Bricks and Nails

Building Materials as Criteria for Dating in Sydney and Environs from 1788

A Documentary Survey and Assessment of Dating Potential

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy
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DEDICATION

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Oom Jelle and Tante Bep Kook nee van Lunteren
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I would like to thank those colleagues and ex-students who showed a kindly interest in my work. I would also like to thank my many dear friends for their encouragement and tolerance, especially those of "Allen Street", Norfolk Island and its Restoration Team.

I would like to record my appreciation for the honour of having received several University of Sydney Postgraduate Scholarships and a Commonwealth Postgraduate Award.

My typist, Mrs Robyn Wood, deserves a gold medal for being simply brilliant.

DEO GRATIAS
This thesis explores the potential of two building materials as criteria for dating buildings, structures and archaeological sites. It is believed that the study of past human behaviour cannot be reconstructed or models formulated unless adequate tools are available whereby past remains are set in a firm chronological framework and, ideally, whereby the function and status of these remains can be identified.

The method adopted in this thesis is deliberately documentary, i.e. it is based on the study of manuscripts, printed material and illustrations, mostly contemporary with the objects under study. Such documentary sources are the essential basis for any study of European cultural remains in Australia. Ideally this approach would be combined with the study of changes in form and material of the building materials themselves. Such a study, however, would require detailed analysis of physical material from as many accurately-dated sites as possible from the period 1788 to the present, another major thesis in itself. Even now few Australian sites have been excavated, fewer still have paid adequate attention to the building materials within them and none have been adequately published. In these circumstances the decision to begin by a thorough examination of relevant documentary sources itself, no small undertaking, is seen as an essential and valid preliminary step.

The thesis evaluates two principal constructional categories of building materials as to their dating potential in archaeological contexts.

It was originally intended to present the research and evaluation of many categories of building materials in as much detail as the studies of bricks and nails here presented. It early became evident that this was impractical in terms of length and for the purpose of the thesis, repetitive. Two categories were thus selected for treatment in full, these certainly having the greatest potential as dating tools. Bricks and nails remain as important today as they were in 1788.

In terms of geographic application this work has wider relevance than its title would suggest. The spatial limitation here proposed to Sydney and its environs is to emphasize that no formulated sets of rules dating a structure on the basis of its building materials can be universally applied; all are subject to variation arising from particular conditions in time and space.

R.V.J. Varman
September, 1993
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<td>CPJA</td>
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Introduction

The dating of undocumented sites in archaeology has traditionally rested on a detailed understanding of artefacts. From about the seventeenth century we find an increasing preoccupation with inventions for which royal patents were applied. With the advent of the Industrial Revolution records were being compiled by many secular authorities, the scope of which has expanded unabated to the present time. In stark contrast to any previous period, the present day student of historical archaeology has access to a wide range of written, printed and illustrated data. This data, when processed and analysed to its full potential, will lead to a greater understanding of development and explain specific and general principles of past human behaviour.

A documentary approach has been taken in this work because such a background, catering specifically for colonial archaeology in Australia, is totally lacking. Without such a foundation the analysis of fieldwork components can barely be considered sound.

The question dealt with in this thesis is, when pared down to the essentials, to determine the extent of building materials as criteria for dating.

It is not asserted that this approach embodies the final word on the dating of individual objects but rather offers a broad scope of possibilities which exist in the documentation under study. The limitation of area, incorporated into the title of this thesis, is intended as a caution, acknowledging the mutation-like effects in the transference of skills, technology and fashion from one area to another.

Most categories of building materials have been researched in the preparation of this thesis. To avoid a data overload, two of the most promising categories have been selected.

The basic tool of archaeology is to be able to date objects of all kinds; the greater the number of dated objects, the easier it will be to establish a framework in which to reconstruct past events and situations. Objects must also be able to be exactly identified before assumptions can be formulated about the nature, function or status of a site. For example, it is useful to know that a certain nail or brick may be dated to the
1820s/1830s period but if it is not realized that the brick was a fire brick or the nail was used exclusively for cooper's work, the crucial information could be missed that the site was once used as a bakery or commissariat store (depending on corroborative evidence). Hence, a glossary of nail forms and functions is included as an example of what could be achieved if glossaries were compiled for all objects. As many objects are stamped with names or initials, a gazetteer of Sydney brickmakers is also included, again as an example of what could be achieved in other categories (tiles, functional terracotta and porcelain, metal fittings etc.). Many objects can be identified and dated by using advertisements and trade catalogues, but few such sources are found before the 1840s and are not common until the turn of the present century. Many mass produced objects were stamped with registration marks or numbers which can be traced from the 1840s onwards. Morphological dating systems are generally constructed in the absence of available documentation; if this technique could be integrated with the thorough documentation of a particular object, a perfect chronological morphology could be theoretically possible.

With any system of dating there are many conditions before assertions may be made: this is the reason why this study must have geographical limitations. The following represent the conditions which one must apply when establishing a chronology based on the flow of technological development originating from Great Britain and Europe to a colonial context:

1. Geography, Geology, Flora and Fauna (Environment)

Geography tempers practical needs created by a particular climate. Geology is the key which supplies a large proportion of raw materials depending on transportation (stone, clay, lime etc.). A combination of the above determines other raw materials, such as timber. The fauna may modify old traditions; for example, where white ants thrive, foundations may be modified to become stilts to allow for the free access of air and light (though other factors may also be responsible for this).
2. Skilled Tradesmen

The more skilled a group of specialists, the better the chance of a sophisticated and enduring artificial environment. A very traditional, or stubborn, group of craftsmen might actually delay the exploitation of natural resources and site-specific conditions as much as a group of inexperienced labourers working things out by trial and error.

3. Transport

This aspect is often ignored, but the lack of transportation can often delay the establishment of a new technology or the distribution of its products. Cartage was very expensive at any time and such objects as bricks, building stone and timber for a house were procured as near to the house as possible. When machinery for brick production became common in Sydney, for instance, it was decades before country areas were able to follow suit, especially west of the Blue Mountains. This latter example is clearly connected with the degree of finance available and expected profit margins, for example, the expected returns from a stamper battery used in connection with goldmining compared to that of a brickmaking plant, made such machinery a good proposition despite the astronomical transport costs. As far as bricks are concerned, it was cheaper by far to import a brickmaker than a brickmaking plant. Many brickmakers became redundant when rail freight reduced the price of transporting bricks to country areas where large output brickmaking plants did not already exist. The nail dating system is as applicable to Sydney as to country towns. Nails are both cheap and easy to transport, bricks are not.

4. Finance

While transport was poor and very expensive, only a large amount of capital could overcome the problem of transport. The owners of such buildings as Abercrombie House at Bathurst could afford such materials as Welsh roofing slates despite the cost of transportation, whereas even the moderately well-to-do continued to shingle their roofs or use corrugated iron (which was easily transported because it was light and could be very economically crated without breakage).
Mass producing dry press brick machinery became economically viable in Sydney during the booming 1880s but not so in country towns. Dry press bricks found in archaeological contexts in the country have radically different chronological implications from those found in Sydney.

5. Government Control

By Government policy certain materials were encouraged whilst others were discouraged. Brickmaking and window glass production were severely curtailed in Britain during the years of the window and brick taxes. The *Sydney Building Act* of the late 1830s restricted or forbade the use of several building materials and encouraged the use of others. In later years local government measures restricted the use of particular building materials to particular areas. A recent case of direct Government control resulted in the ban of asbestos in the building industry.

6. Fashion in Design and Materials

This factor, because it is and was easily transportable whether by people or literature, often modified local developments continually over time. The adoption of technological advances depended on finance, transport and population figures. But changes in fashion were more easily adopted as they relied only on the skill of the craftsman.

7. Chance

This covers all the above categories defying prediction. Examples may include such phenomena as the 1850s gold rush when the skilled section of the workforce abandoned their skills to pan for gold. The gold rush created instant settlements and wealth which stimulated a flood of imported materials and even prefabricated buildings. Wars tended to shrink the availability of skills but stimulate invention, sometimes replacing manual processes by mass production. There were
often unforeseen consequences of chance importations or accidents leading to new discoveries etc.

This thesis is divided into four chapters each with several subheadings. The illustrations have been placed opposite the text for convenience and to assist in the clarification of the text. The footnotes have been placed at the end of each chapter because of their large number. The "imperial" system of weights and measures has been retained as found in the various publications; to transpose these into the metric system would render this work cumbersome and would suggest an absolutism (by the expression of fractions) which in many cases was never intended.

Finally, it should be acknowledged that a dilemma exists in the dating of historical period objects. Although the written, printed and illustrated record may add essential information on individual objects, this form of data can never replace what is actually found on a particular site. Standard processes may be described in detail but even with the most stringent evaluation and vetting of source material, the final word lies with the site and objects themselves. The first and last steps, however, for the historical period under study, should be the exhaustive investigation of documentary sources from which identifications of function may be made, dates of factory produced objects be established and tentative chronological frameworks constructed.
1. Typical brickyard ca.1870 (Hollermann Photographic Collection, ML, A4999).
Chapter One - Bricks

Excepting fire bricks and other special purpose bricks, common building bricks were not an article of importation unless brought incidentally as ballast. Brickmaking, in Sydney and its environs, remained a purely manual employment from 1788 to the 1880s. Unlike the development in Melbourne, the real change to modernization began in the late 1870s and was fairly complete by the late 1880s. The introduction of full mechanization was greatly facilitated by the contemporary financial boom, the collapse of which did not reverse the process of mechanization. Instead it was augmented by the reaction against the stucco boom-architecture and shift to the "Queen Anne" style which required a great variety of good colour external, or facing, bricks as well as specially moulded bricks.

It is important to understand the various modes of manual brickmaking and burning, as improvements made in Britain were exported over time in the form of emigrating brickmakers, farmers etc., and in the form of articles in cyclopaedias and periodicals. Equipment such as moulds had been exported, as later was the most up to date machinery. The greater bulk of the machinery imported came from England, though some had been brought in from the United States of America, and Germany. Several engineering firms in Sydney and Melbourne constructed brickmaking machines based on such famous models as, Platt, Fawcett, Bradley and Craven etc. Some leading brickmakers and engineers patented their own improvements but the impetus was English in origin. The boom virtually wiped out the old technology in Sydney, except for outlying areas where transportation was poor and, beyond a few miles, was too expensive to cart bricks from the large brickworks.

The four basic machine processes produced were; extruded wire cut bricks, plastic moulded bricks, dry press bricks and re-pressed bricks. Each category of bricks may be readily identified except that re-pressed bricks may be difficult to identify as bricks were re-pressed from all the other categories including manually made bricks. For "close" dating however, more must be known about the moulds in the last three mentioned processes. No detailed information has been found on moulds but it is known that the moulds were of a limited life span and were required to be replaced at regular intervals. What is required is the study of machine bricks from closely dated structures and the construction of a morphology.
Fire bricks and some special forms of bricks were imported regularly into Australia, though local production by the early twentieth century would have diminished the imports. There is little documentation available on British fire bricks.

This study of bricks has been divided under two main headings. Firstly, British and Foreign, and secondly Australian. The division symbolizes the two aspects of the Australian scene; firstly the transplanting of technology from the founding nation, which reinforced its technology as time progressed, and secondly the development of technology once it was established in the colony. Other than British skills and machinery played important roles from time to time after the 1840s.

The details given are felt necessary if the physical objects are to be properly classified and understood so that the scientific method can be usefully applied to morphological analysis.

British and Foreign

The Manual Processes of Brick Manufacturing

The manual process of brickmaking remained largely unchanged from late mediæeval times to well into the twentieth century. A writer of the late 1850s wrote, "the history of bricks may be summed up in a few words -- as our immediate and despised forefathers did, so do we".  

The first requisite for making bricks was to find an area of suitable brick clay as close to a source of water and the site of a building as possible. Wilson was of the opinion that there were few positions where brick clay could not be obtained within a few miles. This would have applied to Australia as well as England, as there were formulae to correct most brick clays. A stiff, tenacious, plastic clay was known as a "strong earth" and could be corrected by adding sand. "Mild earth" was preferred, being less tenacious and with a loamy character. The bricks of strong earths tended to warp, shrink and crack, being pure alumina. Mild earths were sometimes too loamy and a flux was needed to bind the brick, such as lime.

Although there is little evidence that the clay was allowed to weather during the winter months in Australia, in Britain it was the custom and for London, it was required by the brick laws. The 1725 law required the earth to be dug between the 1st of November and February and was required to be turned at least once and made into bricks before the 1st of March. Later amendments allowed the brick clay to be dug at any time during autumn and early winter, before the onset of the winter frosts. It was
Scotch kiln in a 'bush' brickworks ca.1870. This was probably similar to the scene at brickfields in Sydney of the 1790s (Holtermann Photographic Collection, ML, A4999).
believed that the swelling action of the frost and the action of air penetrated the clay and divided the particles making mixing and tempering a lot easier, but weathering was often neglected. The longer the clay weathered the better the end product.

Traditionally, a spade with a narrow blade, or scoop, called a "graft" was used to dig the seam of clay. In Australia, ordinary picks and shovels were mainly used. The clay was arranged in heaps, generally between 8 and 12 feet high or in long heaps arranged in "spits" 16 feet long and four feet wide and dug a foot deep, which was enough for about 1000 bricks per foot high of clay. It was recommended that the clay should be turned and worked repeatedly with a spade. In the case where the heap became too wet, it was opened and spread to dry; and if too dry, more water was added.

