

The Diagnosis of Prefabricated Buildings

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South-eastern Australia has more identifiable surviving specimens of mid-nineteenth century prefabrication than any other area of the world, and more are being discovered regularly. Only recently have they been recognised as candidates for conservation, and only still more recently have they been subjected to anything approaching systematic study. They are diverse in materials, construction and origin, and commonly quite difficult to distinguish from conventional buildings. In this paper Miles Lewis, an architectural historian who teaches in the Department of Architecture and Building at the University of Melbourne, describes those characteristics which may suggest that a building is prefabricated and which may, in some cases, indicate the country of origin or even the individual manufacturer responsible.

There survive in Australia some dozens of identifiable prefabricated buildings of the period 1835–1855, and there must be a comparable number which have yet to be recognised. They are in many cases of great technical interest, and they are a telling reflection of peculiar historical conditions which made the transportation of such buildings physically and economically feasible. It is therefore a matter of concern that few people are able to recognise those that they come across, still less to identify their place of origin or their manufacturer. The purpose of this paper is to provide some guide to these buildings in terms especially of those characteristics which may be used as diagnostics.

Only three or four manufacturers actually labelled their buildings; perhaps two others used systems which were patented or otherwise so distinctive as to be immediately recognisable; in a few other cases the buildings can be identified as those of catalogue or other illustrations; and in a number of individual instances there is some sort of documentary record which serves to identify them. Otherwise it is a matter of assembling evidence and drawing conclusions as best one can. The largest category of portable buildings by far (for 'portable' was the term in general use) were those of timber. At the height of importation in 1853 a quarter of a million pounds worth of portable wooden buildings were brought to Victoria. Whether the valuation was geared to the temporarily inflated prices of the local market is not clear. Three years later 75 imported wooden houses were valued at 530 pounds—an average of four pounds each, which seems scarcely credible. There is at any rate no doubt, from the various contemporary reports, that the number of wooden buildings imported in 1853 ran into hundreds. These buildings are, for the most part, impossible to identify on internal evidence with any certainty.

Even where a maker or country of origin cannot be identified there may be numbers or other markings which at least indicate that the structure was prefabricated. In some cases it is quite clear that the numbers were used for assembly purposes, and an excellent illustration of this is the John Walker iron house at Inverleigh, where the numbers are in pairs, one on the corrugated iron panel and one on the wrought iron frame adjoining it. Moreover, we have a drawing of an identical house on which the numbering system is indicated, although each number differs by one unit from those of the Inverleigh building.¹ These were iron houses imported from Britain, but in the same way Elford's Patent Portable Houses—made of Californian redwood with oregon flooring, and presumably imported from the United States—were advertised in 1883 as having the pieces 'numbered to enable construction with unskilled labour'.² Peter Bell quotes

the advertisement in 1903 of James Campbell & Sons, a Brisbane-based firm then expanding into provincial Queensland, 'All materials numbered and ready for erection'.³

The most exotic case is that of a house built in the Melbourne suburb of Collingwood in about 1853 and later moved: it is of meranti, a Malayan timber, and presumably of Singapore origin. Many of the components are identified with Chinese characters which were fortunately discovered when, the building being partly demolished, a shower of rain washed the dust off the roof timbers. Throughout the house there regularly appears a stencilled symbol which may be a brand—a sort of star consisting of a central dot with four dashes radiating from it at right angles. Of the Chinese characters themselves, which Allan Willingham has recorded and had translated, one is a proper name, 'Lee', which might conceivably refer to the maker, and a few others ('double', 'connection', 'secure', 'fixed') may refer to the method of assembly. The great majority, however, seem to be words chosen almost at random, 'moon', 'sun', 'pearl', 'road', 'horse', 'bee', 'egg', 'vegetable', 'fruit', 'surplus', 'hero', 'prosperous', 'bitter', but may nevertheless have provided some sort of sequence for identifying components.⁴

There are other painted symbols which may indicate that the materials were imported, but not necessarily that the building was prefabricated. Symbols often appear more or less randomly on lining boards, occasionally broken, indicating that they were initially painted across two or more boards which were not placed together in the assembled building. This generally means that they were not part of an assembly system, but were the means of labelling packages of building materials while in transit. This is particularly true of boarding, which might be so labelled while being shipped in bundles, but which also was sometimes used to form crates for other components before ultimately reverting to its intended function of flooring or lining. In the case of Andrew Abercrombie's house, formerly in Arden Street, North Melbourne, and now at the National Trust's site in South Melbourne, one lining board is actually labelled 'TO GO BETWEEN DECKS'.

The shipping marks tend to be not merely a single letter or figure, but a group, or, whether single or multiple, to be enclosed in a shape such as a diamond or rectangle. The original house at 399 Coventry Street, South Melbourne, has in a number of places a diamond containing the initials RP (Fig. 2), for Robert Patterson, who imported the house and its neighbours. Outside the diamond is the letter A, and a symbol resembling a dollar sign but with diagonal slashes, followed by a number such as 420 or 501—possibly to identify the package, or to indicate the number of super feet of timber in it. These symbols would be recorded on the bill of lading so

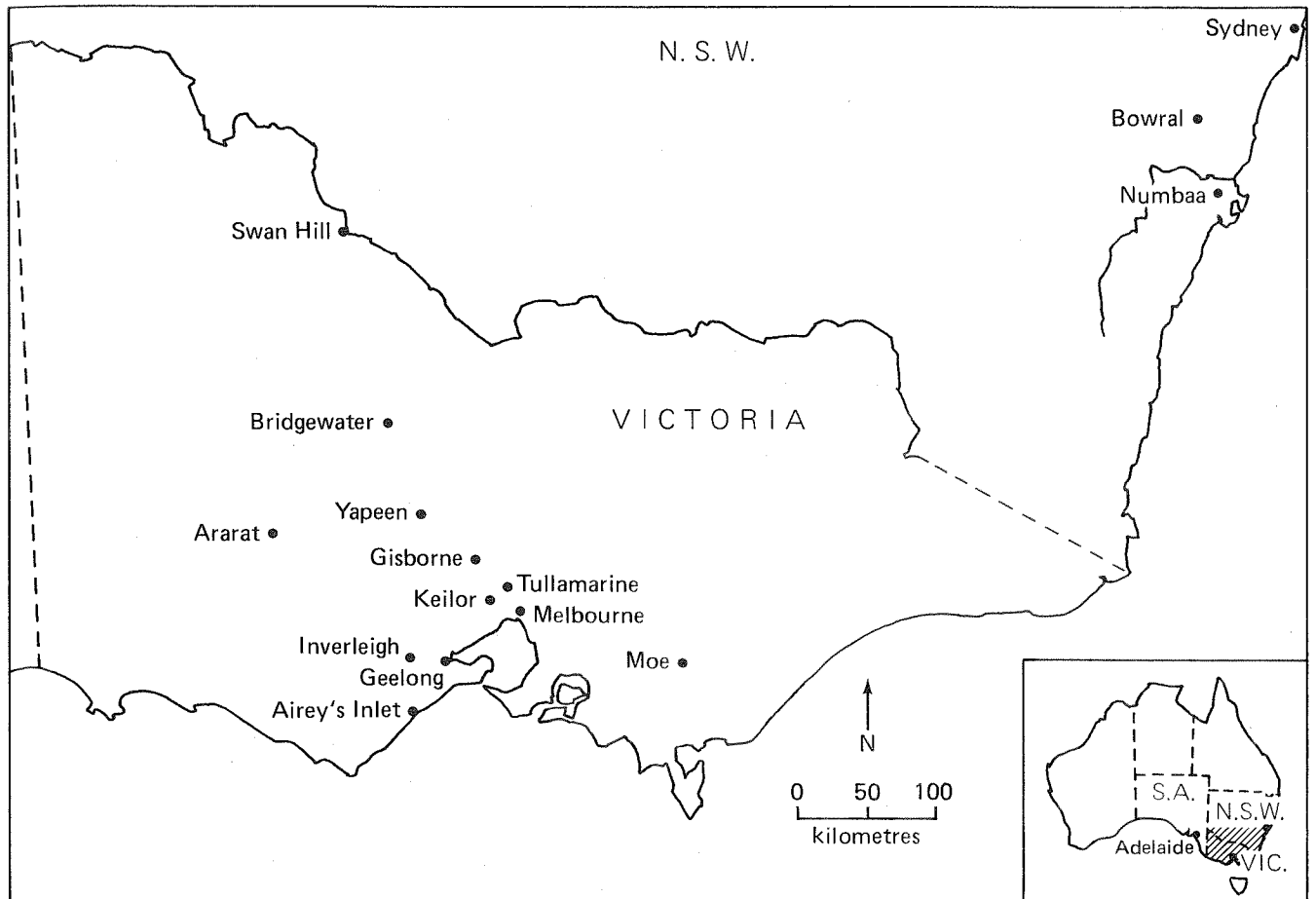


Fig. 1: Location of sites.

as to identify the crates and bundles so labelled, and we have a good example of this. The bills of lading survive for the iron school buildings imported by the Victorian National Schools Board in 1853 from Francis Morton & Co. of Liverpool, and sketched in their margins are diamond shapes containing combinations of letters to identify the packages.⁵

A little reflection will show that precisely the same labelling requirements for shipping apply to materials being consigned for ordinary building purposes, and confirmation is found at *Barwon Bank*, Geelong, a solid stone building of 1853 which bears on the underside of its flooring the initials 'JAG' in a diamond—not a key for the reassembly, but the initials of the owner John A. Gregory. It follows, then, that figures and letters which bear a meaningful relationship to their assembled position are the best indicators, especially if they are stencilled.

A good example of a number of these markings combined occurs in a house at 256 Pakington Street, Geelong, which was only recently demolished, though the components have been preserved. It is known to date from at least 1854 and is largely of oregon. One of the wall plates was labelled 'window', presumably to indicate a location above which a window was to be installed. At least one of the studs had the word 'ABERFOYLE' in high quality stencilling, perhaps indicating the mill or merchant which supplied the timber to the pre-fabricator. On other studs there were various painted numbers possibly relating to the assembly system and/or the packaging and consignment. Elsewhere appeared 'T.S. & Co.' and 'C.T. & Co.' in stencilled lettering. The latter was on the back of one of the cladding boards and probably stands for Caldwell, Train & Co. This firm was established in Melbourne by the Boston-based ship's captain Ebenezer Caldwell and the merchant G. F. Train, and may well have been the consigners, shippers and consignees of the whole package. Their own 2½ storey warehouse at Sandridge (Port Melbourne) was a prominent example of a wooden building imported from Boston.

