springs and each has a distinctive pitch so that the servant can readily distinguish which room requires attendance. Sometimes the bells are labelled as well.

Even where the wires have gone, the cranks often survive in the roof space, and the mechanism can be reconstructed. Where the bells themselves are labelled, or where the routes can be tracked, light may be shed on the original functions of the rooms There can be complications. The door bell commonly operated by a similar mechanism, which should not be confused with the service bells. Occasionally there is a bell pull hanging from the ceiling of a room. This usually indicates a later installation rather than the original designer's intention. Frequently the manually-operated bells have been replaced by electrical ones, and the evidence has been disturbed.

Electric bells are operated by buttons rather than lever handles. They were used in larger houses from the late 1870s, long before the connection of reticulated electricity, so they relied upon batteries. They are more varied in form and less easily tracked because the wiring has more often been entirely removed. There would have been two wires, usually of different colours, leading to each service point, and where they passed down a plaster wall they would commonly be in a zinc tube just as with a manual bell wire. In some cases such a pre-existing tube was used, as the electric wires could be fixed to the manual one and pulled through.

In a new installation the electric bell system is more likely to be installed under the skirtings than through the ceiling space. The bellboard itself is even more commonly labelled than in the case of manual bells. This is because there is normally a single bell rather than a series of distinctive tones, and the servant has to consult an indicator or light on the board to know whence the summons originates. The board is commonly glass fronted, with the indicators set on a black background, and with the name of the local maker – Alcock being one of the commonest. The standard reference is:
F C Alsop, *Practical Electric Bell Fitting* (London 1889).

12.7

Electricity

Electric connections to buildings, like gas ones and for exactly the same reasons, are not readily datable, but it may be helpful to establish when reticulated supplies became available in the area concerned. In the case of Melbourne there were experimental and on-off uses of electric lighting from 1863 onwards, but the chances of finding any traces or fixtures from this phase are remote. A number of generating plants were established in the central area in the decade 1881-91, the Melbourne City Council power station was established in 1894, and country plants followed at various dates. Most of these companies and authorities were united under the umbrella of the State Electricity Commission in the years immediately following the Great War.

Early electric wiring has usually been more or less completely removed for reasons of safety or obsolescence, but fittings of interest, such as insulators attached to external walls, may survive. As technical advances were fairly rapid in this area such fittings can be useful in dating either the building itself, the components to which they are directly attached, or the decorative schemes immediately under or over the fittings. Typical fixtures are illustrated in the texts referred to below.

Understanding early electric installations can be confused by various factors. Sometimes they were installed parallel with gas fittings, to allow for possible failure of the electricity supply, though these combinations were later prohibited. Sometimes electricity was connected only to principal rooms, while gas remained elsewhere. Often major gas fittings such as chandeliers or sculptural lamps on the newel posts of stairs, were converted to electricity, and the wires run through the old gas tubes. This was also done with tubes in the wall so as not to disturb the decoration.

Contemporary texts with useful illustrations are:
A B Holmes, *Practical Electric Lighting* (London 1887).
J W Urquhart, *Electric Light Fitting* (London 1890).
W P Maycock, *Electric Wiring, Fittings, Switches and Lamps* (London 1899).

13. INTERIORS

13.1 Plasterwork

Plastering is a craft which changed little due to technical advances during the nineteenth century, and therefore offers little scope to the investigator. There are some general points which should be understood to avoid confusion.

Plasterwork on ceilings, and on timber framed partitions, is usually laid on close-set timber laths, which may be of either split or sawn timber. Split timber is often taken to be the earlier and more primitive type, but this is not necessarily so. In the 1850s, when cheap sawn pine laths were imported in quantity from America, the split laths which gave a better bond to the plaster were regarded as preferable.

Some confusion can also be caused by the hard plasters, Keene's and Martin's cement, which have already been discussed in connection with skirtings. Although these were sometimes used solely for the sake of durability, especially in mouldings and arrises which might be easily damaged, they were also used on occasion to provide a finished decorative surface. In the former case they will be painted or papered in the conventional way. In the latter they may have been tinted and/or polished, and have been exposed for many years.