The clay, mellowed by weathering or not, was transported by barrow to shallow pits where water was added to soak the clay. The clay was left to stand for several days. It was at this stage where any deficiencies were made good in the mix, and in the London area the breeze was added which would form part of the fuel for burning. The clay was then tempered by treading, either by oxen or by human feet. The use of human feet was common in England up to the 1850s and was also practised in early Sydney. It was also common in Europe. In France it persisted for a long time because of the cheap labour and it was considered more efficacious for the removal of unwanted material such as stones. Additives such as breeze or coke dust were sprinkled to the extent of a few inches (depending on the proportions required) over the clay and thoroughly worked into the clay.

In the more sophisticated yards, especially from the 1840s, a pug mill was employed for the same purpose. A typical pug mill was a conical tub, secured by hoop iron, about six feet in diameter and in height. The clay was fed in at the top and the clay was worked up and down (screw-like action) so that the clay was reduced to a smooth paste by the action of revolving rakes with iron teeth like a harrow. Other mills had revolving blades and in both cases, stones and unwanted material were eliminated. By 1820, London brickmakers tempered the clay by horse mill and the technique was later adopted in many other brickyards. The pug or horse mills were operated by a horse treading a circular path activating the central shaft of the barrel-like contrivance. For such a simple mill the horse or ox could be substituted for water or steam power. Where economy was required, the heap was merely broken up and soaked with water and covered by bags to prevent drying or further soaking by rain. The following day the clay was turned over with a fork-like tool with three broad prongs and a blade across the lower end of the prongs, known as a "turning iron", or "mule". The heap was then trodden down by feet as it was turned. The clay was removed from the mill or pit and heaped and patted down and
3. Traditional Australian brickyard with a pug mill (*BEIJANZ*, 23:02:1889, plate 6, fig.1).

covered with boards, cloths or bushes to protect it from the sun and air. The clay was now ready for the moulder.

Much of the labour in brickmaking was performed in the open air. Sheds with only a roof were used by moulders to protect them from the effects of the rain and the sun.

In the shed were located the moulding table, usually referred to as "the bench", or "stool"; a sand box and water trough was located at the moulder's right hand; on the table were located the brick mould, stockboard, a pallet, or "setting board", a strike, a trimming knife and perhaps some wire. At the ready were also a number of brick, or 'hack' barrows.

When the moulder was ready, the "pug boy" cut pieces from the heap of tempered clay using a "steel" cutter, or wire. The clay was rolled on the ground into a shape called a "pug". The heavy pug was carried by the pug boy, held against his chest which was protected by a heavy duty apron, to the moulder's table and was deposited on the left hand side of the moulder. In some yards the clay was wheel barrowed to the bench, in such a yard sufficient clay for 30-60 bricks was delivered at a time.

The moulding box was most commonly made of a hardwood (oak, mahogany etc.), but by the 1840s were sometimes lined with sheet iron. Some were bound with iron for strength as well as iron lined. This led to cast iron moulds being used but these were abandoned because they were too heavy to work with and were too cold to handle during the cooler months. Brass lined moulds were also employed. It was found that the wooden moulds wore out too quickly and lining prolonged the life of the mould, and allowed the brick to slip out more easily. Some authorities warned that the moulds should be frequently gauged, or measured, otherwise the bricks produced could vary. Sometimes only the edges were lined with iron. The use of mould liners was common by the 1870s and 1880s. Australian authorities by the 1880s recommended (for "bush work") that moulds should be constructed of good seasoned wood and plated with iron around the edges and mentioned that iron and brass moulds were sometimes used. Although the use of metal did prolong the life of the wooden mould, the sand used in the mould quickly wore away the metal sheeting, which was expensive to replace. Wooden moulds, including a stock board with a kick-up in the centre, were illustrated in advertisements by 1870, otherwise they were rarely mentioned except in the various cyclopaedias. The advantage of a metal lined mould was that it produced bricks at a faster rate and ensured that the bricks remained at one uniform size, with good, sharp edges: wooden moulds lost their shape as the wood became exhausted (some claim to have detected signs of cracking and worn wood on bricks made in this
Hand moulded bricks of the late nineteenth century often have sharper arrises and a smoother surface, but these could be the result of other factors, such as slope moulding.

The size of the mould was calculated to allow for shrinkage during drying and firing. The advice offered by the various authorities on how to achieve the ideal size of brick differed from source to source, reflecting the great variation which must have existed on a practical level. A *late nineteenth century* Australian authority on the manual process advised that the mould should measure $9\frac{1}{2}\times 4\frac{1}{2}\times 3\frac{1}{4}$ inches to achieve a "proper size" of brick of $9\times 4\times 3$ inches. Wilson confirmed this shrinkage rate by advising that the mould should be a half an inch longer and wider and deeper by a quarter of an inch but did not specify the size of the resultant brick. An authority, who published advice to prospective immigrants in 1854, recommended that moulds should measure $10\times 5\times 3\frac{1}{2}$ inches. Another authority recommended that the mould should measure between one twelfth to one twentieth larger than the desired brick; another put it in terms of a percentage, between eight and ten per cent.

After the mould was cleaned and sanded and the surface of the moulding table sprinkled with sand, the moulder took sufficient clay from the pug for one and a quarter bricks (either by cutting the clay from the pug or wrenching it off with his hands). A good brickmaker kneaded the clay on the table by drawing it towards him and pushing it away, working it with the palms of his hands: the "clot" of clay was roughly formed into the shape of a brick. The clot was then drawn forcibly into the prepared mould and the clay was well pressed in so as to fill all the corners. A wooden "strike", or scraper, generally measuring $10\times 1\frac{1}{8}\times \frac{1}{2}$ inches was used to scrape off the excess clay along the top of the mould. This action invariably left longitudinal scrape marks along the top of the brick (opposite the side of the frog). From the early 1840s the strike was sometimes like a large thick knife, called a "plane". In other brickyards a wire stretched between the ends of a bent stick was pulled across the surface. If the drag marks were too obvious or messy, this surface was smoothed down.

The moulding box was lifted from the stock board on the moulding table and tilted to one side, the brick was then forced onto a flat wooden pallet by a skilful twist of the wrist. The pallet was the width of the brick, five eighths of an inch thick and three quarters of an inch longer than the mould, though another source gave three inches for the latter measurement. The extra length of the board was for the handling without damaging the bricks. The brick sometimes required dressing with a knife when sufficiently dry. The pallet and "green brick" were then placed on the "hack barrow", also called an "off bearing barrow", until the barrow was filled. The barrow load was

5.

Pug boy taking "pug" of clay to moulder's bench

(*After Tomlinson, fig.235*).

6.

Covered moulder's bench, moulded bricks being stacked in hack barrow

(*After Tomlinson, fig.236*).
7. Traditional wooden brick mould without stock board (Spon, 1874, fig.1339).

8. Wooden brick mould showing details of construction (Bourry, fig.77).

9. Wooden mould and stock board with rectangular kick for frog (Tomlinson, fig.237).

10. Single and multiple moulds (Knight, fig.921).

11. European opening brick mould (Bourry, fig.182).
often sprinkled with sand to absorb extra moisture and give greater protection. The "off bearer" or "hack boy", wheeled the barrow to the vicinity of the "hacks". The barrow was often run on planks to prevent concussion to the soft brick. The barrow generally accommodated 26 bricks (though Wilson quoted 20 bricks), each one resting on a pallet in two rows of 13 bricks. Generally, three hack barrows were required for each moulder's table; one being loaded, another being unloaded at the drying ground or hacks, and one going back and forth.

In order that the bricks would not warp during stacking in the hacks, the bricks were first dried on the ground and then hacked. In the case of very soft green bricks, these had to be taken from the hack barrow by wedging them between two pallets to avoid finger and thumb marks and warping. When drier clay mixtures were used and machine moulded bricks were made, the bricks could be hacked immediately.

Hacks varied from place to place, mostly depending on the degree of quality desired and the manpower available. In a very good yard, a drying "floor", or drying ground, was prepared on a high and open piece of ground. The foundations of the hacks were prepared by creating earthen "beds" 50 metres or more in length running in a north-south direction to ensure equal distribution of sunshine to either sides of the hack. The beds were about 610mm wide and were raised from the drying floor by about 150mm-180mm. The beds were spaced about 1220mm apart to allow for the wheeling of the barrows.

The bricks were arranged on the beds in low walled rows called hacks. Sometimes, as mentioned above, the bricks were allowed to harden a little on the drying floor before hacking. In other cases the bricks were laid out along the hack with their pallets until the long row was completed; by this time the first bricks would have hardened on their surfaces, depending on the weather, and another hack boy carefully removed them to the adjacent hack. The brick was slid off the pallet, supported on the other side by a hand. The most common method appears to have been to place the next row of bricks on the hack until the previous row had sufficiently dried. The hacks were built two bricks wide, leaving a small space between the two rows. In larger yards these were placed on the earthen beds, as described; in small or country yards they were placed on a flat, well drained, piece of ground. The favoured height for the hacks appears to have been eight tiers high. Accounts of the stacking methods vary considerably. Archaeological evidence found in Sydney and elsewhere in Australia suggests that the bricks were arranged parallel to each other but at right angles to successive tiers initially (and were then presumably restacked when hardened in a scintled arrangement with wide spaces. The latter is supported by an Australian.
account of 1889 and some earlier English accounts. The 1848 Wilson account provides us with reversed instructions: the bricks were at first laid at an angle, each successive tier was laid at an opposite angle to the previous one after being sanded. After a good week the bricks were then removed to the adjoining vacant hack area, "turned over", and set parallel to each other but at right angles to the previous tier. The bricks were not permitted to touch adjoining bricks and during the first hacking process were spaced no further apart than two inches, during the second process the spaces were reduced to one inch. The common or "Australian", method seems to be more logical as initial stacking at right angles would give more support to the green brick and initial narrower spacings would allow far slower drying and the later wider spacing and skintling would allow for the free flow of air when the bricks were more stable. The drying period lasted between three to five weeks. Sometimes the hacks required "turning" three or four times before being ready for firing. After the initial drying in the later nineteenth century, the bricks were sometimes raised in higher tiers of between 12 or 13, but this was probably due to the bricks having been machine moulded (less water and more dense).

Whilst in the hacks, the bricks needed to be protected from rain and from drying out too quickly. The earliest method in England for protecting the hacks from the rain was to thatch over the hacks. To protect the hacks from excessive sun, light frames of a type of basket work made of intertwining twigs and straw were made. These "straw hurdles", described as being six feet long and as high as the hacks, were very versatile and were used to shelter the hacks from sun, rain and frost, they were even used to direct air into the hacks. For "violent rains", the tops of the hacks were recommended to be thatched using long wheat or rye straw laid transversely and weighed down with planks. In Australia it was the practice to cover them with straw, reeds or sheets of bark during the day and night, in later years tarpaulins made of old bags or canvas were used. Evidence suggests that the drying period in Australia was of much shorter duration. Permanent yards built long drying sheds and during the period of mechanization, the heat from the kilns were utilized to speed up the drying process.

If a group of bricks can be found from the same batch, nearly all the phases of its manufacture may be found, if viewed collectively. One lot examined showed the following characteristics: clay exhibiting a fairly good puddling process, though some stones were found in the clay; evidence of gritty sand on the surface of the brick, a result of the sand stock process; a fixed position government, or "king's broad arrow" (as opposed to one stamped on after moulding), revealing that a stock board fixed on a moulding table was used in conjunction with the mould; a range of fine and deep broad
arrow marks to quite wide and deep marks, revealing a gradual build up of clay around a probably fine broad arrow fixed on the stock board; drag marks, mostly fine but some large where tiny fragments of stone were dragged across the surface, lengthways along the face of the brick (always opposite to the broad arrow mark), the result of wooden strike used to scrape excess clay from the top of the mould; a slightly raised horizontal band along one or both sides of the bricks, due to stacking in hacks; a flattening of the broad arrow face of the brick, the result of flipping the brick from the mould onto the pallet; thumb or finger marks on the sides or faces of the brick, the result of handling whilst the brick was still soft; depressions on the sides of the bricks, the width of a brick, evidence of stacking in the hack whilst the brick was too soft; distinct hay and/or grass impressions on the long, or "stretcher", sides of some bricks, the result of initial stacking on the ground where perhaps hay/grass was strewn about from the hack covering or used to keep the bricks off the dirt of the ground; possum and cat footprints on the long, or stretcher, sides of the newly formed bricks, indicating that the brickmakers had not covered the hack at night; distinct pockmarks on the stretcher sides of bricks, evidence that rain had fallen on the unprotected hack; outlines of a reddish colour without depressions, the width of a side of a brick, on stretcher sides, the result of slight overheating in the kiln (the outlines being formed by the protection of bricks stacked perpendicularly above and below); vitrification of a purple colour at the ends of bricks, known as "flare headers", the result of bricks being too close to one of the flues created through the method of stacking in the kiln; small "clinker" hard (vitrified) bricks, purple in colour, some times warped and showing evidence of having become fused with other bricks, the result of being too close to the source of heat in the kiln; large, soft salmon-yellow bricks, the result of being too far away from the source of the heat in the kiln.