A number of portable wooden houses have Roman numerals or similar markings cut into the frame with a chisel.⁶ However, what is not clear is how often this was done also in ordinary wooden buildings put up on site. It seems likely enough that a skilled carpenter dressing his pieces at ground level would find it convenient to number them, and certainly there are cases, as at *Black Rock House*, Sandringham (near Melbourne), where chiselled Roman numerals appear in a house which is not fully prefabricated. In other cases one finds painted or stencilled characters, and these seem to be much more specifically characteristic of portable houses—especially stencilled numbers, which tend in themselves to imply some degree of systematisation.

These markings, even the chisel marks, are to be found in iron as well as timber houses, for the iron buildings are commonly framed in timber. They do not normally offer any clue as to the country of origin, but an interesting question arises in the case of *The Heights* at Geelong. This is a wooden house believed to have been imported from Germany in 1854, and has chisel marks resembling Roman numerals, but with single strokes running diagonally rather than vertically.⁷ These are essentially the markings used by mediaeval carpenters in England,⁸ and it is unclear whether they imply that the house was in fact of British origin, that the marks were the result of later work on the building, or that a similar system of numbering was traditional in Germany.

TIMBER

If numbers and symbols are not a sure guide, they may provide the only useful evidence there is in the case of a timber building. There is almost no known case of a timber building bearing a maker's brand or name, and no docu-



mentary evidence that any maker was in the habit of signing his buildings.

The problem with wooden buildings is that they came from anywhere—not just Britain, which supplied the majority, but North America, Europe, Hong Kong, Singapore, India, New Zealand, and the other Australian colonies. They could be made of any timber which was used for building anywhere, and they could be made by ordinary carpenters working in just the same way as the carpenters who built any wooden house in the colonies. It is little wonder, therefore, that the results are not distinctive. Traditional timber framing, before the advent of the stud wall or balloon frame, was well adapted to prefabrication. It relied upon a minimum of nailed joints, because nails were or had until recently been expensive. Each joint was virtually tailor-made and effected with mortice and tenon, wedges, dowels or trenails. The members were large and purpose-made. Therefore if the members were numbered the frame could easily be taken apart and moved elsewhere for reassembly, regardless of whether it had been constructed with this in mind.

Apart from inscriptions on the building, there may be other clues which suggest prefabrication, even if they do not clearly indicate a particular place of origin. One of these is shiplap boarding—boarding placed horizontally as cladding, with the two edges rebated so that the upper board laps the lower one, but the faces remain in the same vertical plane. Sometimes the rebates are arranged so as to leave a wide recessed channel exposed, as became standard in the 'rusticated boarding' of the southern colonies. The shiplap principle then became very widespread as the 'chamferboard' of North Queensland.⁹ At earlier dates this boarding is fairly rare, and those instances where it occurs are often established or putative examples of prefabrication.¹⁰ One example of what looks like shiplap boarding, *Lyndhurst Hall* in the Melbourne suburb of Coburg, has metal tongues linking the boards: the

Fig. 2: 399 Coventry Street, South Melbourne, c.1853: detail of the lining boards, probably used previously to crate the building materials. In the lading mark 'R.P.' stands for Robert Patterson, the consignee. Photo: author.

house was imported in about 1853 but its precise origin is not known.¹¹ A technique as elaborate as this, quite out of step with standard local practice, naturally gives rise to the suspicion that the building is an import, even in the absence of other evidence. There is in fact other evidence of this technique being used, firstly in the 'portable brick houses' of E. Smallwood, which were clad in tiles hung over 'metal-tongued yellow deal wainscoting',¹² and secondly in a house made privately in an attic in Essex. This house is said to have been of tongued and grooved boarding with tongues of hoop iron, and was brought to Ballarat in 1856 or 1857.¹³

There are other unusual details which are less clear as indicators. *Woodlands* at Tullamarine, a house by Peter Thompson of London, imported in 1842, has loose tongued floorboards.¹⁴ So has *The Heights*, at Geelong.¹⁵ That is, instead of the boards being tongued on one edge and grooved on the other, so as to fit together, they are grooved on both edges and a separate timber fillet is inserted between them. However, if it were not for the fact that these houses are known to have been prefabricated, little weight would attach to this sort of detail. Not enough intact early floors survive and have been investigated for us to know whether loose tongues were much used in local buildings. Certainly they do not require components, materials or tools beyond the normal resources of the carpenter, and it is not difficult to envisage that when boards were being hand run or hand finished, the cutting of a second groove might be an easier and more natural process than the cutting of a tongue. The technique may well have been widespread in cases where boards were produced locally or on site, and where moulding mills were not in operation.

Woodlands has other distinctive details as well. One is a fairly large roll moulding on the strip which terminates the weatherboarding at the corner. It may be a regular characteristic of houses by Peter Thompson. A similar detail occurs on another building thought to have been prefabricated, the front section of the Mills brothers' cottage at Port Fairy, an addition of the 1850s (conceivably even the building first imported to Port Fairy and erected at Griffiths Point by the Griffiths brothers before 1843).¹⁶ A similar detail occurs at the corners of *Black Rock House*, which cannot have been prefabricated in anything like its present form because it contains substantial areas of brick. Another slightly unusual element at *Woodlands* is the original roof, comprising board sarking clad first in oilcloth, then in zinc tiles, and today in corrugated iron.

Oilcloth was widely marketed, and could be used by a local builder, but it was commonly supplied with prefabricated houses as a means of getting them waterproof until a more permanent roofing material could be obtained locally. Samuel Vaughan's house, made by Manning of London, came out in 1852 with one case of 'Floor Cloth for Roofing'.¹⁷ Manning had previously fabricated a pavilion which the Agricultural Society used over the years for its meetings in different parts of England, which was also roofed in floorcloth.¹⁸ Another Manning house was described rather differently in 1854 as being 'now covered with 3/4-inch deal boards, thin canvass, and over all tin tiles painted'.¹⁹ It is not impossible that the 'canvass' referred to was in fact oilcloth, but the interesting aspect is the tin tiles, which seem to have been added rather than original, as may be the case with the zinc tiles at *Woodlands*. Another owner of a Manning house referred to his roof as having tin tiles over one-inch boarding, and made no specific reference to oilcloth or canvas.²⁰

These oilcloth roofs are not a universal characteristic of Manning's houses: the Quaker Meeting House at Adelaide, for example, arrived with its own slates.²¹ Nor is it clear how widely they were used by Thompson: at least one of his London churches, which were designed to be temporary, though not portable, had the roof as well as the walls clad in patent asphalted felt.²² Zinc and tin tiles are so far outside the range of normally used and available local materials that they are probably a strong indicator of a prefabricated building. Although a few Melbourne buildings in the 1840s were roofed in zinc,²³ this was probably sheet zinc laid in the conventional way with timber rolls at the joints. Galvanized iron tiles and corrugated iron are common in buildings of the 1850s, but were marketed locally and are not specific to imported buildings.

One of the most unusual details occurs in the building recently demolished at Pakington Street, Geelong, previously referred to. The studs are tenoned into the top and bottom plates in the usual way, but each junction is reinforced by a bolt which passes through the plate and then flattens out into a strap which is screwed against the side of the stud. The total length is 575mm, and the same sort of bolt is used in the horizontal position to tie the plates together at the corners. This apparent over-design may indicate that the frame was being strengthened so that it could be moved about in one piece without disassembling it. This is certainly an example of a distinctive detail which would be almost inconceivable in a house built by a carpenter *in situ*.

Only two other diagnostics of timber buildings remain to be mentioned. One is rather tenuous, the use of a module based on the metric rather than the imperial system, as is the case in a house at Ormond Road, Moonee Ponds, Melbourne, which is a panelised structure of unknown date and origin,²⁴ but seems likely on this ground to be of other than British, United States or Australian origin. The other more generally applicable but not very much more useful diagnostic is the identification of timber species. Why it is of no great use is that the majority of the North European and North American timbers used in portable buildings were also imported as boards or

deals, and used by local builders, and therefore they are no indication that a building is prefabricated. However it is true that when a building is already known on other grounds to be prefabricated, the identification even of the commoner species may clarify its place of origin. This was so in the case of the house made of meranti, and that of the now demolished *Avoca Lodge*, South Yarra, Melbourne, which was reputed to be of American origin, but which was built of exotic timbers²⁵ (not specifically identified) and was therefore probably of South-East Asian origin. Still more was this true of *Osborne House*, North Melbourne, which had been reputed to have come from Ireland. Mr Hugo Ilic of the Commonwealth Scientific and Industrial Research Organisation, who has carried out a number of such investigations, identified the timber as North American white pine (*Pinus strobus*).²⁶ This, combined with other evidence, strongly suggests an American origin.²⁷

MANNING HOUSES

There is one wooden building manufacturer whose work can be said to be distinctive. John Manning made buildings (nearly all of them houses) of panels which slotted in between grooved posts on a modular system, so that doors, windows and solid panels were interchangeable (Figs 3-5). An intact Manning panel of the standard type is fairly recognisable. It measures 2.337 × 0.952m (7ft 8in × 3ft 1½in), like an oversized door, and it contains two muntins dividing it vertically, creating three vertical panels. Regrettably this knowledge will be of no use in identifying Manning houses from external inspection. Manning built larger custom-made structures which were not panelised at all.²⁸ He built panelised buildings of panels different from the standard size and form, such as the Quaker Meeting House at Adelaide, *Jolimont*, the one reasonably intact house of standard components, has the exterior faces of the panels overlaid with weatherboard, which was done at a very early date, and possibly at the very time of erection. Other surviving buildings are so altered that only interior inspection will reveal the Manning characteristics.