There is also potential confusion in the use of papier mâché, carton pierre, composition (the material used for picture frames) and similar materials. These were used for centre flowers, cornices and decorative elements imported from England, because they are relatively light and flexible. Close examination and tapping will usually unmask them, and it may be possible to trace their source. A catalogue of the leading papier mâché manufacturer, C P Bielefeld, is held by the State Library of Victoria.

'Cannabic work', or plaster reinforced with hemp fibre, was often used to create more elaborate forms in situ, but it is also the forerunner of fibrous plaster ornament which was made off-site by local craftsmen, rather than imported from Britain. The development of the material has yet to be researched, but it probably began to be used for ornamental work in the 1890s, and by about 1905 it was being widely used in the form of plain sheets with cover straps, and often associated with elaborate art nouveau relief ornament.

'Compo' Board available in 1914 was described as a compressed composition, and it apparently contained plaster and was intended as the basis for a plaster finishing coat. It came in sheets 3 ft x 2 ft 8 ins x $^{3}/_{8}$ in (921 x 819 x 9.6 mm). King's diamond brand fibrous plaster board with a felt paper finish came in sheets of the same area and thicknesses of 8.0, 9.6 and 12.8 mm. Plain stippled and fancy design fibrous plaster 'slabs' came three feet (921 mm) square by 16 mm thick. Gypsum wallboard, already well established in the United States, began to be made by CSR during World War II with the support of the Allied Works Council, and was subsequently marketed as 'Gyprock'.

13.2

Chimneypieces

Chimneypieces, ranging from simple fireplace surrounds and mantels to elaborate compositions of mirrors and shelving, can often be dated on the basis of style, but it is impossible to give a thorough guide. They are often stolen, and equally often bought from dealers and installed, so one needs to be sure in discussing any given example that it is indeed original. Moreover, the earlier forms of chimneypiece continue in use in less important rooms decades after they have been superseded in the reception area of the house.

These earlier forms include:

- simple pilaster-like side pieces, a rectangular opening, and a horizontal bressummer below the mantel,
- a similar arrangement with an arched opening, and the structural brickwork exposed in the corners above the arch,
- the same arrangement but with the corners occupied by spandrels of the same material as the surrounds.

There is no clear stylistic development, but the arch with filled spandrels tends to supersede the other types in all but the humblest locations. All the detailing becomes more elaborate in the later and lusher examples: the edges of the mantleshelf moulded; a keystone at the head of the arch, sometimes carved with ornament, or a mask; foliage or other motifs in the spandrels; half columns or even freestanding colonettes at the sides; and curved panels at the outer corners. The placing of the fireplace can be more of a guide than its style. Corner fireplaces were at first rare, and confined to smaller buildings like gate lodges, but rose to prominence in the late 1880s and 1890s, and in Edwardian houses were often favoured for principal rooms.

The material is sometimes timber – occasionally exposed cedar, but more commonly painted pine, of a plain colour in a kitchen or minor room, but elsewhere artificially grained to imitate a more expensive timber. This has often been painted over subsequently. Later the timber is sometimes finished quite convincingly in imitation of marble.

Slate is almost always enamelled black, a process carried out locally from the late 1850s, or marbled, which became common after about 1865. The imitation of marble can be extremely convincing because of the similar density and coolness of the material. However the ornamental details tend to be simpler and are rarely curved in two directions, because slate is laminated and harder to carve. When in doubt look for chips at the edges, where the natural slate will be exposed. Marble itself comes in a huge variety of colours, almost all imported from overseas, and sometimes with the most elaborate modelling.

Convention tended to call for a light marble chimneypiece in a parlour or bedroom, and a darker or richer colour in a dining room or billiards room. The influence of the Arts and Crafts movement tended to license the use of lighter timbers in all these locations after 1880, but only in more advanced houses, and even then the detailing tends to be heavier in the dining room and more refined, perhaps set off with gilding, in the drawing room.

13.3 Painting and stencilling

The complexities of painting and stencilling are such that it is difficult to say anything useful in a limited space, but certain generalisations can be made about style. As in the case of chimneypieces, lighter and more feminine schemes tend to prevail in drawing rooms and bedrooms, darker and richer ones in dining and billiards rooms. While there are changes in fashion, of which recent writers give very plausible accounts, the differences between one owner and another or one decorator and another tend to be far greater than differences over time – at least between about 1850 and 1890 – so that interpretations based on style are rash.