Once the bricks had dried completely, the bricks were ready for firing. There were two methods of firing bricks, by kiln and by "clamp burning".

Kilns for "stock", or common, bricks were simple constructions. The type of kiln used for simple brick burning, since the construction of the first kilns in Sydney, was a type known as the "Scotch", box, or rectangular kiln. This was a single chambered kiln on a rectangular plan. The Australian version was generally similar to the British kiln. The kiln had three permanent walls and one temporary wall (or two permanent walls and two temporary ones) which was bricked up after the "green" bricks had been set in place inside the kiln and was demolished at the completion of the firing and cooling. There were three to four flue arches, or "fire holes", opposite to each other at each side of the kiln. The top of the kiln which was not permanently closed, was covered with whatever materials could be found whilst the setting and the initial

16. Hack barrow of 26 bricks, each one on a pallet to avoid excessive handling of the soft brick (Tomlinson, fig.239).
burning was taking place, in later years iron sheeting was used. The walls were made about three feet thick and made of old or rejected bricks, stone or a combination of both. The material was bonded in clay as lime mortar would disintegrate in the heat. In some cases the kiln floor was sunk about four feet below ground level.

The bricks were stacked in the kiln with considerable skill, this process was known as "setting the kiln". It must be admitted that the setting of the kiln varied from one brickmaker to another. One method commonly used was as follows: the firing area was at the base of the kiln and to construct this area, rows of bricks were laid two or three bricks wide along the length of the kiln, intervals of two bricks were left vacant between the rows. The rows of bricks were built at least six or eight courses high. Before any further bricks were stacked, the flue like vacuums were laid first with timber shavings or light and dry brushwood for kindling; then a layer of larger brushwood cut into short lengths was compacted over this, then finally logs of split strong burning timbers were placed on top. All the "flues" having been filled up, the arching was commenced; each course of bricks was made to cantilever one and a half inches beyond the course below it to the extent of about five courses in height which coincided with the fire holes. The spaces left by the arching were then filled with timber. The ends of the bricks were made to touch each other but narrow spaces were left between the sides of the bricks which were always on their sides, this allowed the heat to travel throughout the kiln. The bricks were organized in units of "three upon three" which was the rule of brickmakers; each course was reversed in direction for stability. The main setting occurred above the arching (in more sophisticated kilns, this arching was a permanent feature) and the bricks arranged in the manner described until the top of the kiln. The top course was laid with bricks placed flat, each brick covering a part of three others, the process being known as "platting". The top of the kiln was temporarily covered in order to protect the green bricks from the rain and to minimize the up-draught whilst the bricks were being dried out by a slow heat. Spon 1874 edition illustrates a kiln set in this manner.

In some kilns a "deadman", or solid wall of brick, was built in the centre of the kiln to ensure that the heat rose in the kiln, rather than travel from one fire hole to another.

The general size of the Scotch kiln in England seemed to vary little. The consistency of some of the figures for kiln sizes ranging from the late 1830s to the 1870s was due to later authorities borrowing from earlier sources. Up to the late 1830s, English kilns were described to be generally 13 feet (3.965m) long, 10 feet (3.050m) wide and 12 feet (3.660m) high, holding 20,000 bricks. Spon of 1874 gives the same
figures but it is obvious from the text that he borrowed heavily from the earlier account. Ure, in the 1853 edition, gave the average size as 13x10½x12 feet and another authority contemporary with Ure advised that the average size should be 14x10x9, though the height at nine feet (2.742m) appears insufficient. A mid nineteenth century account, republished in 1880, offered 13x11x12. Each account, however, maintained that the kiln would hold 20,000 bricks; a kiln of this capacity was considered to be an "ordinary kiln". The thickness of the kiln walls vary in the several accounts from "very thick" to one foot two inches thick (.353). The walls inclined inwards as they approached the top of the kiln, hence the walls were generally thicker at the base than at the top, as can be seen on Spon 1874 edition.

The usual fuel used in Scotch kilns was wood. Timber shavings, light brushwood etc., was used for kindling. In Australia timber was almost exclusively used in the Scotch kilns, even up to fairly recent times. The kindling in the arched flues were set alight after the door or doors had been bricked up. To avoid the whole from burning violently and destroying many bricks by the sudden heat, the fire holes were also bricked up to prevent the entrance of air. This slow fire was kept up for about three days and nights and regulated by opening the fire holes occasionally to allow some air in and to add more fuel; these were then blocked up or partially blocked. This preliminary firing was to remove all the moisture from the bricks and produced a white smoke. The next stage could commence when the white smoke (mostly steam and called "water smoke") turned to a dark or black colour. The fire was then allowed to take its course, the "roof" was removed and the fire holes were opened to admit a full draught and a strong fire was kept going for 48-60 hours. If the fire burned too strongly, the flues had to be partially closed. The brick burner would know when the bricks were sufficiently burned when the arches of the fire hole flue turned white and fire appeared ("gets up") at the top. A kiln holding 35 courses of bricks was expected to sink about nine inches. Up to that point the fire had to be fed from time to time. When sufficiently burned, the fire was slackened and all air vents were closed up. The kiln was permitted to cool down until the bricks could be removed. Variations in the burning process, as in all other aspects of this method of making bricks, were numerous.

The door or doors were taken down and the bricks were then sorted into different qualities; the lowest bricks were burned to a great hardness and perhaps even vitrified; those in the middle were well burned; those at the top were merely baked and were reserved for interior construction. As the outside walls absorbed a great deal of the heat, bricks adjacent to them were often found to be under-burned as well. The

18. Compare the 1820s Brisbane brick kiln with the one below. See Illustration 2 (Lionel Lindsay, *Art in Australia*, September 1925).
under-burned bricks were generally of a salmon colour and were large and relatively soft; well burned bricks were generally of a deep red colour; and over-burned bricks were small, very hard, and of a deep purple colour, often partially glazed or vitrified.98

The Scotch kilns had a high proportion of waste bricks due to uneven heat distribution. An efficient early twentieth century Scotch kiln in England was reported to have had an 84 per cent success rate, 8 per cent being underburned and 8 per cent being overburned.99 The overburned bricks were known as "clinkers".100 Under-burned bricks, or "dough boys" were often refired in the next burning101 or were used for such purposes as surfacing roads (after crushing).102

Clamp-burning was an alternative method of firing bricks with the advantage that a permanent kiln was not needed. Clamp-burning was not considered a primitive form of firing bricks, as it remained the common practice in the London area until at least the 1870s103 and was still used in the traditional brickyards there and the south of England into the 1930s.104 The method used in these areas, however, involved mixing the fuel, "breeze", with the clay of the brick to burn them.105 If this method was ever used with clamps in Sydney, it did not occur until after about 1850.106

In England, during Tudor times, most of the bricks produced were of the clamp-burned variety. The clamp was set up and wood was used internally and externally to fire the bricks.107 This method survived in British country areas and the British colonies where wood was plentiful.108 It was also the chief method to be used in New South Wales.109 In later years, especially in the south of England, breeze, or ash, was mixed in with the clay, constituting the bulk of the fuel to burn the bricks. Layers of breeze were added between the bricks and flues were filled with wood, coal and breeze. This method was very economical, while the more ancient method was calculated to waste about 60 per cent of the heat.110 One burning of a clamp could take from two to six weeks, the longer the firing the better the end product (as long as it was not overheated).111

The construction of a clamp varied greatly in detail but remained the same in principle. A foundation of a layer or two of previously burned bricks was established to protect the clamp from rising damp. Channels, or flues, also called "live holes", were arranged in this foundation which ran the length and breadth of the clamp. The flues contained fuel and the green bricks were stacked around the flues.112 An "upright", or double battering wall was built along the centre, this was six bricks thick at the base and diminished to three bricks thick at the top. A number of walls, or "necks", of three bricks thick were built to either side, each neck diminished in height the further they were placed from the central wall. Live holes, or flues, were made throughout the
clamp. Those burning wood for fuel were so clamped that openings were left for feeding the fire in every direction. The interior bricks were "scintled", or spaced, to allow for the circulation of heat; those on the outer side of the clamp were "close bolted", or laid as close as possible, to restrict the heat to the clamp. Overburned bricks and mud were applied to the sides and top of the clamp to protect it from the weather and prevent loss of heat. The flue openings were fired in succession, timber fuel clamps needed to be refuelled regularly.

As an indication of fuel consumption, to fire 100,000 bricks of the thickness of three inches, it required "146 cwt of wood or 512 cwt of coal".

The temperature throughout the clamp was uneven, those near the live-holes were overburned and often ran together in masses, called "burrs". Those in the centre of the clamp were sometimes partly vitrified and small; those at the outside were not sufficiently burned and remained large, pale and soft, these were placed aside for the next firing or sold off cheaply for second rate housing etc. Great skill was needed in order to proportion the amount of fuel to the size of the clamp, a slip in judgement sometimes rendered the whole clamp underburned or overburned.

In Sydney, the very first bricks (produced either by Samuel Wheeler or John King) must have been fired in clamps. The rejects of the first burnings were probably used in building the first brick kiln. Structures built of clamp-burned bricks may be recognized by the variety of colours of the bricks and the variety of brick sizes, the largest are usually soft and very red, the smallest are usually small and purple with a glassy surface. It is well known that during Elizabethan times that the dark vitrified bricks were used to create patterns in walls: an early Sydney example may be seen on the north elevation of the Hyde Park Barracks.

Recorded Brick Sizes and Factory Restricting Size

It is thought necessary to review some of the main trends surrounding the brick trade in Britain because British methods and traditions were periodically reinforced in the colonies, modifying local methods and traditions as new settlers and new information arrived. Some aspects of brickmaking have already been reviewed but the preference for particular brick sizes and laws relating to the industry have not yet been examined.

The British brick laws and duties are often mentioned when the subject of brickmaking is discussed. The London brick laws did not extend far from the metropolitan area. British brick laws did not extend to Ireland or the British colonies.
Bricks made in Britain which were intended for export were not subject to the duty either.\textsuperscript{118} Despite the above, there was a relevance to British colonies; prescribed brick sizes tended to influence colonial brick sizes. Brickmakers who had worked under the restrictions "at home" continued to make bricks of the same size when in the colonies. Colonial governments looked to the latest laws when confronted with brick related controversies (for example, as a result of the Bigge Reports and the 1830s \textit{Sydney Building Act}.

The London and British Brick Laws

Early regulations referred to roofing tiles, (1477, 1567/1568, 1571 and 1625).\textsuperscript{119} In 1725 a petition was presented to the House of Commons by the "Masters, Wardens, and the Society, or Company, of Freemen of the Art and Mystery of Tilers and Brick Layers, London". They were concerned about the poor quality and "uncertain dimensions" of stock and place bricks which of "late Years" were burned in clamps instead of kilns, jeopardizing the safety of buildings.\textsuperscript{120} An enquiry was ordered by the House\textsuperscript{121} and the results were presented on the 21st March 1725.

The Report to the House of Commons revealed that the opinions, even of the experts varied. The Committee decided that the best size for bricks was $9\times\frac{4}{14}\times\frac{2}{3}$ inches. One of the Committee reported that bricks made generally measured $8\frac{1}{2}\times 4\times \frac{3}{4}$ inches and thought that 9 inches was too long for bricks. The smaller sized, or "middle bricks", had become commonly made within the last 12 years but that several were found to measure below 8 inches in length. The faction promoting the $8\frac{1}{2}\times 4$ or $4\frac{1}{2}\times 2\frac{1}{2}$ expressed their concern that the larger and thicker the brick the more poorly it burned.\textsuperscript{122}

The final decision recommended that the best bricks "for sale" measured $9\times\frac{4}{14}\times\frac{2}{3}$ inches. They also decided that the clay for bricks should be dug and turned over between the 1st of November and February, and that moulding should begin early in March. They wished to restrict the amount of "Spanish", or ash, in the bricks and that the Corporation of Tilers and Bricklayers should be empowered to regulate the brick trade within a 15 mile radius of London.\textsuperscript{123} The Bill received the royal assent on the 24th May 1725.\textsuperscript{124} Amendments and renewals occurred during the years 1769\textsuperscript{125} and 1777.\textsuperscript{126}

On 1st September 1784 a brick duty was imposed for the London area and a minimum size was established for bricks, $8\frac{1}{2}\times 4\times 2\frac{1}{2}$, the duty being three shillings per thousand.\textsuperscript{127} In 1794 the duty was increased to four shillings.\textsuperscript{128} In 1803 the duty was increased to five shillings per thousand for bricks made under $10\times 5\times 3$ inches in Britain.
those exceeding those dimensions were required to pay ten shillings per thousand. Those bricks with smoother or polished sides attracted a rate of twelve shillings per thousand. In 1805 the duty on bricks and tiles was increased by three pence.

According to the Builder in 1843, the upper limit of 10x5x3 referred to green bricks (as they were always counted before burning) and that after burning they would be reduced to 9x4½x2½ "varying according to the material". The London Brick was said to be a fraction less, especially in the length. The upper limit quoted in 1803 appears to have been due to brickmakers making extra large bricks in order to avoid duty. The extra large bricks were doomed to fail, despite the Act, because bricks have practical limitations. Bricks could not be wider than 4½ inches (114mm), otherwise they could not be picked up with one hand for laying; also the length had to be twice the width of the brick or else it could not be bonded properly (for example in the case of English and Flemish bonds); and the weight could not exceed 10 or 12 pounds (4.540kg or 5.448kg), when wet, and should generally have been about half this weight. As a rule, the width was about half the length and the thickness about half the width.