We are fortunate, on the other hand, that we possess the inventory of components of one Manning house brought by an immigrant to Victoria in 1852, together with the detailed instructions for erecting it:

'Directions for erecting my Wooden House. (Portable Pannell'd made by Mr Manning of Holborn)

First look out the ground plates or cills and knock them together, take care to bring the corners together as they are marked—next place the corner posts according to their respective marks into the bottom plates + put the nuts on screws from the underside + screw them tightly up—next put in the middle posts those that are fastened with screws + screw them from the underside very firmly; next knock the top plates together according as they are marked (these plates are grooved the bottom are not) + lift them up bodily + place the same upon the top of the posts already screwed in. Then screw the top plates down to the posts but not close down at first until you get all the panelled framings + posts in all round which you must do by first placing in a framing then a post and the last (when you come to close the last two) must be sprung in thus [sketch]. You must take care to place the doors and windows in the places where you want them to be before you screw down the top plates firmly + put in the cross partitions—i.e. in a similar way to the external inclosures the cross plates are marked at each end which you must be particular in looking to. having got all properly down screw up all the nuts very firmly—next put in the Rafters + nail two or three braces across the underside of the Rafters to keep them in their places—then nail on Board covering

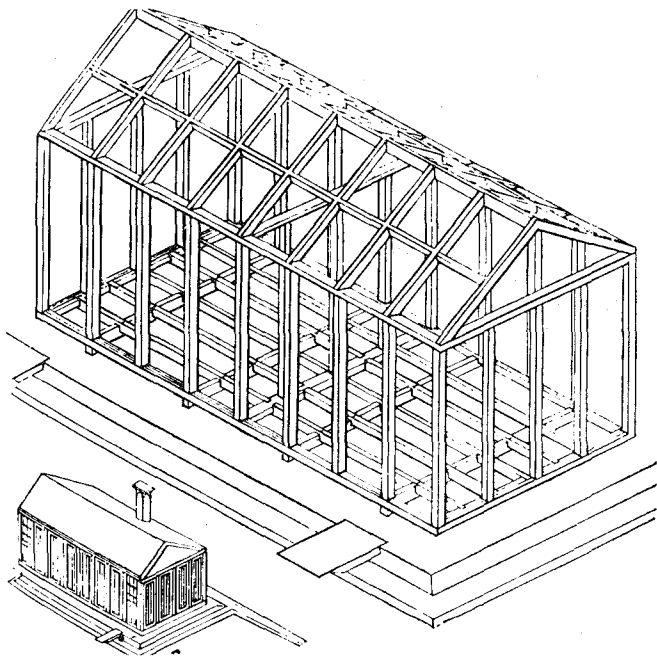


Fig. 3: Frame of building on Manning's system. Loudon 1846: 255.

for the Roof—and last of all put down the Floor Boards.

The gable Enclosures are put in similarly to the Panell'd framing. Note: the Bottom plates are painted Black.²⁹

These details may assist in distinguishing a Manning building from a panelised one by another manufacturer. In Victoria school buildings were soon being built on a panelised system,³⁰ as were some government buildings,³¹ and the building previously mentioned as being on a metric module was also panelised in a fashion. A difficult example is *Carey Cottage* at 18 Perry Street, Hunters Hill, Sydney, which looks like a panelised house of the Manning type, but has three rather than two muntins per panel.³² Even more confusingly, it was owned from 1860 by Edye Manning—who is not known to be a relation of the manufacturer. Manning's system was published in Loudon's *Encyclopaedia*,³³ which must have encouraged imitators, and we know that in the United States as early as 1840 a Baltimore architect, James Hall, published a cottage design based on what was in all material respects the Manning system.³⁴ An apparently similar type of building—feasibly even by Manning himself—appears in an illustration of the Crimean War,³⁵ and in 1861 the New York lumber dealers Skillings and Flint patented a panelised building system and supplied structures for a variety of purposes including those of the Union Army in the Civil War.³⁶ In Australia, however, a private house built on a panelised system is overwhelmingly likely to be a product of Manning.

CAST IRON BUILDINGS

Iron buildings come in a variety of types, ranging from what is essentially a timber building with a corrugated or sheet iron cladding, to a building with a solid cast iron front resembling a masonry or stuccoed façade. Some iron buildings can be distinguished by means of features characteristic of a particular manufacturer, as will appear below, but there remain a number which are more or less anonymous.

The cast iron buildings in Australia seem to have been products of two Glasgow manufacturers only, for there is no evidence of importation from the New York makers Daniel Badger and James Bogardus. One of the Glasgow makers, W. & P. McLellan, can so far be credited with only one building, *Tintern* in Toorak, Melbourne, imported by William Westgarth in 1854–5.³⁷ Another maker, Robertson & Lister, was responsible for two churches made for export to Australia in 1854, identical in size but differing in appearance in that one had a central spire, and the other had one on each side of the façade.³⁸ What was unmistakably one of these churches—the double-spired one—was put up as the Free Presbyterian Church in Macquarie Street, Sydney, and spent its last days as a dining hall at the Rosewood Asylum at Lidcombe until its final demolition in 1958.³⁹ We know almost as certainly, though the source is a description of 1863 rather than an illustration, that the other church was sent to Melbourne but not put up,⁴⁰ and ultimately went to New Zealand.

This brings us to a major diagnostic problem, for what is equally unmistakably the Melbourne church appears as an illustration in the catalogue, not of Robertson & Lister, but of C. D. Young & Co., also of Glasgow.⁴¹ It is single-spired, but so similar to the Macquarie Street church that Gilbert Herbert has gone so far as to attribute them both to Young rather than Robertson & Lister. It is now possible to say with some certainty that this interpretation is incorrect, and it is worth saying because it determines the attribution of two important surviving buildings. In July of 1853 the Glasgow publication *McPhun's Australian News* reported that Robertson & Lister had made a remarkable three-storey warehouse with an elaborate architectural front, but the sides of corrugated iron running between pilasters—which was precisely the nature of

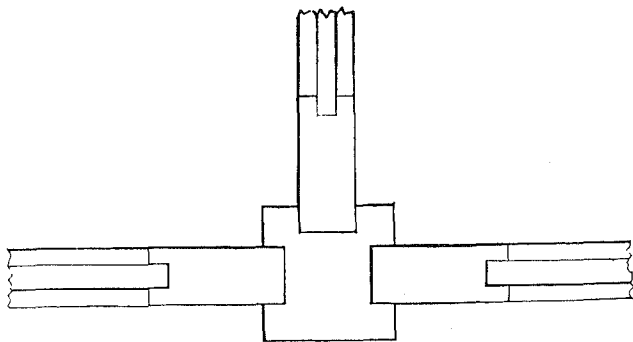


Fig. 4: Plan of a junction of post and panels on Manning's system. Loudon 1846: 255.

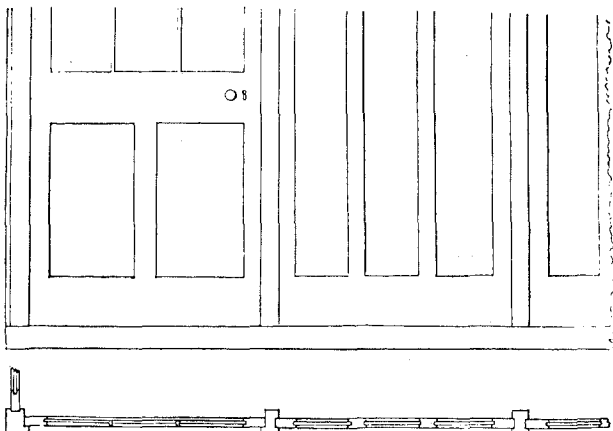


Fig. 5: Manning's system, showing the form of the panels in part-elevation and plan. Loudon 1846: 255.

the sides of the Macquarie Street church. The warehouse was destined for 'Mr Dismorr's fashionable store' in Collins Street, Melbourne, and was designed by the engineers Bell & Miller.⁴² Not only is this building illustrated in C. D. Young & Co.'s catalogue, as having been made for Miller and Dismorr [*sic*] of Collins Street (in 1851, which is clearly erroneous)⁴³, but Bell & Miller are named as the architects of this and six other buildings which are illustrated.⁴⁴ There can be little doubt that C. D. Young & Co. had in some way acquired this aspect of the Robertson & Lister business and that some or all of the buildings in the catalogue were those made by Robertson & Lister before the takeover.

There are two surviving buildings in Australia which are illustrated in the catalogue, and it is a question of some interest whether they were made by Robertson & Lister before, or by C. D. Young & Co. after the transfer of the business. This transfer can have been no earlier than 1854 when a house just made by Robertson & Lister is reported.⁴⁵ It was almost certainly no earlier than 1855, when the Glasgow directory still lists them as iron house builders, and still at the address (in Parliamentary Road) where their previous works had been reported.⁴⁶

Now one of the buildings in the C. D. Young catalogue is, in fact, the surviving house *Corio Villa* at Geelong, as was first recognised by Sutherland Lyall in 1971. The catalogue describes the house as having been made for 'the late Mr Gray, Colonial Land Commissioner at Geelong'.⁴⁷ E. G. Robertson identified this man as probably being William Nairne Gray, police magistrate and land commissioner, who died at Hamilton on 11 June 1854.⁴⁸ Any hesitation on Robertson's part may have been due to the slight discrepancies in the account of Mrs W. G. Jones, whose grandfather, Alfred Douglass, finally acquired and erected the building. According to Mrs Jones the house reached Geelong from Glasgow late in 1855 and was left unclaimed on the wharf for six months, then had to be put together without plans due to the foundry of its origin having been destroyed by fire.⁴⁹ However, according to another of Douglass's granddaughters, Mrs E. M. Sampson of England, the destruction of the foundry was not revealed until years later, when an extension of the building was proposed, and the reason why Douglass was able to buy the building was that the person who ordered it had died.⁵⁰ This latter detail seems to clinch the attribution to Gray, indicating, therefore, that the house was ordered before Gray's death in June of 1854, which fairly definitely puts it within the period when Robertson & Lister were still making such buildings, and indicates that it should be credited to them.

The other surviving cast-iron-fronted building which can be identified with an illustration in the catalogue⁵¹ is the Legislative Council Chamber in Macquarie Street, Sydney, the history of which is vaguer, but which had been sent originally to Victoria and then brought to Sydney in 1855.⁵² Once again, the building seems almost certainly to be the work of Robertson & Lister. Neither in these Robertson and Lister buildings, nor at *Tintern*, can one find much evidence from the outside of how the cast iron façades were assembled, for the joints are effectively invisible. A possible explanation is found in photographs of the demolition in 1956 of a less pretentious two-storeyed iron building. The façade was of rectangular plates with flanges around all edges (pointing inwards into the wall) and they were laid and presumably fixed together in stretcher bond.⁵³ This suggests a form of jointing used in prefabricated iron lighthouses in the 1840s, in which flanged plates were bolted together and sealed with iron cement, or planed to make a perfectly smooth joint and sealed with red lead.⁵⁴ Although no details have been published, I have been informed that both *Corio Villa* and the Legislative Council Chamber are indeed made up of flanged sections.⁵⁵

One point of confusion remains about the C. D. Young catalogue. Apart from the elaborate cast-iron-fronted buildings apparently taken over from Robertson and Lister, it also illustrates much more primitive buildings identical in form to

some exported to California in 1849 by E. T. Bellhouse of Manchester.⁵⁶ Gilbert Herbert claims that Bellhouse's buildings were clad in corrugated iron running vertically, while Young's show it running horizontally, which is the form patented by Bellhouse at a later date.⁵⁷ This is a double misconception, for it is not clear that Bellhouse's buildings were at this stage clad in corrugated iron at all (as opposed to flat sheet) nor did he subsequently patent the idea of running the corrugated iron horizontally—which was done by a number of fabricators. What Bellhouse patented was a system using horizontal corrugated iron fitting into specially shaped cast iron stanchions (as we shall see). It is difficult, looking at Young's catalogue, to avoid the conclusion that he had just taken over Bellhouse's business as well. This was presumably late in 1856 when Bellhouse is reported to have made a building for the Manchester Exhibition of Fine Arts,⁵⁸ for a printed slip inserted into Young's catalogue makes exactly the same claim for him—saying that this commission had come since the printing of the catalogue, and that the building was to be finished by 1 January 1857.⁵⁹ However, Young's Robertson & Lister style buildings remain quite distinct from his Bellhouse type, and even where the Robertson & Lister type use horizontal corrugated iron for side or rear walls, as can still be seen at *Corio Villa*, they do not use the Bellhouse patent stanchion.