The number of colours used in any room in the nineteenth century was often far greater than would be the case today. They were nearly always mixed by hand, and various of the colours would be based on the same ingredients in different proportions, giving rise to elegant harmonies. At the same time there would be deliberate and striking contrasts, especially in the form of thin lines in inaccessible locations, such as cornices.

Today, of course, the original scheme is likely to have been painted over, but even if you scrape back to find it you may easily be deceived. If the first layer was a wallpaper which was later removed, the bottom layer of paint may well be quite modern. Or if the bottom layer of paint was originally covered by a darker glaze, as was especially common in a hallway, you will get quite the wrong impression by looking at the paint and ignoring the glaze.

The physical investigation of decorative schemes is a very specialised activity which can only be carried out reliably by a professional. However, historic interior decoration is a field much frequented by creative faith healers: if you determine to engage a consultant, make sure it is not someone who works by intuition. The consultant should undertake to do microscope analysis as required, and show you the results, and to record colours in terms of the Munsell system, which is the only comprehensive and generally understood one.

13.4 Dadoes and friezes

A Victorian wall surface could be divided into three parts: the lowest was a dado, rising from the skirting to the level chair back, or about a third of the total height. The body of the wall is referred to as a filler. At the top, immediately below the cornice, there might be a frieze. Until about 1880 walls often had none of these divisions, and even afterwards they were little used in bedrooms, and quite often omitted in drawing rooms. Nevertheless a distinct fashion for the dado arose in the 1870s and had become widespread by the 1880s, especially in dining rooms, halls, billiards and music rooms. It served an aesthetic function in providing a base for the wall, and a practical one in concealing scuffing and marking by chairs. It was darker than the filler above, and was often explicitly designed to imitate masonry, or timber panelling: sometimes, indeed, there was a real timber wainscot in this position.

The frieze was at first a narrow decorative band, but as time went on it became more prominent, and was often divided from the wall surface by a timber picture rail. Between 1890 and 1910 the division of the wall became more idiosyncratic. The frieze and dado might become so deep as to eliminate the filler entirely. By the time of the Great War it was common to have timber panelling rising to door height or above, but now the frieze tended to disappear again because the panelling finished in a narrow shelf upon which china could be displayed, and this tended to call for a neutral background.

13.5 Wallpapers

Because they are manufactured products wallpapers are more easily datable than painted schemes, although the same generalisations about the selection of colours and the division of the wall surfaces are applicable. Generally speaking papers were printed in rolls which were hung vertically, as they are today, but there are a number of exceptions.

The earliest papers used in Victoria would have pre-dated machine printing in rolls, and were hand blocked in areas of about 550 x 780 mm, but they are unlikely to be found today. Until the 1860s French papiers peints were quite widely used, although surviving examples are extremely rare. These were strips in sets of twelve to twenty or even more pieces, which were assembled side by side to form a continuous scene, sometimes extending around all four walls of a room.

Another distinctive form of paper was that printed in blocks rather than strips. This tended to be used in halls and passages, the blocks representing masonry, sometimes with illusionistic shading, and having the advantage that scuffed or dirty parts could be replaced without a complete redecoration. For similar reasons blocks are found in nurseries, not representing masonry but decorated with nursery rhyme scenes, letters of the alphabet and so on. Friezes were printed in rolls to run horizontally, and similarly horizontal bands separating the dado from the filler. The dado itself was usually placed in vertical strips, but a wide roll designed to run horizontally is not unknown.

Hand blocked papers in the form of the early sheets referred to, and the blocks used in passages and nurseries, tend to have a distinctive quality rather like poster colours, whereas machine printing is thinner and smoother. However, there are transitional examples machine printed in rolls with a light pattern, and then enhanced by hand blocking more colourful motifs, such as flowers, at intervals across them. Also fairly common in the fifties, though at the luxury end of the market, were flock papers in which a pattern was printed in glue and dusted with powdered and dyed cotton waste to give the effect of baize.