In 1803 "common" and "dressed" bricks were also distinguished for the purpose of imposing extra duty. This effectively stifled any incentive to experiment with new forms or improvements because the bricks were counted before burning and any failure could result in a spectacular loss of money. Moulded bricks became too expensive and "ceased to be made". The famous architects, Wyatt and Nash, decided to use stucco and Roman cement to achieve decorative effects; many architects and builders followed their example.

In 1835, the duty on bricks was raised to five shillings and ten pence, and the duty on dressed bricks was also raised. Protests led to the duty on common bricks to apply to bricks of all kinds in 1839. The general duty was seen as a boon to manufacturers who wished to produce bricks of moulded patterns. Little came of these hopes because moulded bricks were expensive to produce and any failures in experiments still required duty.

Despite the duty, the number of bricks produced increased dramatically between about 1820 and 1850. In 1821, duty was paid on 899,178,510; in 1840 the number had increased to 1,677,811,134; and in 1849 the figure had reached 1,800,000,000, producing a revenue of £600,000. In order to lessen the effect of the duty, brickmakers appear to have made shortcuts in production, diminishing the quality of their bricks. The 1840s saw a great increase of interest in the invention of brickmaking machines. This interest even extended to members of the nobility, such as
the Marquis of Tweeddale, and the Earl of Lovelace. The approach of the Great Exhibition of 1851 may have had an influence on the decision to repeal the duty on bricks. The lead up to the Exhibition stimulated debate and contact, as is reflected by publications of the time. The many patents and reports on hollow and polychromatic bricks in 1851 and the involvement of the Prince Consort seem to suggest that the anti-duty lobby had some success. The final blow to the brick duty came as a result of a meeting between the Board of Health and a deputy of men representing "various philanthropic, architectural and sanitary societies of London" on the 2nd March 1850. It was represented that the necessity of paying duty on spoiled bricks caused them to be used, resulting in unsafe and unhealthy habitations; improvements to hollow bricks were stifled resulting in the continuation of damp and unhealthy homes, hospitals and public buildings; and extensive housing for the poor, etc. It was also noted that the bricks of Hamburg were free of duty and as a consequence were being exported to Britain and British colonies - at a great loss to potential income to Britain. The Board of Health made an immediate recommendation for the removal of the duty.

The Act to repeal the brick duty was passed on 17th May 1850, acting retrospectively from 27th March 1850. Despite the large press received on hollow, moulded, glazed and polychromatic bricks and speculation that even the rectangular nature of the brick would be abandoned, practically nothing had come of it by 1857, though the following decades were to see the expected changes.

References to brick sizes are quite rare for any period, some of the measurements of those mentioned in the various Acts have been presented facing p.17. Often dimensions are quoted in twentieth century secondary sources but in almost every case with little or no foundation can be found for them.

Wilson mentioned that in England the size of bricks were determined by law, "and no man can make bricks larger or smaller than the prescribed dimensions". Despite the fact that this statement was written while the brick laws were still being enforced, it seems to have no foundation. The 1725 Act gave a guideline size which was little more than a recommendation. For the purpose of the duty in 1784 and as a regulating factor for the quality of bricks, a minimum size was given of 8½x4x2½. In 1803, a maximum was given for green bricks (10x5x3) instead of a minimum, to deter people from avoiding duty by making bricks resembling blocks to avoid duty. Wilson, a little further in his account states that the standard London brick measured 8-3/4x4-2/8x2-3/4 which does not coincide with any quoted brick size (including the size required by the London Building Act of 1839, being 8-3/4x4-1/8x2½ and of 1774, being 8-3/4x4x2½ inches). It was acknowledged by every early writer on bricks that
there were two other factors which were involved in determining the size of the brick apart from the mould, namely, the type of clay or clay mix used and the various temperatures within a kiln or clamp. It would be impossible for the law to insist on a standard size after firing.

Measurements quoted after the abolition of the brick duty also tend to dispel any idea of a standard size.

Tomlinson, in 1851, wrote that English bricks were "commonly of one form", 9x4½x2½ inches. This size probably represents an average size of the 1840s and before. An account published three years later advised that moulds for bricks should be 10x5x3½ inches. Note that the width is exactly half the length. In 1858 brickmakers from Birmingham and the Midlands came together to agree on a uniform size for bricks. It had been noted that some bricks produced in the area measured as much as 9-5/8x4-3/4x3½ inches; they decided to "restrict" brick sizes to 9x4½x3 inches. Twenty principal brickmakers resolved to "firmly carry out the principle of making only one uniform size of brick", which seems to suggest that the word "restrict" was meant to denote an absolute size. The depth of three inches for the Midlands size was the thickest published "regulation" size to that time and nears the later "Hoffman" size. One source stated that the minimum size of a brick should be 8-7/8x4-5/16x2-5/8 inches and the maximum size should be 9x4-7/8x2-11/16 inches. Knight, who published in 1878 wrote that the English "regulation" size was 8½x4x2½ inches.

Brick sizes also differed in various localities. As seen above, the Midlands made attempts to standardize their brick sizes. The Hull brick measured 9x4-3/8-2-11/16. Winser noted that the traditional brick of the north of England was 3 inches thick, whilst that of the south tended to 2-5/8 inches.

As can be seen, there really was no absolute traditional or regulation size in either time or place. A regulation size would have been impossible to impose on hand moulded, clamp or Scotch kiln fired bricks anyway. Accounts of brick sizes should be viewed with caution, for example in one yearly publication, the same list was published year after year from 1894 to at least 1926 (for example, London stocks 8-3/4x4½x2-3/4 inches).

One general trend, however, does emerge: stock bricks during the eighteenth century tended to be thinner in width and depth than those of the latter half of the nineteenth century. By 1851, the general size had only increased marginally from those of the century before. The source material after 1851 provides us with a broader picture and suggests a much more complex situation for the first half of the nineteenth
century. Measurements taken of dated buildings covering the late eighteenth century and the early nineteenth century in New South Wales reveal just such a complex picture. If a similar survey was made in Britain, a similar picture might emerge. Accurate surveys of building materials were made in Britain for the benefit of architects, builders and engineers, one account was published in 1937. Specification listed 165 brick types made, each with one to four sizes of brick depths, a large percentage being traditional stocks. One sand faced facing brick from Flintshire was made in the following thicknesses; 2, 2 1/4, 2 3/8, 2 5/8 and 2 7/8 inches.

Stock brick developments in England after the 1870s are irrelevant to developments in the Sydney region and Australia in general. The last major impact on brickmakers which may have modernized aspects of the Antipodean traditions probably occurred during the 1850s with the great influx of immigrants and new ideas. The introduction of fully mechanized brick production in the Sydney region virtually wiped out the traditional yards within a decade after the initial introduction. This complete transformation was largely due to the availability of money during the boom years of the 1880s and the almost universal use of stucco, which of course hid the brickwork. The introduction of the "Queen Anne" style, by the late 1880s and very popular during the 1890s, did not stimulate traditional brickmaking methods, (unlike Britain's William Morris "Arts and Crafts" school and "Queen Anne" revivals). Instead, efforts were concentrated on producing good quality facing bricks by patent brickmaking and firing processes as well as double pressing.

Stock Brick Weights

Brick weights were also governed by practical considerations, the ideal weight for easy bricklaying was considered to be between five and six pounds. Knight suggested a weight of about seven pounds or a little less. Various factors, of course, varied the weight of a brick, such as size, ingredients and even the method of moulding. The slop moulding process was supposed to increase the weight of a brick by one pound.

Machine made bricks were heavier as they were slightly larger and the ingredients were compressed to a greater extent than those made by hand. The average weight of these bricks were around 7 1/2 pounds.
Frogs

Frogs are indentations, or depressions, on one of the broad sides of a brick. In England they were being produced from about 1690 onwards and the earliest were formed by scooping out a slot with a finger. The common method of forming a frog was to attach a rectangular piece of wood called a "kick" to the stock board. The frog is always found on the opposite side to the scrape marks made by the striker (as this is done over the top of the mould, the kick up of the stock board being at the base). Cox noted that in England during the later eighteenth century, frogs were usually about one inch wide and four to five inches long; but by the early nineteenth century they had become broader and longer, sometimes with rounded corners, measuring approximately six inches in length, two and a half inches in width and a half to one inch in depth.

The purpose of the frog was chiefly to form a key for the mortar, but it also made the brick lighter, making it easier to handle and lay. Some writers believed that the creation of a frog hardened the core of the brick, counteracted a tendency to swell and secured the horizontal line of the edges. The frog probably assisted in better overall burning as well. The advantages or otherwise of the frog were still being debated during the 1920s.

The frog was not a constant feature after the 1690s. Tomlinson wrote during the mid-nineteenth century that, "It is very common at the present time to make bricks with a hollow underneath". In New South Wales they are almost non-existent before the 1830s but are common from the 1850s onwards. Frog marks in New South Wales come in a myriad of shapes, rectangles, ovals, circles, hearts, diamonds, spades, clubs, miniature footprints, heel shapes etc., in all variations, sizes and even multiple forms. The various shapes appear to have been required when several brickmakers were using a communal kiln or clamp to permit proper tallying after burning.

Machine made bricks' frogs are almost invariably rectangular with sharp arises, though wire cut bricks do not have frogs.

### Brick Impressions

Impressions, such as the name or initials of a brickmaker, were sometimes included on bricks. Sometimes the initials or name of a property or a property owner were marked on bricks to avoid theft. These impressions were placed on a broadside of the brick, most often in a fixed position (the letters being fixed on the stock board or

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**Summary of Brick Sizes mentioned in the Text**

<table>
<thead>
<tr>
<th>Year</th>
<th>Origin</th>
<th>Size - inches</th>
<th>Size - millimetres</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 1725 | (London) | under 8 x 4 1/2 x 2 1/2 | (230.2 x 114.3 x 63.5) | "some found"
| 1725 | (London) | under 8 x 4 1/2 x 2 1/2 | (230.2 x 114.3 x 63.5) | "generally"
| 1725 | (London) | 8 x 4 1/2 x 2 1/2 | (203.2 x 101.6 x 63.5) | "generally"
| 1725 | (London) | 8 x 4 1/2 x 2 1/2 | (203.2 x 101.6 x 63.5) | "a recommendation"
| 1725 | (London) | 8 x 4 1/2 x 2 1/2 | (203.2 x 101.6 x 63.5) | "a recommendation"
| 1725 | (London) | 8 x 4 1/2 x 2 1/2 | (203.2 x 101.6 x 63.5) | Recommend "the best"
| 1739 | (London) | 8 x 3/4 x 4 1/2 x 2 1/2 | (223.2 x 101.6 x 63.5) | "minimum"
| 1774 | (London) | 8 x 3/4 x 4 1/2 x 2 1/2 | (223.2 x 101.6 x 63.5) | "minimum"
| 1784 | (London) | 8 x 3/4 x 4 1/2 x 2 1/2 | (223.2 x 101.6 x 63.5) | "minimum"
| 1803 | (London) | 9 x 4 x 1/2 x 2 1/2 | (254 x 127 x 76.2) | green brick after burning |
| 1803 | (London) | 10 x 5 x 3 | (254 x 127 x 76.2) | (used same source?)
| 1803 | (London) | 10 x 5 x 3 | (254 x 127 x 76.2) | |
| 1843 | (London) | 9 x 4 1/2 x 2 1/2 | (223.2 x 120.7 x 69.9) | "commonly"
| 1847 | (London) | 9 x 4 1/2 x 2 1/2 | (223.2 x 120.7 x 69.9) | "mould", i.e. green brick |
| 1848 | (London) | 9 x 4 1/2 x 2 1/2 | (223.2 x 120.7 x 69.9) | "agreed size"
| 1848 | (London) | 9 x 4 1/2 x 2 1/2 | (223.2 x 120.7 x 69.9) | "some found"
| 1853 | (England) | 9 x 4 1/2 x 2 1/2 | (223.2 x 120.7 x 69.9) | "agreed size"
| 1854 | (England) | 10 x 5 x 3 | (223.2 x 120.7 x 69.9) | "some found"
| 1858 | (Australia) | 9 x 4 1/2 x 3 | (223.2 x 120.7 x 69.9) | "some found"
| 1859 | (Australia) | 9 x 4 1/2 x 3 | (223.2 x 120.7 x 69.9) | "some found"
| 1861 | (London/England) | 9 x 4 1/2 x 3 | (223.2 x 120.7 x 69.9) | "some found"
| 1878 | (English) | 8 x 1 1/2 x 2 1/2 | (223.2 x 101.6 x 69.9) | "some found"
| 1881 | (London) | 8 x 3/4 x 4 1/4 x 2 1/2 | (223.2 x 101.6 x 69.9) | "some found"
| 1894-1926 | (London) | 8 x 3/4 x 4 1/4 x 2 1/2 | (223.2 x 101.6 x 69.9) | "some found"

Source:
(a) unless footnoted
(b) Builder, 1847, p.500ff
(c) Building News, 02/02/1861, pp.297-299 (converted to nearest fractions)
(d) ibid., p.299

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kick of the stockboard), but were sometimes stamped on after moulding which resulted in a varying position from brick to brick.