CORRUGATED IRON BUILDINGS

Buildings clad in flat wrought-iron sheet do not appear to have been common in Australia as they were in California, and none is known to survive,⁶⁰ but portable corrugated iron buildings were and still are fairly numerous. Those of them which contain metal structural members are much easier to identify than those which are entirely timber-framed and are clad, in some cases, in just the same way as would be a conventional *in situ* structure. The most distinctive of all the iron-framed buildings are those of Edward Taylor Bellhouse.

E. T. Bellhouse was a Manchester manufacturer, who began by making buildings for the Californian gold rush in 1849, and gradually evolved the system which he patented in 1850 (Fig. 6).⁶¹ The essential characteristic was that the building was framed with vertical cast iron stanchions which had side flanges shaped to receive the ends of corrugated cladding sheets running horizontally. These stanchions might be expressed externally as pilasters or half-round engaged columns, but they were in either case open at the back so that a piece of timber could be set inside them, and then horizontal boards could be nailed to these timbers to create an internal lining. Bellhouse made other cast iron components such as roof gutters and ridges, similarly shaped to fit the corrugations of the roofing iron⁶² but nothing as immediately and generally recognisable as the stanchion, which could be identified in at least three examples surviving into modern times, though only one of these now remains.⁶³ There is no other feature which deserves mention except a form of cast iron window which Bellhouse adopted from Manchester cotton mills: this was in appearance a fixed sash divided into sixteen small panes in the Georgian fashion, but the central four panes were a separate unit which pivoted horizontally to create an opening within the sash.⁶⁴ The one known surviving Bellhouse building formerly had a window of this sort, though it is now missing.⁶⁵

Another group of buildings which use pilasters do so in a more architecturally pretentious but less technically sophisticated way. These are buildings clad in corrugated iron running vertically in the conventional fashion, but with the bays marked out by cast iron pilasters in the Tuscan order, 0.36m broad, with the words 'Edwin Maw, Liverpool' cast into the surface. One of these buildings stands in King William Street, Fitzroy, Melbourne, and three others were recently discovered by Mr Robert Irving at Numbaa in New South Wales.⁶⁶ This presents a problem because Edwin Maw's name is not known

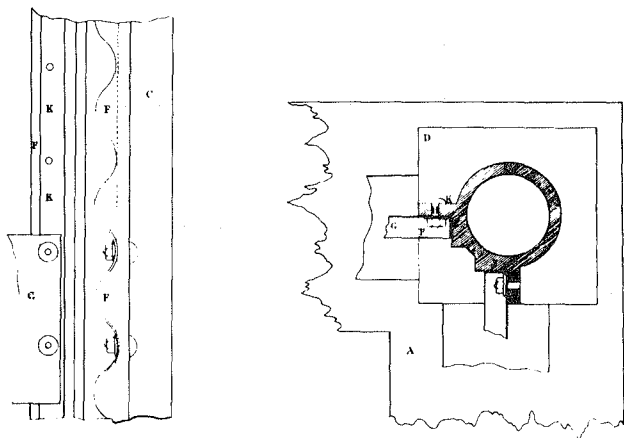


Fig. 6: Edward Taylor Bellhouse's British patent, no. 609 (1853). Detail showing a cylindrical corner column (not at this stage hollow-backed) with side flanges which are shaped to fit the ends of corrugated sheets.

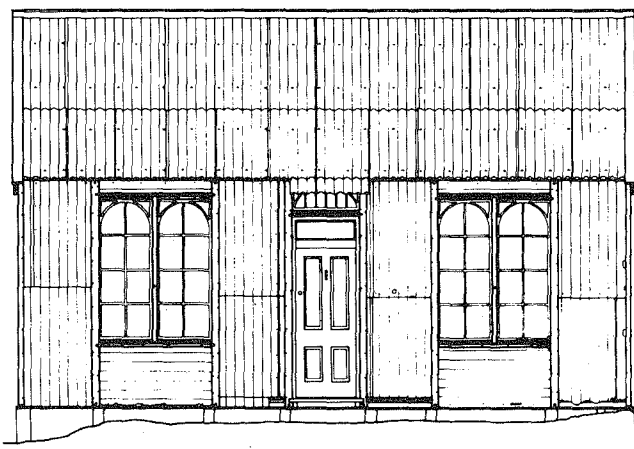


Fig. 7: 399 Coventry Street, South Melbourne, by the Coventry Street Master, c.1853. North elevation, measured and drawn by Pru Sanderson.

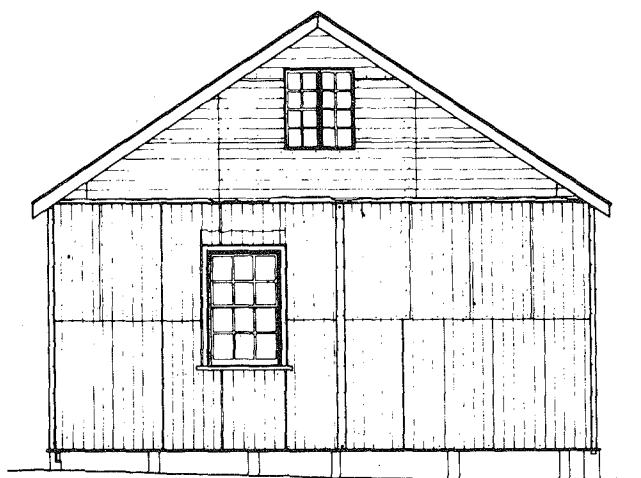


Fig. 8: 399 Coventry Street, South Melbourne: east elevation, by Pru Sanderson.

from contemporary documentary sources, and because the Fitzroy building would otherwise have been attributed with moderate confidence to the firm of Morewood & Rogers. The building is divided by the pilasters along its length into six bays of about 4.5m each, though the front is of cement over what is probably solid brickwork. Although in recent years it has served as a hall for the adjacent All Saints Roman Catholic Church, it seems originally to have belonged to the Wesleyan Methodists, who had ordered five churches from Morewood & Rogers.⁶⁷ It is possible that Maw was not a building manufacturer, but simply a founder who cast pilasters to order, but even so there is nothing about this building to suggest any specific connection with the works of Morewood & Rogers, which will be discussed below.

Another manufacturer, who made occasional use of pilaster-like cast iron corner angles only, remains anonymous, but has left far more identifiable works than any other. He is referred to, for convenience, as the 'Coventry Street Master', on the strength of the fact that he was responsible for more than twenty houses put up by one developer, Robert Patterson, in Coventry Street, Montague Street and Patterson Place, South Melbourne.⁶⁸ There are fragments of these preserved in various locations, but the important example is 399 Coventry Street, preserved on site by the National Trust, while another, moved from the corner of Montague Street and Patterson Place, is preserved at the Swan Hill Folk Museum. The larger buildings are four-roomed cottages (Figs 7 & 8) with a steep stair and two attic rooms, the smaller ones are of two rooms with a single-roomed attic. These South Melbourne houses do not have the cast iron corner angles, which are used only in the full two-storey buildings of this manufacturer found elsewhere, but they have smaller wrought-iron corner angles, angles as base and top members of the walls and intermediate verticals of T-section iron with the flat face exposed, on either side of doors and windows. Within this framework are set corrugated iron sheets running vertically, except in the spandrels above and below openings, where they run horizontally. It is this vertical and horizontal combination which is particularly characteristic of the Coventry Street Master.

Another distinctive feature of this group of buildings is the use of cast iron casement window sashes divided into panes by integrally cast glazing bars, and in the more pretentious windows with curved bars creating an inscribed arch at the top. Some doors are made similarly with the upper part glazed and a panel of horizontal corrugated iron at the bottom, while the major doors are conventional timber panelled ones, and there are also occasional timber sash windows which appear to be original to the time of erection, if not necessarily a part of the design as prepared and supplied by the manufacturer. The South Melbourne cottages are lined inside with timber boarding nailed to a timber framework built against the inside face of the iron walls in no very systematic fashion, while the partition walls are a single thickness of tongued and grooved boarding running vertically between grooves formed by timber strips nailed to the floor and ceiling. This form of partitioning is not confined to prefabricated buildings,⁶⁹ and would have been quite widely known because of its use in dividing up the cabins of ships.

The preceding description of the external framing and cladding serves also for a large rectangular shed used as a garage at Bridgewater, Victoria, but thought to have been originally a church in Melbourne. However, there are two similar structures which are of two storeys, the house *Loren* formerly at North Melbourne and now at Moe, Victoria, and the former Brown Brothers drapery store, Geelong: both of these have cast iron corner angles with the faces treated as slightly recessed panels terminating in Gothic pointed arches. The remainder of the wall is framed in the characteristic wrought-iron, clad in vertical and horizontal corrugated iron, and at Geelong provided with the characteristic cast iron sashes. *Loren* is a strange hybrid, with the front door and

sidelights as well as the upper window made of timber, though this may conceivably be the result of a later alteration. At Geelong the front façade is also different, as the ground floor is known to have been a plate-glass shop window,⁷⁰ now entirely replaced, while the upper floor is capped with an arched roof, the segmental tympanum of which is treated in a most interesting way like a sort of giant fanlight with the arched decoration partly formed of rope. The surviving upstairs partitions are again of the single board thickness and have the remains of granite wallpapers which are probably original.

While the maker of this group of buildings is not known, they do bring to mind the Birkenhead firm of McKean & Parkes, who had shipped a large corrugated iron building to California. This was framed in T-iron 'not unlike that used for ordinary deck-beam purposes' and so placed as to give 'the appearance of being formed of latticing on the Venetian principle'.⁷¹ Against this attribution, however, is the fact that there stood until recent years on the Calder Highway at Keilor a timber house so like the four-roomed houses in South Melbourne that it strongly suggested the same manufacturer. Very few makers seem to have worked in both iron and timber, but one of these was John Walker,⁷² son of the original manufacturer of corrugated iron. As Walker is known also to have used angle-iron framing and, moreover, to have used timber window and door frames in the same building as cast iron sashes,⁷³ an attribution to him would seem promising. Even more convincingly, Walker advertised corrugated iron sheets in an 'improved size' of 8 feet by 3 feet 2 inches (2.438 × 0.940m),⁷⁴ which is the size used at South Melbourne. The flaw in this attribution is that the one known Walker building is quite different.