Machine printed papers can often be dated by means of a registration mark printed on the selvedge: although this is overlapped by the adjoining strip of paper, it can be exposed if it is possible to remove the papers and soak them apart. For the interpretation of these marks see section 6.4. Dating by style can be almost as hazardous as in the case of painting, but there are some conspicuous fashions such as that for William Morris designs, which will be familiar to many readers, and which appear from the mid-1870s. Further guidance can be obtained from: Phyllis Murphy, *Decorating with Wallpaper*, technical bulletin 6.1 of the National Trust of Australia (Victoria) (Melbourne 1987).

'Sanitary' or washable papers were introduced in 1884, and can be recognised by their slighly glazed finish and a minute mottled effect in the printing which is visible on close inspection. From the later 1880s heavily embossed imitation leather papers become common in more luxurious houses. They are of heavy quality and are stamped in relief with fruit, flowers, &c. They were originally richly coloured and gilded, though they have usually been painted over at a later date or, if exposed, have darkened considerably. From about the same time, and persisting well into the twentieth century, are various other cardboard or linoleum-like embossed materials such as 'Lincrusta Walton', used especially for dadoes, but elsewhere as well.

While the chances of finding an illustration of any particular wallpaper are slight, examining a range of pictures can give one a much clearer idea of date and context, and the major texts give other useful data about manufacturers, countries of origin, &c. Some of these are:

C C Oman & Jean Hamilton, *Wallpapers* (London 1962).

Brendan Greysmith, *Wallpaper* (New York 1976).

Françoise Teynac et al, *Wallpaper: a History* (New York 1983 (1981)).

13.6 Pressed metal

Alfred Wunderlich had a Sydney agency importing zinc roofing from 1885 in a very small way, but the business expanded rapidly and his brother Ernest took out a local patent for metal ceilings in 1888. It seems unlikely that any significant amount of pressing was carried out locally at this stage, but the patent rights were sold to W H Rocke & Co. in 1889: Rockes had some sort of factory in Melbourne, and completed a substantial factory at Redfern late in 1890. In 1892 Rockes became insolvent, and Wunderlichs bought back the business, but Rockes recovered from their difficulties and emerged as rivals. Later there were others: by 1908 G E Crane & Sons of Sydney were manufacturing pressed steel ceiling and wall sheets, and by 1914 so were Dobson Franks Limited.

There is a great deal of Wunderlich material including patterns, company records, &c. held by the Powerhouse Museum in Sydney, but there are also a number of published Wunderlich catalogues and various editions of the company history held in major libraries elsewhere. A full account with illustrations is: Susan Bures, *The House of Wunderlich* (Kenthurst NSW 1987), pp.21-30.

Ceilings of this material often closely resemble plaster or embossed card, and to tell the difference it is necessary to look for edges, usually at the mitred corners, or at the decorative fillets often placed over these mitres. It should be born in mind that in their original form they were often decorated in multiple colours and/or gilded.

13.7 Floor coverings

Carpets are such a distinct topic, and so rarely found in place, that they will not be dealt with here. However, the investigator should be alert for floor cloths. These were designed and placed very much like carpets, as has been discussed in section 3.11, with the exception that because they were impervious they were often used as small mats beneath washstands. 'Oilcloth' was an eighteenth century material in which a mixture of materials was applied to a canvas backing to give a smooth, impervious and generally dark coloured finish. Although it is not often found surviving on floors, its appearance will be familiar from the lighter grade which was often used on Victorian furniture in place of leather.

A thicker material called 'Kamptulicon', and incorporating rubber and cork dust, was patented in the 1840s. Though this was fairly widely used in England and was being advertised in Victoria into the 1860s, no examples have been identified. 'Linoleum', on the other hand, was patented in 1860, and often survives without its age or significance being appreciated. The original manufacturer produced it in sheets either one or two yards (0.92 or 1.84 m) wide, and strips for passages in widths of 0.56, 0.69, 0.92 and 1.15 m, but by about 1880, when the original patent had expired and competing manufacturers were in the field, the standard breadth was six feet (1.84 m). Some fine manufacturers' catalogues are held by the State Library, and an idea of the designs can be gained from the illustrations in: Suzanne Forge, *Victorian Splendour* (Melbourne 1981), pp.134-5.