In New South Wales and Tasmania during the 1820s and 1840s, government bricks were sometimes marked with the “king’s broad arrow” to discourage theft. The arrow varied a great deal but was most often in a fixed position. The broad arrow does not necessarily indicate that a brick was made by convicts, as contracts were sometimes let to private brickmakers.

Thumb or finger depressions are occasionally found on bricks, these are mostly the result of careless handling. Only in rare cases were finger or thumb impressions used as tally marks, probably to mark every one hundred bricks. The impressions should have a deliberate appearance, usually seen in rows on a stretcher, side of a brick.179

Initials and names are often useful in dating if the history of a brickmaker, factory, landowner etc., is known. Machine made bricks in later years were sometimes advertised along with details of their particular names or initials, especially in the case of fire bricks.180

Accidental impressions were also sometimes left on bricks, and may reveal aspects of the brickmaking process, as in the case of impressions left by stacking the bricks in the forks, uneven burning marks left by stacking or position in the kiln or clamp. Some bricks may accidentally record something of the flora and fauna of the area, for example; impressions left by stacking on the ground, leaving the outlines of plants; footprints of animals etc. Some idea of the weather when the brick was formed may also sometimes be gleaned when, for example, rain drop impressions are found.

Brick Colour and Appearance

Iron oxide found in most clays renders the traditionally made stock bricks a reddish colour. Impurities, or the inclusion of certain minerals and organic material may modify the colour of the brick. The Scotch, updraught, kiln and still more the clamp, produced a great variety of colours ranging from light to deep reds to glazed bluish purple colours. The colours in this instance depended on the position of the brick in the kiln, or actually the degree of heat at which brick was fired. The colours could be modified by intensity or length of firing but this was a risky business as the whole batch of bricks could be rendered useless by over or underfiring. However, between the years of the brick tax, 1784 and 1850, very little experimentation occurred
30. Mostly extruded or double press bricks, 1880s-c.1900 (Warwick Gemmell Collection).


32-34. 1820s-1840s County of Cumberland bricks. The first and the third bricks of 33 are of a later period (Warwick Gemmell Collection).
because any failure in the kiln was a loss of finance, the brickmaker was required to pay duty on every brick loaded into the kiln before firing.\textsuperscript{182}

The clays used up to the early nineteenth century could not be exploited to their full potential in colour because of the relatively "crude" methods of firing.\textsuperscript{183} As in New South Wales, the old firing method produced varieties of red and purple-blue vitrified bricks. Timber tended to be the main fuel used in eighteenth century England but in Sydney and New South Wales it was almost universal until the 1850s (and in country areas up to the 1940s or 1950s). The use of timber as fuel tended to produce a high percentage of vitrified bricks, possibly because of the intensity of the fire in the flues and because of the production of potash in the burning.\textsuperscript{184} If special hues were required for a building, the bricks would have to be especially selected at the kiln. The switch to coal in nineteenth century Britain and large urban areas in Australia reduced the incidence of vitrified bricks.\textsuperscript{185} Thus the only colours available in eighteenth century England were reds and purples, though a yellow brick had been developed in the London area toward the end of the century.\textsuperscript{186} In Sydney reds and purples would have been the prime colours up to the Macquarie period, some bricks during and after this period were spotted by the inclusion of some organic material and purples became very rare. Between the 1850s and 1870s some bricks tended to have been burned with a very high organic inclusion. White bricks began to be made by the 1870s. The introduction of patent kilns for common bricks had a bleaching result on the brick clay, but careful firing and control of air in a patent kiln could enhance the potential of the clay with calculated inclusions of special clays and minerals.

In England, Robert Salmon in 1807 experimented with clay and sand proportions. The increasing proportions of sand above a proportion of one measure of sand to two or three of clay produced soft bricks or poor colour.\textsuperscript{187} British brickmakers had a greater variety of clays and fuels than had brickmakers of the Sydney area. One authority who wrote in 1845, mentioned that bricks were made of, "clay, marl, and loam, in all their variety, with the different admixture of breeze, chalk, small coke, etc."\textsuperscript{188} Clay there was basically silica and alumina with a small quantity of lime and "occasionally a magnesia and alkali". In colour the clays were red, yellow, blue, greenish blue, or mottled. Some clays were light, loose and sandy but frequently "heavy and greasy". Too much silica, or sand, could cause fusing and running when being fired but sand was needed to hold the particles of clay together. Chalk was added to sandy clay as a "dry substance" to take up the fusing silica and very little breeze, or cinders\textsuperscript{189} was needed as the particles of such a brick easily transmitted the heat of the kiln. "Malm", or "marl" bricks were made from a light clay with a natural proportion of limestone (or chalk)\textsuperscript{190} but sand and breeze needed to be added; the sulphur produced
from the breeze combined with the alumina to brighten the colour to an off-white. A mistake made in the proportions of any of the above materials could result in a useless product. As the 1845 writer explained, the above principles, at that time, were poorly understood and the want of proper mixing or puddling, resulted in very imperfect bricks. It must be said that the excessive brick duty allowed the ordinary brickmaker few chances to experiment or spend too much time on any part of the brickmaking process.

The late 1840s was a period of experimentation on a modest scale which led to mechanically controlled production resulting in the use of polychromatic brickwork from the late 1850s. Polychromatic brick work began to be seen during the 1870s in Sydney but was developed to a high degree in Melbourne between the 1870s and 1890s. The initial experiments took place with the manually produced brick but the bulk of the development of polychromatic brickwork in Australia relied on the development of machinery and special kilns.

Machine Made Bricks

Machinery made an enormous impact on brick production in Sydney during the 1880s, virtually wiping out the manual process within a decade. In Britain the introduction of machinery began at an earlier date but it did not displace the manual process suddenly, as in urban Australia. There were many traditional brickyards in urban British areas well into the 1930s and 1940s. Despite the prominence given to the various machines, some contemporary writers were unaware that machinery had been applied to brickmaking in the mid-1850s. By 1874 Spon was pessimistic, stating that few are at present at work.

A complete study of brickmaking machines deserves the space of a large volume to deal with the subject adequately. As this study pertains to objects used in building, the exact method of production is important only to the extent that the method employed affects the end product. In the production of nails, it is important because these changed regularly over a long period of time, affecting the product at every change. With the production of bricks, there were about three or four basic types of machine principles, each of which produced an instantly recognizable object. The brick machines were so basic in facility and purpose that some machines remained in production for over seventy years in some instances. Once the machine process is known, the only other factors which need to be known are the brick moulds used and the manner in which the bricks were fired. Almost nothing was recorded about the all important machine brick moulds which needed to be replaced regularly and could be
modified to include makers' names etc. Most machines were so versatile that they could be provided with moulds producing any shape and size of brick and some machines could be converted to making pavers, floor and roofing tiles by simply changing the mould.197

The earliest mechanical contrivance connected with brickwork were pug mills and by 1840 was the most common machine in use.198 Later rollers, grinding pans and toothed rollers were used.199

Very little is known of the early patents. One of the earliest which was not simply a press in which hand moulded bricks were re-pressed, was the Lyne and Stainford patent of 1825. This patent milled the clay and five moulds pressed out bricks, the machine was powered by a horse treading a circular path much like the horse-powered pug mills.200 It is unlikely that this patent was ever a practical success but later machines were to develop the principle of pugging and brickmaking in one machine. However, machines of the 1820s and 1830s were little more than mechanized moulds.201 By the end of the 1830s the first practical machines were being developed which were to have a consequence. The early successful machines were based on the extrusion principle and there is a strong indication that these machines were rather a consequence of the development of the tile, or drain tile, machines. Drain tiles and bricks were exempt from duty, so there was an extra incentive for producing these machines. There was also a great interest in draining swamps from the 1820s to the 1850s. Practical books, such as Low's Elements of Practical Agriculture, illustrated the type of tile most favoured which was a tile in the shape of a long barrel vaulted arch, a flat tile formed the base when laid. Low illustrated a machine by John Ainslie which produced such tiles ready-made without further modification.202 This Ainslie machine had a pug mill and a set of rollers to process the clay ready for moulding.203 Low mentioned in the 5th edition (1847) that the machine had been patented and had been "lately much simplified".204 Earlier machines, such as Robert Beart's of 1833 or before, extruded slabs which were then given the barrel vault shape manually on a "horse". A number of brickyards and private individuals were using the Beart machines by the early 1840s. The Marquis of Tweeddale had advertised his patent tile machine by 1839 which, like the probably later Ainslie patent, was able to produce the barrel vault shaped tile without further manual manipulation.205 The early Tweeddale machines required a yoked beast or machine but by 1843 a model was simplified so as to allow it to be portable and to be operated by a labourer revolving a crank.206 The machine by this time was claimed to be the only machine which could form "a complete draining tile in one operation".207 The Tweeddale Patent Drain Tile and Brick Company
announced in 1843 that their attention had been drawn "to the great importance of extending it [the drain tile machine] to the making of bricks".208

Tweeddale simply converted the principle of the basic drain tile machine, working on the extrusion principle, to form bricks. Earlier patents were unsuccessful because they had concentrated on mechanical moulds: "All previous attempts to manufacture bricks by machinery have failed, because it has always been thought necessary to use moulds for the formation of the article".209

Extrusion Wire Cut Brickmaking Machinery

The clay was extruded out of the Tweeddale machine, like toothpaste emerging out of a tube, the length and breadth of a brick but like a long slab. The slab was converted into green bricks, "being cut off quite clean by a very ingenious arrangement, and received on palate boards".210 This was not quite the wire cut method as generally known as each brick seems to have been "cut off" individually, judging by the appearance of the machine. One of the first, or perhaps the first wire cutting brick machines, using a wire frame was demonstrated by a William Erving in 1841 but some clays were too resistant to the wires which led to some initial strife.211

Successful long term patents for extrusion machines producing wire cuts were Henry Clayton & Co. (making large machines); B. Page and Co. (specializing at first in hand operated easily portable machines); Sharp and Bulmer; Chamberlain, Ainslie, Clayton and Hunt.212

Henry Clayton, who was a "plumber and machinist", was granted a patent, "for improvements in the manufacture of tiles, drain pipes, or tubes and bricks" on the 30th March 1844.214 This was an improvement to an extrusion machine and probably a precursor of the large crushing, pug milling, brick cutting etc., "at one operation" machine famous from the 1850s to the 1870s. Clayton had established his Atlas Works at Harrow Road London by the latter half of the 1840s.215 At least one of Clayton's Atlas Works machines was on display at the Great Exhibition of 1851, which won a prize. An illustration of one of his 'Brick, Tile and Pipe Machines' was published in the Exhibition's catalogue with details of improvements made in screening clay.216 The machine was hand operated and portable and extremely simple but could manufacture all kinds of drainage pipes and tiles, roofing and paving tiles, and hollow and solid bricks. An advertisement of 1857 mentioned that Clayton's brick, tile and pipe machines could be operated by steam, water, horse or hand power.217 By 1851, "Clayton's Prize Brick and Tile Machine" could also make "bonded hollow bricks"218 as
36A. Hunt's tile machine (Ure, 1853, fig.208).

36B. Hunt's brick machine (Ure, 1853, fig.207).

37. Clayton's early invention (Great Exhibition Report [1851], vol.1, p.360).

H. Clayton, Son and Howlett brickmaking, pugging and crushing machine (Spon, 187 fig.1304).
40. Henry Clayton & Co., wet-clay brick-making machine (Clark, 1862, fig.232).

41. Clayton and Howlett (Spon, 1874, fig.1320).

42. Clayton, Son and Howlett, "brick cutting and self delivery table" (Spon, 1874, figs 1328 and 1329).

43. Plan and elevation. Clayton and Son vertical pugging and moulding machine "two process machine" (Spon, 1874, figs 1328 and 1329).
44. H. Clayton & Co. "Improved Archimedian Knife" mill (Spon, 1874, fig. 1323).

45A-45B. Sections (Clark, 1862, figs. 233 and 234).

46. (Clark, 1862, fig. 235).

47. Clayton's clay crushing mill (Spon, 1874, fig. 1327).

48. (Spon, 1874, fig. 1326).
used in the Model Houses for Prince Albert.\textsuperscript{219} Chevalier and Co. and Mortier, Courtois & Co. purchased hollow brick machines by Clayton at the French Exhibition of 1855.\textsuperscript{220} By 1866, they were advertising "Clayton's Patent Improved 'Universal' Machines", which machines had been judged the best brickmaking machines in the Exhibition of 1862. The machines were offered in "many sizes" to work by steam, water, animal as hand power combining crushing, pugging and moulding in the one machine.\textsuperscript{221} Evidently their machines had won wide acclaim and even Government patronage as it was claimed that the machines were, "used by all Principal Railway Constructions, Brick Manufactures and on Government Works at Home or Abroad".\textsuperscript{222} Henry Clayton around 1863/1862 patented a "close drying house" for drying bricks in hacks,\textsuperscript{223} showing that Clayton was also interested in improving the accessories of brickmaking.