At Inverleigh, to the west of Geelong, there survives the shell of a house of a similar size and general disposition to the larger ones at Coventry Street, for it must have had a central passage and two rooms on either side, though the roof was lower pitched and there was no attic. It bears two cast iron plates which identify it as the work of 'J. Walker, Manufacturer, Millwall Poplar'. The framing of the front and rear façades is of angle iron but quite unlike that at South Melbourne. The whole façade is subdivided into panels, each with a complete angle-iron frame with the flanges on the outer face and pointing inwards into the frame, but the side faces of the building, each having only one window opening, have vertical members only at either side of the opening and at the corners of the building—thus it seems that the corrugated iron wall is conceived as more or less self-supporting. The corrugated iron runs vertically within each panel and behind the flanges. Where two panels are adjacent the angles meet back-to-back in the form of a T. At the joints the angles are connected with flat gussets cut to a curve within the right angles. The windows of the front and rear are missing, and may well have been of cast iron, but on either side flank is a window of timber.

Although a house like this is not likely to have been imported after 1854, such evidence as there is suggests that it was not put up at Inverleigh until a later date.⁷⁵ We have drawings discovered by Mr Ted Collins of the Police Department, of a very similar type of house, ten of which were put up at the Richmond Police Paddock.⁷⁶ We also have a contemporary report that John Walker was making thirty-six iron houses 'for the residence of emigrants sent out by Government to Australia'.⁷⁷ These were undoubtedly houses ordered by the Victorian Government to accommodate its own employees. Peter Alsop has located the official correspondence on the subject, beginning with a suggestion made in February 1852 by an immigration officer, S. A. Cooke, that the government should provide housing. This was endorsed by the Colonial Architect, Henry Ginn, who was ultimately authorised to order thirty-six houses. Finally there are despairing comments made in 1854 by Lieutenant-Governor La Trobe, who had thought that only twelve were ordered, and had discovered how very expensive they were, and a memo of where they

were used, including the ten for the Police Depot at Richmond.⁷⁸ As a number of the police buildings were auctioned off at later dates,⁷⁹ it seems likely enough that one of these found its way to Inverleigh and was put up as a shed, probably without its lining, flooring or partitions, which explains why there is no trace of them today.

No other surviving example of the distinctive gusset framing can be identified today, but there are two other buildings of possible relevance. One is a store which formerly stood at 71 Little Malop Street, Geelong, but which was dismantled some years ago and the components stored to await possible re-erection. This building not only had an arched corrugated iron roof with nothing to support it but iron tie rods, but the walls were also largely self-supporting sheets of corrugated iron. The walls did, however, have angle-iron framing their perimeter, and it was joined by gussets somewhat reminiscent of those at Inverleigh. Also at Geelong is a house, *Eudoxus*, at 34 Fenwick Street, which is much modified and re-clad but which, the investigations of Mr Peter Alsop have shown, probably comprises two two-storeyed four-roomed houses made by Walker, and put up on the present site in 1854.⁸⁰ Only probing would reveal any similarities to the house at Inverleigh.

The next manufacturer to be considered is J. H. Porter of Birmingham who, like Walker, signed his buildings—not by fixing plaques to them but by casting his name into his characteristic iron stanchions. Porter had been one of the first exporters of iron goods to the Australian colonies, and in 1839 was advertising everything from iron chairs to pheasantries, but not buildings in the proper sense. In 1843 he seems to have been involved in the establishment of one of the first galvanizing works in England. By 1852 he was exporting iron buildings and briefly, about 1853, he seems to have been in a partnership as Porter Brothers & Stuart, which exported buildings to Melbourne, though none has been identified.

Two surviving buildings bear the mark of J. H. Porter, both of them arch-roofed stores. One (recently discovered by Allan Willingham) is at the Fitzroy Municipal Depot in Queens Parade, and the other used to stand at 69 Little Malop Street, Geelong, but now, like its neighbour, has been placed in storage. Both show the characteristic stanchion, which is cruciform in plan and which provides in its form for bolting down at the base and for the fixing of horizontal girts at three heights in the wall. This appears to be designed to allow the wall to be structurally separate from the roof, so that it can readily be removed or added. It seems that at times such buildings, with only the roof clad, were used as haysheds. The other distinctive feature of the Fitzroy building is the form of shutter, covered in flat sheet iron, which protects the multi-paned cast iron windows. At Little Malop Street shutters alone were used, with no glazing behind, and they were sheeted in corrugated iron. Here the openings had segmentally arched tops, which links them with those of a two-storeyed store building published in the name of Porter Brothers & Stuart (Fig. 9).⁸¹ Another link between the two is a form of circular ventilator used in the gable ends. A distinctive feature of the Little Malop Street building was the use of skylights each in the form of a shallow sixteen-sided glazed cone, with a small conical metal top which could be lifted by pulling a rope below, to provide ventilation. This form of skylight was not unique to Porter's buildings,⁸² though the lifting mechanism may have been. One last confusing detail of the Little Malop Street building is that one of the horizontal girts bore the word 'Eagle', a brand not known to have any connection with Porter: it could refer to E. T. Bellhouse's Eagle Foundry, Manchester, or, as Peter Alsop has suggested,⁸³ to the Eagle Foundry in Cavendish Street, Geelong.

After Walker, Porter, and possibly Maw, the only other manufacturer to label his buildings is Walmsley of London. Walmsley is a very mysterious figure, known to us until recently only because two cottages and a house made by him

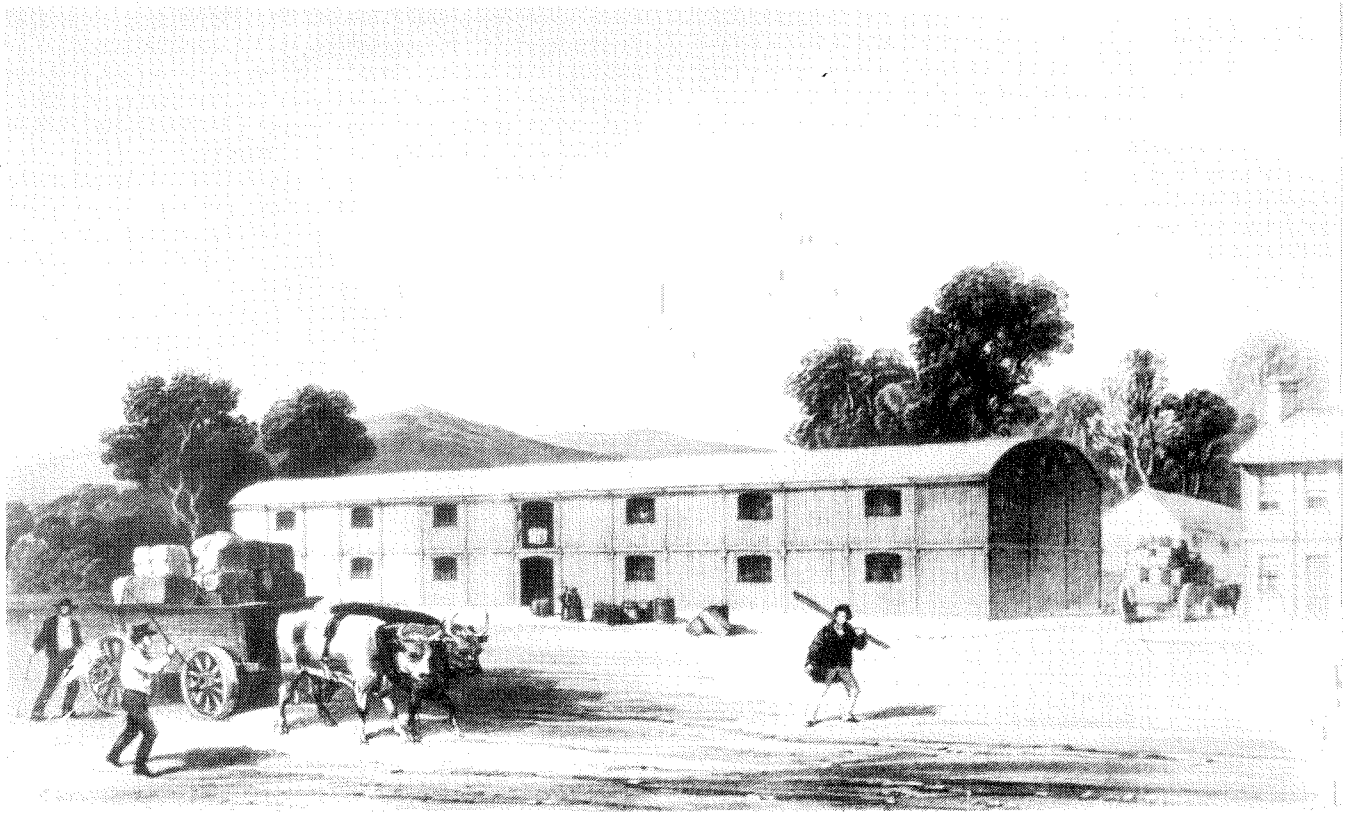


Fig. 9: Iron warehouse by J. H. Porter (sometime Porter Brothers & Stuart) of Birmingham, 1853. La Trobe Collection, State Library of Victoria.

were auctioned at the Richmond Police Depot in 1881.⁸⁴ There is also an Arthur T. Walmsley, presumably a relation, who published a large textbook on iron roofs.⁸⁵ Recently a Walmsley building, identified by a cast plaque, has been discovered in a nursery enclosure in the Botanic Gardens, Melbourne, by Meredith Gould and Oscar Slater. It was almost certainly brought there from some government use elsewhere, perhaps indeed from the Richmond Police Depot in 1881. It is timber framed and clad in vertical corrugated iron, without any really distinctive features.

Timber framed buildings clad in corrugated iron are very common and in general cannot be attributed, or even distinguished from those constructed locally using what is in any case imported iron. The pitch of the iron (the measurement from the centre of one ripple to the next) can be of some help, for although 3-inch (76mm) iron was available, 5-inch (127mm) or slightly larger iron was more common in the 1850s and is found in all identifiable prefabricated examples of this decade. Occasionally, even these simple timber framed buildings may exhibit technically interesting and distinctive features. Morewood & Rogers were a leading English firm of galvanizers and corrugators (their galvanizing is distinctive in having a layer of tin below the layer of zinc) and their brands are found on iron sheets used by other prefabricators, as well as on corrugated sheets and flat iron tiles imported direct to Australia. They did, however, fabricate complete buildings as well, and they maintained a Melbourne agency. Three loose catalogue illustrations of their buildings survive⁸⁶, and while one of them shows an extraordinary system of stepped up lapping sheets, which has never yet been found in a surviving example, and need not detain us, another shows iron window frames with an external flange all around, overlapping the face of the corrugated sheets. An illustration from another Morewood & Rogers catalogue reproduced by Herbert⁸⁷ shows the same detail. Now although this design is not remarkable and perhaps not distinctive, it has not so far been associated with other manufacturers. On this basis a house formerly at 59 Arden Street, North Melbourne, and now at the National Trust site in South Melbourne—where the frame

contains a horizontally pivoting sash with vertical glazing bars only—has been tentatively attributed to Morewood & Rogers, as have one or two other minor examples.⁸⁸

The last manufacturer whose works may be identified was possibly the most prolific of all, Samuel Hemming of Bristol (Fig. 10). His works are shown in a number of catalogue illustrations, and in the case of his Anglican churches in Victoria there is local documentation to support the attribution. Only one of them actually survives, in a modified form, at Gisborne. One exceptional house which can be identified from one of the illustrations is *Wingecarribee* at Bowral, New South Wales, where there is an elaborate treatment with a parapet and classical urns, but this is not typical. Generally Hemming used timber joinery, in such quantities that his seasoning stove was said to be itself the size of a building, and his windows tend to be pairs of casement sashes divided by horizontal glazing bars only, and protected by louvred timber shutters. He tended to favour somewhat lower than average roof pitches, and gables—often gabled roofs running in parallel—rather than hips. The gables may contain horizontal louvres for ventilation. Some buildings shown in old photographs can be tentatively attributed on this basis, as can one surviving one, *Marsh House* at Yapeen, Victoria. At *Marsh House*, however, there are cast iron angle pilasters at the corners not unlike those used in the two-storey buildings of the Coventry Street Master, though different in detailed design. These are not known in other documented buildings by Hemming.

A number of other materials were used in prefabrication in the nineteenth century—oilcloth, papier mâché, zinc, brick, tiles set in frames, and slate, but no examples of any of these have yet been located, and it will suffice to mention them only briefly. Oilcloth was used in Australia's first European house, that of Governor Phillip, which was made by Nathan



Smith of London. It was not very successful, and buildings of the material are not known to have been used subsequently in Australia, though they were elsewhere.⁸⁹

Papier mâché buildings were developed by Charles F. Bielefeld on the basis of his experience in making, first, papier mâché cornices and other architectural details and, second, decorative partitions for the cabins of steamships.⁹⁰ In 1853 Bielefeld constructed a complete village of buildings for an emigrant departing for Australia, and a published booklet of the designs⁹¹ shows them varying from a small, box-like, two-room cottage to a large villa of nine main rooms plus kitchen, store, closets and so on. It also illustrates a church, although there is no evidence that this was exported to Australia. A patent in 1853 describes the way he constructed his buildings, except that it refers to the outer walls as being covered in plain or corrugated iron, a practice which he soon abandoned as being unnecessary.⁹² The walls were of double thickness with an air space running through them, and they were built up of papier mâché panels framed in timber and fitting into grooved posts (such as in Manning's system). The floor was built up in a square grid into which made-up panels of board flooring were set, and the roof was of rectangular papier mâché panels fixed to the rafters.⁹³ Although none of these buildings is known to survive, there is contemporary evidence that some were built in both Melbourne and Geelong.⁹⁴

Zinc buildings were used extensively in Victoria, and the reason why none appear to survive is probably the high resale value of the metal. There is some evidence that zinc buildings were being advertised for South Australia in 1839,⁹⁵ and certainly some were sent to the Californian gold rushes.⁹⁶ In Victoria the commonest type seems to have been those of James Middlemass (Fig. 11), for which he obtained a Scottish patent in 1853,⁹⁷ described in the *Edinburgh Post* as follows:

'the roof is sustained at the centre by an iron tye-rod, screwed up to iron stretchers, acting as stents, with a plat in the centre, where the roof exceeds 12 feet in width. The walls are composed of overlapping panels, along which iron rods pass at 3 feet from the ground, and, again at the eaves, along the whole sides, through

Fig. 10: View of Samuel Hemming's works, Bedminster, Bristol, including a church similar to the one which survives in part at Gisborne, Victoria. Illustrated London News: XXIV, 669 (18/12/1854), 141.

metal eyes, and are screwed up from the extreme ends, so as to tighten and compact the structure. The walls are secured to the ground by cramp irons or brackets, having holes for pegs or screws, to attach them to sleepers of wood, or by which they may be battened down to sleepers of stone.'⁹⁸

Another description, of a combined shop and dwelling, refers to an eave height of 8 feet (2.44m) and to zinc sheets of 3 by 8 feet (0.91 × 2.44m) which presented a flush face to the interior, while the wooden frame of each panel was exposed on the outside. The bases of the panels rested in cast iron shoes which could rest on the earth or be fixed to a wooden sleeper or stone foundation.⁹⁹

Middlemass soon had an Edinburgh rival in the firm of Kirkwood & Sons. Kirkwoods' houses were described as being of 3½ foot (1.07m) panels joined together by nailing through the overlapping flanges and, in the case of the roof, further protected with cover strips. The walls and roof were lined with canvas, and wallpapered, and generally they were insulated with felt. They were superintended by a local architect, John Lessels, and packed in wooden cases made of the boarding intended for the floor.¹⁰⁰ The only known English makers of zinc buildings are Boydell & Glasier, of the Anchor Iron Works at Smethwick, near Birmingham, and the Camden Works at Hawley Crescent in Camden Town, London. Their system was to lay four pieces of deal quartering on the ground as the base for the perimeter walls, and fix into mortices in this their 'patent grooved wooded iron standards'. The outside was covered in zinc plates cut to size, and the inside with patent felt, covered with wallpaper.¹⁰¹ A building of this description and probably made by Boydell & Glasier, was sold by the merchant George Train to the North Melbourne Anglicans to become their church.¹⁰² There are numerous other references to zinc buildings, but the only physical

evidence was the roof lining of T. B. Pearce's bark hut at Airey's Inlet, which appeared to be of zinc sheets seamed together, and may have been part of such a building. This was destroyed in the bush fires of 1983.

Portable brick houses were of two sorts. The better-known stemmed from the model housing designed by Henry Roberts, and the model cottages which he built at the Great Exhibition under the direct patronage of Prince Albert. They were of hollow blocks manufactured by Hertslet & Co. by extrusion, mainly using Henry Clayton's machines.¹⁰³ An English company was set up, the 'Melbourne and Colonial House Investment Company', initially to supply houses of hollow brick, with a view to using a range of other materials in due course. Lewis Hertslet himself was a director.¹⁰⁴ We have no positive evidence of any of these hollow block houses being built, but there is a report in 1854 of a Melbourne company having been set up to manufacture 'Patent Portable Brick Houses' consisting of brick panels screwed onto supports of 'non-combustible wood'. A demonstration house was put up at Emerald Hill.¹⁰⁵ This sounds closer in principle to the 'portable brick house' made by E. Smallwood of Camden Town, London, consisting of a timber frame clad in metal-tongued deal wainscoting (used to form crates on the voyage out) and hung on the outside with tiles 'which give it the aspect of a brick building'.¹⁰⁶

Another use of tiles was the system of building houses of clay slabs, said to have been developed in 1852 by the English architect James Edmeston. In 1854 Edmeston designed a clock tower consisting of a cast iron frame filled with glazed Minton tiles.¹⁰⁷ It had been ordered by the Geelong Council, and was put up in Market Square, where it remained until its demolition in 1923.¹⁰⁸ The system seems to prefigure the tile-filled prefabricated buildings of Andrew Handyside in the 1860s,¹⁰⁹ the much better known (because of its promotion by Viollet-le-Duc) Chocolat Menier factory by Jules Saulnier at Noisiel-sur-Marne in 1870,¹¹⁰ and Viollet's own illustration of *pans-de-fer de face en encorbellement avec revêtement de fayence*.¹¹¹ A similar iron framing system may well have been used for the slate houses, of which we know only from a passing report that a company had been established to manu-

facture them,¹¹² and a later reference to the fact that Alcock, the local billiard table manufacturer, re-used slabs from these houses in his early tables.¹¹³

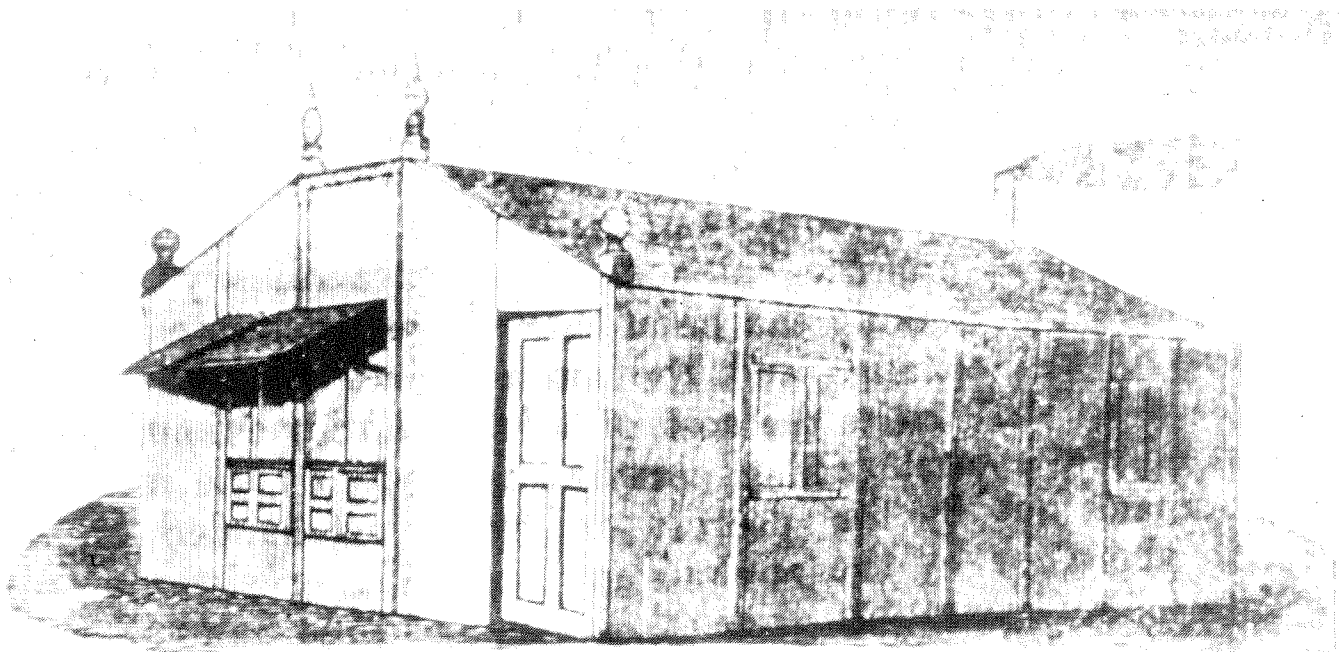
CONCLUSION

There are certainly many prefabricated structures yet awaiting discovery, often concealed within a shell of later date. Sniffing them out is a matter of experience and instinct but when they are discovered, either by such intuitive means or by accident, the discovery will be worthless unless their nature can be confirmed, preferably to the extent of identifying a country of origin and even an individual manufacturer. While there is no one simple way to do this, and while very few buildings are actually labelled, this paper has suggested a number of clues and has outlined the features of the main prefabrication systems.