By early 1873, Clayton's were offering illustrated catalogues with prices free by post. The range of products had expanded considerably, they offered:

- . . . tile and pipe machines;\textsuperscript{224} socket, or sanitary pipe machines; pugging and crushing machines;\textsuperscript{225} brick and tile presses;\textsuperscript{226} edge runner mills; iron works for kilns, sheds, etc; contractors' plants; mortar and loam kilns; granulating and washing mills;\textsuperscript{227} oil mill machinery; wood sawing machinery; sugar machinery; machines for preparing and moulding small coal; portable and stationary steam engines, etc.\textsuperscript{227}

Clayton's had won prizes at the following "Universal Exhibitions", 1851, 1855, 1862, 1867 and 1871. Spon's \textit{Dictionary of Engineering} of 1874,\textsuperscript{229} section on brick machines, reads like a catalogue of Clayton's machines. The Clayton machine may easily be recognized as it was most commonly, whether large or small, a wire cutting brick machine - the overall design of which changed very little. It is suspected that the mould machines and dry press brick machines, by the 1880s, had gained immense ground through gradual improvement: they had the advantage of compressing brick clay with the inclusion of frogs, which the Clayton's machine could not do and importantly had dry and stiff processes which dried the bricks faster.

Clayton's did export to the Australian colonies, four of their hand lever presses (for re-pressing wire cut bricks) were operating at Petrie & Sons at Brisbane in 1887\textsuperscript{230} and a tile and brickmaking machine (wire cutting) by 1882, at Ewbank's at Lithgow.\textsuperscript{231} In fact many yards had wire cut brick machines as part of the process to make double-pressed facing bricks; these were considered so ordinary after the 1870s that they rarely rate a mention as to the patent. One of these type machines was operating in the outskirts of Mudgee as late as the early 1970s.\textsuperscript{232} Clayton's seem to fade out during the 1880s; they are not listed in the British, Brady Official Post Office Directory with the other "Brick and Tile Making Machine Manufacturers" of 1887.\textsuperscript{233}
As an indication of the changing times, Clayton's brought out a double brick "semi dry" process machine by 1881 but they may have been years too late.234

John Ainslie's machines were known by the 1880s as "one of the earliest forms", at least in pipe making machinery, using the extrusion-wire method. Ainslie appears to have started his working life as a farmer,235 but like many farmers, he had a keen interest in tile and brickmaking in the 1840s.236 He patented a kiln with chambers in 1846 where the heat of one chamber would be passed on to the next, and so on.237 This principle was taken up later in the century by others. By 1846 he was classified as a "Brick and Tile Manufacturer" of Middlesex and patented improvements in brick machinery.

Although Ainslie's machines had a low profile, his machines, mainly for pipe making, were recommended by such agricultural authorities as Low (in 1847).238 The machines were so basic that they were not prize winners at the various exhibitions, though they are mentioned by authorities as late as the 1880s. Illustrations suggest that they had been little modified since the 1840s.239 However, large early works such as Thomas Cubitt's at Durham of the 1850s were able to boast that they had 17 Ainslie brick and tile machines "as improved by Cubitt".240

Humphrey Chamberlain of Kempsey, Worcester, became known during the mid 1840s for his experiments in using waste kiln heat for drying bricks.241 In 1846 he built a drying kiln for Hand's works at Epsom.242

Late in 1855 or early 1856 Chamberlain patented a brick and tile machine on the extrusion principle, the bricks were cut by a wire as the slab emerged, the angle of the wire compensated for the movement of the slab. The clay was very stiff and required little drying as no water was added to the clay.243 The same machine was illustrated again in Ure's of 1860 and 1878, it was mentioned that by changing the mouth piece, or "die", one could make hollow and perforated bricks.244 The Chamberlain machine must have retained its design status up to the late 1870s because the illustration of it was also published by Knight in 1878.245 Chamberlain was the agent for Clayton's by the late 1850s246 and Chamberlain's hand brick presses were sold by Clayton's up to the 1880s.247

After the 1880s neither the Ainslie or Chamberlain machines are given much prominence. The emphasis appears to have shifted from wire cut machines, except as needed for double pressed facing bricks.
Little is known of Edward Page and Co., Victoria Ironworks, of Bedford and Sharp and Bulman of Middlesboro, except that their machines received attention at the 1862 Exhibition. These companies produced mostly small machines powered by hand, though the larger machines could be operated by animal power on steam. Page & Co. were still in business by the late 1880s by which time they were still able to offer "new" lines in pipe and tile machines for horse or steam power. Their later promotions reveal that they had developed larger machines which crushed and pugged the clay and moulded bricks in one operation. All these machines used wire cutting frames, as were used in many of the small or remote brickyards well into the twentieth century in both Britain and Australia. There were many other patent machines producing wire cuts but references are isolated. Some large companies such as Fawcett's produced wire cut machines, mainly as a side line.

"Wire cuts", unless they have been re-pressed, are easily identifiable. As the bricks are not pressed in a mould they do not have frogs; drag marks may be found on both of the broad sides of wire cuts instead of one side as in hand moulded bricks. Some bricks, depending on the type of wire frame, may show drag marks at an angle to the rectangular lines of a brick (Clayton, Page, Sharp and Bulmer etc.), whilst others will invariably show drag marks running parallel to the length of a brick. In the U.S.A. many machines severed the bricks from the stream of clay, end to end, or at the header sides of the brick.

For double pressed facing bricks, wire cuts were often placed in a hand or mechanized press for extra compression and for a smooth surface and sharp arrises.

Soft and Stiff Clay Moulding Machines

This process involved a mould where clay was poured and stamped into it. In some cases plungers applied great pressure to the top of the mould and in the more advanced machines pressure was applied to both the top and bottom of a mould.

As mentioned earlier, this class of machine was the first to be developed. The first machines were merely mechanized moulds where the clay was poured into a series of moulds. In the 1825 patent of Lyne and Stainford, a series of five plungers moderately compressed the clay once poured into the moulds. Drying these early high moisture content bricks appears to have cancelled out the advantages of mechanical production.
Maintaining these machines was also a problem. The problem of drying had been partially solved by the borrowing of the extrusion technique used for making drain tiles, pipes and roofing tiles and applying the principle to brickmaking. By necessity, the extrusion machines needed very stiff clay or the extruded tiles and pipes would "melt" or lose shape as they emerged from the die opening of the machine. The early successes led to the predominance of extrusion wire cut brick machines, during the 1840s and 1850s. It had been recognized in 1843 that attempts at mechanizing the brickmaking process had failed because inventors had been restricting themselves to the mould techniques. There was little doubt about the success of the wire cut brick but its limitations were soon apparent as they required to be repressed for use as facing bricks. Although several patents, such as the Chamberlain patent, could be made to produce hollow and perforated bricks by inserting centre pieces into the die opening, they could not produce finished moulded bricks of various designs (which were becoming so popular from about the time of the Great Exhibition of 1851).

Lyne and Stainford's 1825 patent must have sustained interest in the moulding process as it appeared in all of Ure's editions from 1853 to 1878. As with the later patent of Edward Jones, the clay descended into a series of moulds but had the advantage of having a series of plungers to compact the clay. The theoretical result of the Lyne and Stainford patent was that the compression resulted in a strong, well-compacted, heavier and well formed brick. It was these qualities which were desired but with a reduction in drying time (which had resulted in great losses before stiff clay could be managed by improving grinding and puddling techniques). Richard Prosser by 1851 had invented a machine on the heavy pressure dry press principle.

By 1853 Whalley and Lightoller had a patent which combined a pug mill, pressing cylinder, screens and die plate. There were several other patents which moulded bricks but the most successful of these was that of R. Bradley, later known as Bradley and Craven.

**Bradley and Craven**

R. Bradley and Company of Wakefield, exhibited a brickmaking machine in the Great Exhibition of 1851 which could mould bricks "of various sizes and shapes." Although interest in hollow, perforated and variously shaped bricks had begun in earnest during the late 1840s, it was not until the repeal of the brick tax in 1850 that brickmakers could afford to experiment with the manufacture of special bricks. The
fashion by 1851 was to exploit all the variations toward a richer architectural effect or to improve moisture control and ventilation in brickwork.

Brickmaking machines of the 1850s were almost invariably of the extrusion wire cut type. The bricks that these machines produced were very similar morphologically but hollow or perforated bricks could be produced by adding accessories to the die or mouthpiece of the machine. Bricks for engineering purposes were in high demand but it was found that the wire cut machines were not able to produce bricks from heavy or dense clays. By about the mid-1850s Bradley had formed a partnership and from that time Bradley and Craven were to become a name well known in brickmaking circles throughout the world.

Bradley and Craven's first great success was developed by 1856 when they won a silver medal from the Yorkshire Agricultural Society. The machine had a vertical pug mill where heavy to light clays could be thoroughly tempered and mixed, the clay was forcibly pressed into moulds arranged in a circular revolving table, piston rods forced the bricks upwards out of their moulds. Depending on the clay and horse power, the machine could produce between 12,000 and 18,000 per day. The chief advantage, though, was that it could process clays which otherwise could only be worked by the manual process. By the late 1850s it was largely employed in the manufacture of fire and "metallic" bricks which could not be done with machines of the wire process. It was claimed that the stiff clay used could reduce the brick drying time by a half. Where the wire process machine required a soft clay mix to pass through the die, the Bradley and Craven could use the stiffest, "toughest" clay and even clay mixed with breeze, ashes etc. The machine could also produce perforated bricks at a small extra cost of purchasing special moulds.

One of these machines at least had been sent to Australia before 1859 but also to India, Ceylon, South Africa, Russia and Holland. The machine was illustrated in Ure's Cyclopaedia between 1860 and 1878 and also Knight's (USA), publication of 1878.

A development of the above machine led to the creation of the "Dry-clay Brick-making Machine" which was displayed at the 1862 International Exhibition. With variations, this machine was the prototype of the great Bradley and Craven machines used all over the world by the last two decades of the nineteenth century and the first half of the twentieth century. The machine processed clay direct from the clay quarry without the admixture of water and after pulverization was delivered into a pair of moulds, part of a series of pairs of moulds arranged on a revolving circular table, the clay was then subjected to strong pressure by the work of pistons. Larger versions were
55. Messrs Sharp and Bulmer (Clark, 1862, fig.259).

56. John Whitehead and Co. (Bourry, p.117).

available which could impart pressure on both the top and bottom of the brick, compacting the brick throughout.\textsuperscript{269}

Publications brought to the attention of engineers the virtues of the Bradley and Craven machines which could, it was stressed, operate on either plastic or dry clay. The simplicity of parts and the strength of the machine were considered to be the main characteristics of the machine,\textsuperscript{270} which were great advantages because breakdowns were common in brickmaking machines of the nineteenth century and complicated machines were sometimes abandoned if they became too troublesome.\textsuperscript{271}

Like Clayton, Bradley and Craven produced accessories for the brickmaking trade. One of their "Clay Crushing Roller and Breaker" machines was displayed at the Centennial Exhibition (Melbourne), 1888. They produced a range of these crushers so that difficult or stoney clays could be reduced to make homogeneous brick clay.\textsuperscript{272}

The main stiff plastic/"dry clay" machines were numbered from one to three by the 1870s. Without further information, little can be said of these machines. All the machines were variations of the last mentioned machine which appeared in Clark's catalogue of machinery displayed in the International Exhibition of 1862. The circular revolving table with the series of depressed moulds principle dated back to the 1856 prize winning machine, except that the moulds were arranged vertically in relation to the centre point instead of lengthways along the perimeter. The 1862 machine had a main gear in the centre, requiring a strong frame over the machine. By 1869 the modern type, familiar in later illustrations and surviving examples, had been developed as seen in their "No.1" and "No.2" machines.\textsuperscript{273}

Judging by general descriptions and some surviving illustrations from a Bradley and Craven catalogue,\textsuperscript{274} the following may be deduced: The No.1 machine was a "single brick", or "brickmaking and pressing" machine which removed and pressed one brick at a time from the revolving table which had a series of single mould boxes. This machine was used for the "best class of pressed facing bricks.\textsuperscript{275} It appears that this machine and Nos 2 and 3 were sometimes accompanied by steam or hand presses for the very best facing and ornamental bricks.\textsuperscript{276} As Bradley and Craven had had a long association with Humphrey Chamberlain (agent and brick machine inventor of Kempsey, Worcester), Chamberlain's brick presses were often associated with Bradley and Craven's\textsuperscript{277} machines. One of Bradley and Craven’s "plastic brickmaking" machines and a Chamberlain brick press were sent out to "Lloyd Taylor [sic] Esq., Australia" in 1878.\textsuperscript{278} In all other respects the No.1 machine resembled the No.2 machine. A No.1 was displayed at the Adelaide Exhibition of 1887.
61. Patent Brickmaking Machine of Messrs Bradley and Craven received a Silver Medal in 1856 and appeared in H. Chamberlain Catalogue of 1859, p.20. This machine was the first known to be sent to "Australia" before 1859. The design was published as late as 1879 (Ure, 1860, fig.280).

62. Dry clay machine still using the round table of the 1856 machine (Clark, 1862, fig.24).

63. A later version of the above machine taken from an undated Bradley and Craven Catalog (p.86, possibly 1880a).
The No.2 "double brick" machine, or press, produced two bricks at a time from a circular revolving table containing 12 double moulds. In 1878 a No.2 machine was despatched to "Lloyd CR" Australia.