ACKNOWLEDGEMENTS

I owe a debt to a number of property owners who have allowed me to inspect their buildings, and to an even larger number of people who told me of the existence of examples or have given me information. Of the latter it is only practicable to name those whose written or verbal information is directly cited in this paper, Mr Peter Alsop of Geelong, Mr C. W. Black, City Librarian of the Mitchell Library, Glasgow, Mr Peter Bridges of Sydney, Mr Lawrence Burchell of Melbourne, Mr David Earle of Sydney, Ms Louise Elliot of Melbourne, Mr Hugo Ilic of the Commonwealth Scientific and Industrial Research Organisation, Mr Robert Irving of the University of New South Wales, Sir Edward Morgan of Adelaide, Mr Chris Smith of the Historic Buildings Council, Melbourne, and Mr Allan Willingham of Melbourne.

Fig. 11: Zinc building by James Middlemass of Edinburgh, 1853. McPhun's Australian News: 6 (June 1853), p.12.



NOTES

1. Police files: Series 937, Box 141, No. 3: drawing entitled 'Iron Houses', signed by the contractor Edward Blake and partner, witnessed by Charles Maplestone, Clerk of Works, and dated 18/5/1849.
2. *Argus* 15/9/1883: 2.
3. Bell 1984: 139, citing *Queenslander*, 8/8/1903.
4. Information from my inspection and Allan Willingham's detailed notes as conveyed to me verbally from his file No. A.82.23.
5. Colonial Secretary's files: letters received from Agent General, Box 447 (No. R.54/14.353); Box 448 (No. 55/L940); Box 449 (No. 055/9370): bills of lading of the *Carntyre*, Liverpool, 28/9/1854; *Earl of Sefton*, Liverpool, 17/10/1854; *Ultima*, Liverpool, 2/2/1855.
6. For example, *Osborne House*, 456 Victoria Street, North Melbourne, which is now believed to have been manufactured in the United States.
7. Huddle 1985: I, 53; II, Figs 42, 48, 49.
8. West n.d.: 61.
9. Bell 1984: 170-1.
10. For example *The Heights*, Geelong, and *The Chalet*, Yerton Avenue, Hunter's Hill, of 1855, also imported from Germany. See Huddle 1985: 96-7, 99.
11. *Lyndhurst Hall*, 46 Walhalla Street, Coburg, was put up in about 1853 by Edward de Carle, merchant, at the corner of Albion and Nicholson Streets, Brunswick, and moved to the present site in about 1868-70. See Kellaway 1978: *passim*.
12. *Builder*: XI, 550 (20/8/1853), p.544.
13. Read 1963: 22.
14. Lovell 1981: 51, 55, 59, 62, 69.
15. Huddle 1985: 66.
16. Coutts 1984: 11.
17. Vaughan journal (back pages).
18. *Illustrated London News*: III, 63 (15/7/1843), 35, 40, 41; VII, 168 (19/7/1845), 45; IX, 220 (18/7/1846), 44, 45; XIII, 326 (15/7/1848), 17; *Builder*: IV, 182 (1/8/1846), 371.
19. *Builder* XII, 605 (9/9/1854), 476.
20. *Australian Builder*: 27 (4/9/1856), 216.
21. Samuel Darton, quoted Goldney 1968: 7.
22. *Illustrated London News*: V, 123 (7/9/1844), 156; *Builder*: II, 84 (14/9/1844), 471.
23. Griffith 1845: 4-5.
24. 51 Ormond Road, Moonee Ponds. The house does not seem to have been on this site before about 1916, but was possibly moved from elsewhere. The panels are self supporting, with cover straps rather than structural posts between them. They are 1m wide. The timber is teak, but its precise origin cannot be determined.
25. Sir Edward Morgan, personal communication 31/5/1969: the wood of the floors was described as being almost raspberry in colour.
26. Hugo Ilic, CSIRO, verbal report of microscopic examination, 26/3/1981.
27. Neale 1982: 34-5.
28. Lewis 1974: *passim*.
29. Vaughan journal, loc. cit.
30. For example, at Fryerstown.
31. For example, the Gold Warden's Office, Campbell St., Ararat, which is of horizontal boards rather than true panels, between grooved posts.
32. *Old buildings of Hunters Hill*: 63.
33. Loudon 1846: 251-7.
34. James Hall, *A series of select and original modern designs for dwelling houses*, Baltimore 1840, cited by Peterson 1948: 41.
35. 'B. D. Stuart's Army Stores for the Fourth Division, Cathcart's Hill, before Sebastopol', *Illustrated London News*: XVIII, 782 (2/2/1856), 109.
36. Kelly 1951: 9 reproduces the patent drawings; see also Peterson 1948: 41.
37. *Glasgow Commonwealth*, quoted *Builder*: XII, 619 (16/12/1854), 642. See also Mrs Westgarth to her mother, 9/3/1855, 'Three Westgarth Letters' 1971: 108.
38. *Builder*: XII, 592 (10/6/1854), 326.
39. Herbert 1972: 12-13.
40. *Argus*: 18/4/1863, 3.
41. Young 1856: design no. 13.
42. *McPhun's Australian News*: 7 (July 1853), 6. James Stewart Dismorr is listed first as a haberdasher, then as a draper in Collins Street in Melbourne directories of 1845 and 1847. In 1854 he is at 43 Collins Street East, then in 1855 and 1856 Dismorr and Millar (or Miller) are at this address.
43. Young 1856: 15.
44. *ibid.*: 3.
45. *McPhun's Australian News*: 14 (February 1859), 7.
46. Personal communication, C. W. Black.
47. Young 1856: design no. 14.
48. Robertson 1971: 692.
49. Jones 1969: *passim*; Drinnan 1949: 4.
50. Sampson n.d.
51. Young 1856: design no. 11.
52. Personal communication, Peter Bridges.
53. 125-127 Cecil Street, South Melbourne.
54. Morant Point Lighthouse, Jamaica, 1841, designed by Alexander Gordon and fabricated by Bramah & Robinson (caulked with iron cement); Gibb's Hill Lighthouse, Bermuda, 1843-4, by Gordon, fabricated by Cottom & Hallen; Point de Galle Lighthouse, Ceylon, by Gordon, fabricated by Robinsons; lighthouse for Barbados, 1851, by Gordon, fabricated by Henry and M. D. Grissell (planed and leaded); two lighthouses for Bermuda, 1850, by George Halpin, fabricated by John & Robert Mallet of Dublin (planed); Great Isaac Rocks Lighthouse, off Grand Bahama Island, 1855-6, by the Director of Works, fabricated by Grissells. *Builder*: II, 66 (11/5/1844), 245; VII, 368 (22/2/1850), 93; 400 (5/10/1850), 477; IX, 422 (8/3/1851), 148. *Illustrated London News*: IV, 103 (20/4/1844), 210; X, 244 (2/1/1847), 12; XVIII, 477 (5/4/1851), 274; XXVII, 777 (29/12/1855), 755-6. *Mechanic's Magazine*: XXXV, 939 (7/8/1841), 112. *Penny Magazine*: XI, 661 (16/7/1842), 286. Tomlinson 1850-1852: s.v. Lighthouse.
55. Mr Chris Smith of the Historic Buildings Council has inspected the construction of *Corio Villa*, and Mr David Earle of Sydney that of the Legislative Council Chamber.
56. *Allgemeine Bauzeitung*: XIV (1840), 184-5.
57. Herbert 1972: 9.
58. Papworth 1853-92: s.v. Iron.
59. Young 1856: inserted slip.
60. One was demolished in Fitzroy in 1972, but photographs taken at that time by Louise Elliot survive.
61. Patent No. 609, provisional specification 10/3/1853; specification 10/9/1853.
62. *Builder*: VII, 337 (12/5/1849), 221; 343 (1/9/1849), 41; VII, 371 (16/3/1850), 129; IX, 448 (6/9/1851), 559-60. *Illustrated London News*: XIX, 518 (20/9/1851), 363; 530 (22/11/1851), 613. Timbs 1850: 88-90.
63. A warehouse in Little George Street, Fitzroy; a house at 40 Moor Street, Fitzroy, now at the National Trust's site in South Melbourne; and a warehouse in Latrobe Terrace, Geelong. For the first two see Lewis & Lloyd 1959: 27, Figs 38, 44-7. For the third see Read 1963: 29 and plates.
64. *Builder*: VII, 343 (1/9/1849), 417.
65. Lewis & Lloyd 1959: 38-9.
66. A former Presbyterian church, said to date from 1854, and the remains of a house and outbuilding which comprised a neighbouring hotel. The wall construction of the church is visible with horizontal wrought iron straps running between the stanchions as girts. Site reports by Robert Irving, 2/10/1982.