The No.3 machine, or "brickmoulding and pressing machine", produced two bricks at a time as the No.2 machine but the arrangement of the main gearing was different. This model may have been earlier than the No.1 and No.2 models. A report on Bradley and Craven's own works in 1890 mentioned that a No.3 had been at work for "upwards of 25 years", so the model appears to date to at least the mid-1860s. The No.3 was gradually phased out during the 1880s and the last recorded machine was made in 1889. A No.3 brick machine was displayed at the Melbourne Exhibition in 1888, along with a "seven foot" Mill.

The No.3 in basic outline and general principle appears to date, in type, to the early 1860s and was probably displayed in the 1862 International Exhibition, one was installed at Bradley and Craven's own brickworks at their "Roundwood Brick Works, Wakefield" around 1865. It is strongly suspected that the No.1 and No.2 machines were developed in principle and basic outline by the close of the 1860s. These two models were also at work by 1890 in the Roundwood Brick Works. At the Works, a shale (as became the case in Sydney from the 1880s to the present time) was used as clay and a Hoffman kiln was used to burn the bricks, the kiln had been burning continuously since about 1865. John Craven and two others were associated with Hoffman in the patent for the kiln. The brickworks of Bradley and Craven were a prototype for many set up throughout Australia.

Bradley and Craven, now Craven Fawcett Group Limited, have had representatives or agents in Australia since the Adelaide Exhibition of 1887 to the present day. The first representative was James Horsley Craven, son of the founder, John Craven. James H. Craven settled in Australia, selling new and secondhand brickmaking machinery until his death in 1935. The business was purchased by G.M. Seward Pty Ltd, Seward's eventually became the agents for Thomas C.Fawcett. Fawcett and Craven amalgamated in 1972, thus bringing the descendant of the original Bradley and Craven agency back under the wing of Craven's.

Bradley and Craven's machines were sent all over Australia. The earliest was sent out before 1859 which was of the type first publicly displayed in 1856 and illustrated in 1859. The bulk of their machines were sent out after 1878.

A semi-plastic Bradley and Craven machine was set up at the Gore Hill Brickworks by 1891 but it seems that Platt's dry press machines were more popular.
for Sydney's clays and shales. Two "semi-plastics" were operating at the Albion Pottery Works, Queensland. Two No.1 machines and two "7-feet", or "7-feet 6-inches", Mills were sent to the Queensport Brick Company in 1888, one of the mills had been bought by Hudson's Dinsmore Pottery Company around 1917 and was still in use in 1967. The machines were popular at the major brickworks in Melbourne. By 1888 the Box Hill Brickworks had one Bradley and Craven and two machines on the Bradley and Craven principle made at Langlands Foundry, Melbourne, perhaps under licence. The Northcote Brick Company and South Brunswick Brick Company both had Bradley and Craven type machines by 1886 as "improved" by Langlands. Partridge does not mention Bradley and Craven in his 1920s list of brick machines used in Sydney, so it appears that the dry press and wire cut machines were most favoured.

Thomas Fawcett

Very little has been recorded of Thomas Fawcett's brickmaking machines. The absence of references to their brickmaking machines before the 1880s seems to indicate that this line of machine was a late development in the company (which produced a fairly extensive range of all types of machinery).

Thomas Constantine Fawcett's works were known as the Whitehouse Engineering Works, Hunsley, Leeds. Notices of patents were published in Australian journals of the 1880s but give few useful details, one was published in October 1886 announcing a patent granted; another one in July 1888 announcing "Improvements in machinery for making and drying bricks". Fawcett machines were introduced to Australia during the 1880s. Two of "Fawcett's latest patent brickmaking machines" were installed at the Band of Hope and Albion Mines, Victoria, said to be the only ones yet introduced into the colonies, with one exception. This may refer to Fawcett's new, or "latest", machine rather than to Fawcett's machine per se. However, the "one exception" may have referred to Alfred Cornwall's Works at Brunswick, Melbourne in 1886. An account recorded that Mr Cornwall had recently "put down some fine brickmaking equipment -- Fawcett's of Leeds". The machinery included a clay preparation machine. Two of Fawcett's machines were for sale from a failed brickyard in Queensland in 1890. Brittain's Brickworks, Queensland, had a Fawcett wire cutting brick machine at their works by 1899. A number of Fawcett machines were also used in Sydney. One of the first was said to have been installed at the Beulah Brickworks (Bakewell Brothers, 1886 and later), producing double pressed and moulded bricks. Wire cutting brick machines...
were replaced by Fawcett's semi dry process at the Oaks Steam Brick Company, probably during the late 1880s or early 1890s. Fawcett's are not listed by Partridge as a commonly used machine in Sydney by the 1920s.

Fawcett's agents for New South Wales (Sydney) and Queensland was Mason Bros, and McEwan and Co. for Victoria (Melbourne) and New Zealand. A range of Fawcett's machines were featured in The Building and Engineering Journal of Australia and New Zealand of February and March, 1889. The article pointed out that many excellent types of brickmaking machinery were now available in Australia, including the "world renouned [sic] appliances of Messrs Bradley and Craven". Fawcett's machines were chosen for illustration, "as the main principles on which all the machines work are to some extent similar". Illustrated were; a "Pug Mill Brickmaking machine" with a wire cutting table and involved a combination vertical and horizontal pug mill with an extrusion die; a steam powered brick and tile press known as "Gill's Patent Brick and Tile Press" but made by Fawcett's. This machine repressed bricks from the wire cutting machine, or those handmade, by compressing in a metal mould between two presses. It produced a dense brick with sharp arrises (and distinct frogs) in any shape by altering the mould, for example, bevelled, bull nosed, saddle backed, header pointed, beaded, raised panelled etc. A plastic brick moulding machine, producing a compressed brick fed by small hoppers into which the clay was deposited. The mould was contained in a revolving cylinder which compressed the brick at the top and bottom. More compact machines on the same principle, produced two bricks at a time, known as a "double machine" and a "semi-plastic", or "semi dry" machine which processed clay straight from the quarry, forming the bricks under enormous pressure. This method of brickmaking had "only been introduced comparatively recently, but is already largely used". It was noted that wire cutting brick machines and brick presses were also available in light and inexpensive machines operated by hand. These could be used in "shifting" brickyards and by country brickmakers.

Dry Press Process

The semi-plastic, or semi-dry, process aimed at reducing the drying time of bricks as ordinary brick clay required a quarter of its volume of water and therefore the drying process was a lengthy one. There were also many hazards that could befall bricks as they dried in the hacks. Semi plastic bricks were generally formed under high pressure forming a dense and strong brick suitable for engineering works. It was recognized at an early period that pressure bricks were very difficult to dry. This
Bradley and Craven clay crushing roller and breaker (BEJANZ, 18:08:1888, p.126).


Fawcett's "Expression Rolls" (Bourre, fig.283, mostly used for tiles).

Fawcett's brick machine (BEJANZ, 02:03:1889, p.168).
problem, plus the time consuming process of tempering and pugging, appears to have led inventors to sidestep these inconveniences by developing the idea of producing bricks without the use of water.

Some of the semi-plastic machines discussed had developed to such a degree that the clay was worked directly from the quarry without any admixture of water, such as Fawcett's "semi-plastic, or semi-dry" machine316 and Bradley and Craven's "Dry-clay Brick-making Machine".317 These were not true dry-press machines as the quarried clay had a natural water content.

The dry press process required clay to be quarried, dried, and pulverized to a grainy powder, none of the grains being larger than a pea318 and then slightly moisturized by passing the powder through steam and compressing in metal moulds under great pressure. Some processes did not require the steam treatment, the pulverized clay retaining sufficient moisture for the clay to adhere in the form of a brick when subjected to great pressure.

Prosser's "pressure brick" was one of the earliest inventions to explore the dry press principle, though Woodworth and Moore of Boston USA had their dry press machine brought to the attention of English readers in September of 1851.319 The clay was ground to a fine powder in a slip kiln and in a dry state subjected to a heavy pressure of 250 tons in metal moulds. The brick was said to have been reduced to one third of the original thickness by the pressure and the remaining moisture sufficient for cohesion.320

The dry press clay process was perfected by Piatt Brothers and Company Ltd (patent) Hartford Works, Oldham. The process required large sheds to accommodate the various machinery and was so large that they could not display it at the International Exhibition of 1862.321 By the Platt process, the clay was excavated and transported by iron waggons and the contents tipped into a hopper in which large pieces were reduced by two revolving screws. The clay passed through a drying cylinder five feet in diameter and 35 feet long and was blasted with hot air from the kiln, drying and breaking up the clay as it progressed through the cylinder. The clay was then reduced to powder by a cylindrical shaped pulverizer. Stone and clay lumps were reduced by "chilled rolls". The disintegrator prepared the clay for the mould as a fine moist powder.322 The powder was compressed under great pressure in four moulds, twice to the top and underside of the brick, forming bricks which could be delivered to the kiln for burning. The machine could produce 20,000 bricks per day.323
74. Fawcett's "Gill's patent brick and tile press". Note the moulded bricks below (BEIJANZ, 23:02:1889, p.151).

75. Fawcett's (BEIJANZ, 23:02:1889, p.168).

76. Fawcett's brick machine (Bourry, fig.193).

77. Edge runner mill with revolving pan (Bourry, fig.13).
The bricks were slow to overcome the prejudices of "many architects and others" even by the late 1880s, despite tests to prove them equal in strength to bricks made by other methods.324

The Piatt process began to receive serious attention by the early 1870s and publications like Spon republished accounts of the process. The process, as described in 1874, had not been modified; the fine powder in the brick press was subjected to heavy blows of one ton, the pistons working from above and below. The faces of the mould were lined in case-hardened wrought iron plates and secured by pins, or screws, the mould could be replaced as necessary. The clay could be mixed with breeze, ashes, chalk etc. The brick was hard and had a "fine polish" to the surface. It was announced that buildings had been erected with these bricks.325

The dry process was not particularly favoured in Britain but once introduced to Sydney it became the standard process well into the twentieth century once problems had been ironed out. Piatt machines were still operating in many Sydney brickworks until very recently.326

Platt machines are difficult to track down outside the Sydney area, though a Platt, four-brick, machine was dismantled at Gibson's Brickworks at Gunnedah early in the 1960s.327 The Platt dry press process seemed to have been particularly suitable for Sydney shales and clays.

The first Piatt machine appears to have been installed at the Surry Hills works of Goodlet and Smith in the late 1870s,328 which was followed by another in the early 1880s. A third machine was installed at their Waterloo Works. Two of Piatt's machines were set up at the Carrington Steam Brick Company about 1885/1886 to produce dry pressed "commons".329 Two machines were installed at the Stanbury Brickworks in 1886.330 Gore Hill Brickworks had one or two Platt "four stampers" by mid 1888. One report stated that they had two Platt four stampers.331 (producing four bricks at a time); another report stated that there was one.332 An account of the works in 1891 stated that they had a Platt as well as a Bradley and Craven,333 which indicates that the first report must have confused the machine types. Goodsell and Tye were said to have used a Platt machine,334 and several were in use at the State Brickworks.335

The history of the Platt machine in Sydney is quite interesting. As mentioned previously, Goodlet and Smith appear to have been the first to use a Platt machine. Goodlet and Smith worked the Platt machine in conjunction with a Hoffman kiln and the success of this arrangement led them to erect another such plant at Waterloo. Partridge mentioned that, "other brickmakers erected similar plants at St Peters and..."
This would indicate that Platt machines were much more common than the above incidental references would suggest. In support of this, Platt machines were the most commonly quoted of Sydney machines since the 1880s and the Platt brand headed the list published by Partridge in the late 1920s and is constantly referred to throughout his booklet. Partridge mentioned that the Platt machine, "was considered to be the best by most people in the trade", referring to the 1880s. The Davis machine gained favour with some brickmakers but was unable to rival the Platt machine for very long. During the 1890s, Blanks marketed a new two-mould machine which, from the same clay, made bricks superior in texture and density to that of the Platt machine. The Blanks machine had some of its working parts below the floor which led mechanics to ignore any repairs until a breakdown resulted. This brought the Platt machine back into favour again.

By the late 1920s machines being used in Sydney had barely changed since the 1880s, though some were locally made and others imported from Britain and America. At this time, Partridge reported that some brickmakers were discarding their Platt machines in favour of the other brands, while, curiously others were doing the reverse. Partridge believed that the trouble was common to all machines in that they had ‘sliding changers and cam shafts’ to fill the moulds, and proposed an improvement of his own. The Partridge machine was suited for electric motors which the Platt was not.

It should be remembered that the machines sent to Australia were not provided with the elaborate milling and drying apparatus as illustrated in Clark and Spon. Usually, grinding pans were purchased separately for the preparation of the clay and many local and overseas engineering works produced them.