67. Symons 1870: 157–8; Gregory 1871: 142–3; Blamires & Smith 1886: 60.
68. Five 6-roomed houses appear in 1854 in the ratebooks for Lonsdale Ward, Melbourne, into which the area then fell. In 1855 fourteen smaller ones, valued at thirty, as opposed to sixty pounds, appear in Patterson Place. Even more appear to have been put up later. Lewis & Lloyd 1959: 25.
69. For example at *Woodbine*. Port Fairy, c.1846.
70. The building is illustrated on an old bill-head, reproduced in Brownhill 1955: 331.
71. Timbs 1851: 46.
72. *Illustrated London News*: XXIV, 664 (21/1/1854), 48.
73. In a house for the Royal Mail Steam Packet Company at Chagres, Panama, in 1853. *Builder*: XI, 543 (2/7/1853), 422.
74. *ibid.*: VII, 338 (28/7/1849), 359.
75. Brown 1968: 551–2. The description of the buildings on the property in July 1858 does not include this house.
76. Police files: Series 937, Box 141, No. 3.
77. *Builder*: XI, 543 (2/7/1853), 422.
78. S. A. Cooke to Colonial Secretary, 20/4/1852, 52/642 and subsequent items to 52/3241, Colonial Secretary's files Series B.
79. *Argus*: 16/4/1881, 2. This does not refer specifically to Walker's buildings, but to the Walmsley buildings, discussed below.
80. Alsop 1971.
81. 'Corrugated Iron Warehouse 150ft X 40ft Constructed by Porter Brothers & Stuart. Birmingham, 1853', Day & Son lithographers, La Trobe Collection, State Library of Victoria.
82. There were 66 large skylights of this form but with 32 facets used at John Marshall's flax mill, Leeds, designed by the engineer John Combe in about 1840. See Tomlinson, 1850–52: s.v. Flax, and Bonner 1960: 280, 288. Conical lights were also used in 1849 at Price's Patent Candle Company's works at Belmont, Vauxhall, London. *Illustrated London News*: XV, 382 (8/12/1849), 178.
83. Alsop 1971: 7.
84. *Argus*: 16/4/1881, 2.
85. Walmsley 1888.
86. Two arched-roof buildings, one at Summerhill Farm, Mount Duneed, Victoria, and one which was demolished in Fitzroy in 1972, but photographed at the time by Louise Elliot (see note 60).
87. Owned by Mr Ray Hellier, Beaumaris.
88. Herbert 1978: 48.
89. Lewis 1976: 15–17.
90. See the bibliography in Papworth 1853–92: s.v. Papier Mâché, which lists Bielefeld's *Gothic ornaments* of 1835. In 1843 this or another was republished as *Architectural ornaments*: see *Builder*: I, 19 (17/6/1843), advertisement. For a description of Bielefeld's factory, *ibid.*: 7 (25/3/1843), 81. Bielefeld took out various patents, but the important one is that of 1851 for pressing sheets on a table with rollers, for it was this that produced the partitions for cabins, and doubtless the Australian buildings which followed: *ibid.*: IX, 451 (27/9/1851), 616.
91. Bielefeld 1853.
92. *ibid.*: quoting *The Era*, 10/7/1853.
93. *Builder*: XI, 535 (7/5/1853), 299.
94. Two were in Albert Street, East Melbourne: Burchett 1978: 161. Two were in Geelong, at least one being identified as Bielefeld's: Alsop 1979.
95. Stephens 1839: advertising sheet, unpaginated (advertisement of Henry Hewetson of London).
96. Borthwick 1857: 44.
97. Scottish patent No. 153, 21/1/1853.
98. Quoted *Builder*: XI, 531 (9/4/1853), 238.
99. *McPhun's Australian News*: 4 (April 1853), 4.
100. *ibid.*: 6 (June 1853) 5, 11; 8 (August 1853), 12.
101. *Murray's Australian Circular*: 3 (July 1853), 31; Prout 1852: advertisements, no page.
102. *St. Mary's Church of England* 1953: 2, 3, 5–7.
103. *Builder*: V, 227 (12/6/1847), 286–7; VIII, 364 (26/1/1850), 37; 365 (2/2/1850), 49; Roberts 1850, 11–16; Tarn 1971: *passim*.
104. *Builder*: IX, 536 (14/5/1853), 318; *McPhun's Australian News* 6 (June 1853), 5.
105. *Mount Alexander Mail*: 15/9/1852.
106. *Builder*: XI, 548 (6/8/1853), 508; 550 (20/8/1853), 544.
107. *Illustrated London News*: XXV, 721 (30/12/1854).
108. Brownhill 1955: 126–32; Hitchcock 1954: I, 527–8.
109. Handyside 1868: 41–2.
110. Viollet-le-Duc 1881: II, 327. Viollet referred to the illustrations which were published in the *Encyclopedie d'Architecture*, 1872, p.92.
111. *ibid.*: Pl. XXXVI.
112. *Argus*: 14/12/1853.
113. Billards 1962.

BIBLIOGRAPHY

Published sources and theses

- BELL, P. 1984. *Timber and iron: houses in North Queensland mining settlements, 1861–1920*, University of Queensland Press, Brisbane.
- BIELEFELD, C. F. 1853. *Portable buildings designed and built by Charles F. Bielefeld, patentee*, C. F. Bielefeld, London.
- Billiards, 1962. *Australian Encyclopaedia*, 10 vols, Grolier Society of Australia, Sydney, I, 503.
- BLAMIRES, W. L. & SMITH, J. B. 1886. *The early story of the Wesleyan Methodist Church in Victoria*, Wesleyan Book Depot, Melbourne.
- BONNER, K. J. 1960. Marshall's Mill, Holbeck, Leeds, *Architectural Review*, XXXVII (January–June 1960).
- BORTHWICK, J. D. 1857. *Three Years in California*, William Blackwood, Edinburgh & London.
- BROWN, P. L. 1968. *Clyde Company Papers*, VI, Oxford University Press, London.
- BROWNHILL, W. R. 1955. *The history of Geelong and Corio Bay*, privately published, Melbourne.
- BURCHETT, W. 1978. *East Melbourne 1837–1977*, Craftsman Press, Melbourne.
- COUTTS, P. J. F. 1984. *Captain Mills Cottage, Port Fairy*, Records of the Victorian Archaeological Survey, Number 17, Melbourne.
- DRINNAN, G. 1949. Corio Villa, B.Arch. thesis, University of Melbourne.
- GOLDNEY, F. H. 1968. *The Quaker Meeting House*, Pioneers Association of South Australia, Adelaide.
- GREGORY, B. 1871. *The thorough business man*, W. Isbister & Co., London.
- GRIFFITH, C. 1845. *The present state and prospects of the Port Phillip District of New South Wales*, Curry, Dublin.
- HANDYSIDE, A. 1868. *Works in iron*, Andrew Handyside & Co., London.
- HERBERT, G. 1972. Some problematic iron buildings of the eighteenth-fifties (typescript report), Technion Institute, Haifa, Israel.
- HERBERT, G. 1978. *Pioneers of prefabrication*, John Hopkins University Press, Baltimore & London.
- HITCHCOCK, H. R. 1954. *Early Victorian architecture in Britain*, 2 vols., Architectural Press, London.
- KELLY, B. 1951. *The prefabrication of houses*, Chapman & Hall, London.
- LEWIS, C. & LLOYD, M. 1959. Portable buildings, B.Arch. thesis, University of Melbourne.
- LEWIS, M. 1972. Tradition and innovation in Victorian building 1801–1865, 3 vols, Ph.D. thesis, University of Melbourne.
- LEWIS, M. 1974. Jolimont, *Historic houses of Australia*, Cassell Australia, South Melbourne & Broadway, N.S.W.: 88–95.
- LEWIS, M. 1976. Letter quoted in *Kalori Quarterly Newsletter* 3 (September–November 1976): 15–17.

- LEWIS, M. 1981. The Singapore cottage, *Unibeam X*: 89–91.
- LEWIS, M. 1985. The portable house, in Irving R. (ed.) *The history and design of the Australian house*, Oxford University Press, Melbourne: 274–89.
- LOUDON, J. C. 1846. *An encyclopaedia of cottage, farm, and villa architecture*, Longman, Brown, Green & Longmans, London.
- NEALE, A. 1982. The American timber cottage in Australia, B.Arch. thesis, University of Melbourne.
- Old buildings of Hunters Hill*. 1978. Hunters Hill Trust, Sydney.
- PAPWORTH, W. 1853–92. *The dictionary of architecture*, 4 vols, Architectural Publication Society, London.
- PETERSON, C. E. 1948. Early American prefabrication, *Gazette des Beaux-Arts*, 6th series, XXXIII, p.41.
- PROUT, J. S. [?1852]. *An illustrated handbook of the voyage to Australia*, Petter Duff & Co., London.
- READ, M. [?1963]. Prefabricated buildings and structures in the colony of Victoria, B.Arch. thesis, University of Melbourne.
- ROBERTS, H. 1850. *The dwellings of the labouring classes*, Society for Improving the Condition of the Labouring Classes, London.
- ROBERTSON, E. G. 1971. Cast iron architectural ornamentation, *Victorian Historical Magazine* XVII, 4 (November 1971).
- St. Mary's Church of England North Melbourne 1853–1953 Centenary souvenir* [?1953]. St. Mary's Church of England [?Melbourne].
- STEPHENS, J. 1839. *The land of promise*, Smith, Elder & Co., London.
- SYMONS, J. C. 1870. *The life of the Rev. Daniel James Draper*, Hodder & Stoughton, London.
- TARN, J. N. 1971. *Working-class housing in 19th century Britain*, Architectural Press, London.
- Three Westgarth letters, 1971. *La Trobe Library Journal* II: 8.
- TIMBS, J. 1850. *The year-book of facts in science and art*, David Bogue, London.
- TIMBS, J. 1851. *The year-book of facts in science and art*, David Bogue, London.
- TOMLINSON, C. 1850–52. *Cyclopaedia of useful arts, mechanical and chemical, manufactures, mining, and engineering*, 2 vols, George Virtue & Co., London & New York.
- VIOLLET-LE-DUC, E.-E. 1877 & 1881. *Lectures on architecture*, 2 vols, Sampson, Low, Marston, Searle & Rivington, London.
- WALMSLEY, A. T. 1888. *Iron roofs*, E. & F. N. Spon, London.
- WEST, T. n.d. *The timber frame house in England*, David & Charles, Newton Abbot, Devon.
- YOUNG, C. D. [c.1856]. *Illustrations of iron structures for home and abroad*, Charles D. Young & Co., London.

Unpublished sources

- ALSOP, P. 1971. Letter to P. L. Brown, President, Geelong Historical Society, 7/2/1971.
- ALSOP, P. 1979. Address to the Institution of Engineers, Melbourne, 17/7/1979.
- COLONIAL SECRETARY'S FILES. 1854–59. Public Record Office, Laverton, Victoria.
- HUDDLE, L. 1985. 'The Heights' conservation analysis report, 3 vols, draft report to the National Trust of Australia (Victoria), February 1985.
- JONES, 1969. Letter of Mrs W. G. Jones to the National Trust of Australia (Victoria), 25/6/1969.
- KELLAWAY, C. 1978. Research notes on *Lyndhurst Hall*, 46 Walhalla Street, Coburg, for the National Trust of Australia (Victoria).
- LOVELL, P. 1981. *Woodlands* homestead complex, report to the National Parks Service, Melbourne.
- POLICE FILES. 1852–4. Public Record Office, Laverton, Victoria.
- SAMPSON, n.d. Note on Corio Villa by Mrs E. M. Sampson, in the possession of Mrs W. G. Jones, Ocean Grove.
- VAUGHAN, S. B. 1852. Journal, in the possession of Mrs W. J. Kendall, Malvern.

Periodicals

- Allgemeine Bauzeitung* (Vienna)
- Argus* (Melbourne)
- Australian Builder* (Melbourne)
- Builder* (London)
- Illustrated London News* (London)
- McPhun's Australian News* (Glasgow)
- Mechanic's Magazine* (London)
- Mount Alexander Mail* (Castlemaine, Victoria)
- Murray's Australian Circular* (London)
- Penny Magazine* (London)