A list of some of the parts of a Platt machine may help in understanding how such a machine worked. The following represent the "working parts" of a Platt machine:

- 2 large cam shafts
- 2 large toothed wheels
- 1 large toothed pinion
- 1 small toothed pinion
- 3 large pulleys*
- 2 gear shifts
- 1 rocking shaft* (with 2 oiling parts)
- 3 rocking shafts
- 1 sliding charger* (to fill moulds)
- 1 saddle
- 2 compression rollers*
- 4 main bushes*
- 4 gearing parts*
Those noted with an asterisk, 16 in number, were classified as "oiling parts", 30 were classified as "wearing parts". Full descriptions of the working parts may be found in the accounts of Clark and Spon. The most important part from an archaeologist's point of view would be the mould and the pressure applied resulting in the density and weight. The sliding chargers, or back rammers, would be filled under the hopper and slide across to the mould where top and bottom die, or pressure, plates applied pressure to the upper and lower broad sides of the bricks. The mould itself had four sides known as liners, the Platt liners were five inches deep and needed to be replaced from time to time because of wear. The clay was further compressed by compressing rollers. The sliding charger then pushed the brick forward, after it was formed, onto the rack for receiving bricks. The distinctive qualities of the bricks are to be found on the upper and lower broad surfaces, caused by the die, or pressure, plates - usually including frog and pin, or screw, marks. As for the size of the brick, the depth was most easily adjusted by modifying the plate liners and the die plates. An illustration of a machine mould, though not of Platt make, may be found in Spon.

William and John Kennedy

Kennedy's, of Whitehall road, New Wortly, Leeds, were a little known company of brick and tile machine manufacturers. The earliest machines, appear to have been set up on the ground floor of a building at the Lithgow Valley Colliery during the late 1870s or early 1880s. The machines were described as Kennedy's "dry pressing" brick machines, "pioneer of its kind in the colony". Each machine turned out two bricks at a time and was said to be able to produce 10,000 bricks per day but was worked at 7,000 per day as it was found to turn out better quality bricks when worked slower.

During the 1880s a Kennedy machine was set up at Hayes' Oaks Steam Brick Company at Neutral Bay. Described as a "semi dry" machine, it was selected because of a saving in horsepower in that the sliding charger only travelled half the distance as that in the Platt machine. As the charger pushed the brick sideways from the die plate though, the bricks were often damaged on their race, rather than their ends -- as in the Platt machines.

A Queensland brick plant consisting of two Fawcett brick plants and one Kennedy's brick plant, including boilers, engines, brick press, disintegrator, hoists,
pumps, friction winch, blowers, shafting and pulleys, large trucks, rails, wire, piping etc., was offered for sale in 1890 by a Sydney agent.349

The damage frequently done to the face of bricks made by Kennedy machines probably led to their disuse by the close of the nineteenth century.

John Whitehead and Company

Whitehead machines, made at the Albert Works, Preston, Lancashire, were one of the first machines to be used in the Sydney area. This machine was actually a drain pipe making machine and was set up in Holtroyd's Sherwood Brick and Tile Company during the 1860s.350

One of Whitehead's "new" machines for making and pressing bricks was displayed at the Great Exhibition in 1851 along with a couple of drain pipe and tile machines.351

Apart from brick, tile and pipe machines, the Company also manufactured pugging and clay crushing roller mill, socketing machines, brick and tile pressing machines, etc. They had received 14 prizes from the Royal Agricultural Society of England and prizes from the Royal Agricultural Societies of Ireland and North Germany and the State Show at Richmond Virginia, USA in 1893. Prize medals were also won at the following International Exhibitions, 1851, 1855, 1856, 1862, 1874, 1877 as well as exhibitions in Amsterdam, Rotterdam and Lille.352

A "new model" brick-making machine, "the first of the kind ever imported into this Colony" was installed in the Brick and Tile Works of the Lithgow Valley Coal Company. The machine was thought to produce 12,000 bricks per day and worked by the "dry process" or "semi-plastic" processes.353

Some of Whitehead's movable brick cutting machines were illustrated in Bourry after the turn of the century, suggesting a long continued success.354

Stanley's

The Stanley machine was manufactured by the Nuneaton Engineering Company, Tuttle Hill at Nuneaton. A machine was assembled at Gulson's Brickworks by February 1914 and was described as a "semi plastic dust single brick machine".355 Little is known of this company but it was most likely established by the late nineteenth
century as one of their "Nuneaton" presses appeared in Bourry's work,\textsuperscript{356} (used for providing a better finish on bricks produced by other means).

There were many companies engaged in the manufacture of brickmaking machines, as can be seen by perusing British trade directories. A number of companies were also engaged in this manufacture, principally in Sydney and Melbourne but these shall be dealt with under the Australian heading.

American Machinery

Machinery of American manufacture were also imported into New South Wales,\textsuperscript{357} and other parts of Australia. "Dry clay" machines in the USA, were considered suitable for but a small proportion of clays and best suited for pressed bricks for the facades of buildings.\textsuperscript{358} The American machines by 1892 had not perfected the process because there were often complaints of lack of uniformity in the density of the brick and that after baking they were often "open and weak". This was largely due to the failure in processing the clay properly.\textsuperscript{359} Most authorities between the 1870s and 1890s had little to say about the dry press process.\textsuperscript{360}

The wire cutting extrusion machines were generally of the vertical pug mill type.\textsuperscript{361} The Chambers' brick machine, produced by Chamber Bradley and Company of Philadelphia, Pennsylvania, was one such machine but the bricks were cut by rotating discs, "or spiral cut-off", rather than wire.\textsuperscript{362} Vertical pug mills were also employed, such as the "Penfield Plunger" brick machine by J.W. Penfield and Son, Willoughby, Ohio.\textsuperscript{363} One thing which these machines had in common was that the extrusion came in head-first sections and the bricks were severed at their ends, or heads.

Brick moulding machines were generally of a type consisting of vertically revolving periphery circular wheels\textsuperscript{364} though machines with drain moulds and flat table moulds were also popular.\textsuperscript{365}

The American machines are quite distinct from the English varieties. Wire cut bricks may be identified by the drag marks left on the heads, or ends, of the brick (rather than on the broad sides of bricks).
Re-Pressing Machines

In most cases these were simple constructions which were hand operated, re-pressing bricks made by hand or wire-cuts one at a time. These machines were used to improve the appearance of bricks, generally intended for the fronts or exteriors of buildings, hence the name, facing bricks. The dies of these machines were sometimes arranged so that moulded pattern bricks and even decorative designs could be produced. Machines for hand pressing paving and patterned roofing tiles were built on the same principle.

An early type of hand powered brick re-press, commonly used, was illustrated in Bourry. The early hand powered re-press machines were operated by a lever and remained popular because of their simplicity and portability right into the early twentieth century. Screw presses were also used, but more often for paving tiles etc. Clayton and Howlett promoted a lever operated hand press, with the die at the top, for small brickyards but they later developed a heavy machine able to re-press bricks by using steam power for larger brickyards. Fawcett produced a steam powered screw press, another more powerful steam powered press was able to re-press bricks of any pattern.

Machine Accessories

The main accessories associated with brickmaking machinery were clay and stone crushing machines and mills. The stone crushing machinery was mostly the result of developments made for mining purposes. The most common accessory was the clay grinding pan. These were used for reducing very firm clays and hard materials in the clay. The wrought iron pans were provided with adjustable scrapers to turn the material and force it under the rollers. The pan mills with the two large rollers were known as "edge runners". The machines were available "underdriver" and "overdriver" one could he powered by pulleys for belting connected to a steam engine, although some had machines attached to the side. Edge runner mills appear to be based on the old Chilian mill. Edge runner mills were useful in all branches of the clay industry and were made by a number of engineering and brickmaking machinery companies, such as Fawcett, Dryton etc. These mills were essential for the dry clay process machines. Several machines had also been developed where the clay and stones were worked between rollers. Clay mixers were occasionally used to combine and work the clay and water, after crushing in the pan mill or roller mill. These mixers were required if the extrusion or plastic moulding machine did not have its own
pug mill as part of the apparatus. Some machines combined two processes in one, such as Bradley and Craven's "Clay Crushing Roller and Breaker".379

Boilers and steam engines were also used in most large brickworks of the late nineteenth century onwards but as these do not directly affect the end product and that they were developed for general purposes, it is not considered necessary to describe them.

Kilns

The updraught intermittent "Scotch", or box, or rectangular kiln and the various types of clamps are traditionally associated with the manual processes of brickmaking. However, it is rarely realized that the Scotch kiln and even clamps were used for burning machine-made bricks when the optimum potential for colour was required from the brick clay. These bricks were usually called "OKs", or open kiln bricks (i.e. the Scotch kiln does not have a roof, whereas kilns such as the Staffordshire and patent kilns were roofed with a dome or barrel arch).

The Staffordshire, circular, or cupola, kiln was used in the Staffordshire area.380 It was a domed circular kiln with a series of fire holes along the base of the walls and a hole cut at the top of the kiln. Such a kiln burned intermittently as the Scotch kiln but burned efficiently at a high temperature. The number of bricks which could be burned in such a kiln were restricted to about 8-9,000 bricks. Improvements were made to the flue area, which was subjected to the vagaries of windy weather. To combat the dangerous acceleration of burning by draughts a low wall was built around the kiln. These kilns were often used for firing pottery.381 Another type of sophisticated kiln was the Essex, or Suffolk, kiln which had an arched furnace beneath the floor and worked on the updraught principle. This particular method allowed for higher and more uniform firing but the kilns were generally small.382

The Staffordshire, Essex, or Suffolk kilns were often used for improvements made to the burning of bricks up to the 1860s.384 The updraught kilns, although wasteful of fuel and labour, produced bricks of a good colour. The early patent notices rarely provide much information on even the basic principles of a new invention; for example, William Ridgway of Northwood, Staffordshire applied for his patent in August 1842: "a new method of conveying and distributing heat in ovens [kilns] used by manufacturers of china, earthenware, brick, tile, and quarry makers".385

86. Stanley's Nuneaton press (Bourry, fig.192).
One of the earliest inventions which was a precursor to the multichambered kilns made famous by such men as Hoffman was Ainslie's "Brick Burning Kiln", details published in 1846. The kiln was composed of various compartments where the heat of the first was passed into the next and so on. It was claimed that when the bricks of the first chamber were burned, the bricks would be repeated for all the remaining chambers.386

Another advance was the downdraught kiln. The heat of the fire was drawn up from the base of the kiln in cavities in the wall and then descended over the bricks and down through perforations in the floor of the kiln, drawn by the draught via the flue connected to the chimney. These appear to have been developed for firing pottery and were later extended for use in burning bricks.

A combination of several previous ideas was united by the Austrian Frederick Hoffman. The Hoffman kiln was a continuous multi chambered tunnel kiln where bricks could be loaded, dried, fired, cooled, unloaded, loaded and so on, theoretically without end. The basic advantage was that the heat from the firing of one chamber was used to ignite the next lot, and the heat from cooling bricks was used to dry bricks ready for firing utilizing all the heat produced resulting in a considerably saving in fuel. The use of coal to burn bricks had been in vogue for some time and patents were taken out to improve the use of coal.387 The Hoffman kiln used coal but it was not necessary to use the best grade for good results as coal dust, or "small stock" could be used to equal advantage.388 The coal was fed through apertures in the roof of each chamber, the vertical shafts, or fire holes, channelling the fuel in to the skilfully arranged green bricks below.389 The chambers were generally eight to nine feet (2.440m-2.742m) high and 15 feet (4.575m) wide and were divided by movable partitions. The kiln contained an inner annular chamber and heat was regulated into it and channeled to any other chamber by an inverted bell shaped cast iron cover, or conical plug.390 These regulated the draught and burning rate by adjusting the plug (which was attached to the end of a pulley) and operated from the roof of the kiln. The flues leading from the chambers to the plug could be set at the top or the base of the chambers of the tunnel, depending on whether an updraught or downdraught system was desired.392 The inner annual chamber was also used to transport the heat from cooling bricks to chambers where green bricks were being dried. There were many variations from one Hoffman kiln to another and these were fully described in many books and articles.393

One authority claimed that Hoffman kilns were first introduced to Britain in 1856394 and others point to 1859,395 or "after" 1858.396 A patent notice appeared in the
90. Lever press (Bourry, fig.92).

91. Boulton’s screw press (Bourry, fig.93).

92. Fawcett’s power driven screw press.

93. Clayton’s repress machine (Bourry, fig.197).
and A. Licht for, "a circular continuous kiln for baking bricks and manufacturing lime", dated 17th December 1859. Apparently Friederich Hoffman was not the only one associated with the kiln as Albert Licht of Danzig was included in the patent notice in a six months protection patent published a week later. John Craven (of Bradley and Craven) "and two other gentlemen were associated with Mr Hoffman in the patent for the kiln" or so a later account rendered it. It appears that the other gentlemen had bought patent rights and developed the patent further. Humphrey Chamberlain, John Craven and Herman Wedekind adopted the Hoffman system to produce a variant with the chimney on the very end of the kiln. The chamber was in one long length, along which the fire burned progressively (with an option to divide it into sections). Both Wedekind and Chamberlain were agents for the Hoffman kiln. The circular arrangement of the kiln perfectly suited a continuous kiln of 12 chambers and was considered a good compact form for the average large brickyard, even after the turn of the century.

The first Hoffman kiln built in Britain was built at Bradley and Craven's Roundwood Brickworks, Wakefield, England between 1862 and 1865. It was specifically intended to burn bricks made by the early No.3, plastic, "Brickmoulding and Pressing Machine". The machine by the close of the 1880s had worked for 25 years, but the kiln continued to burn without interruption for 52 years. The Hoffman patent kiln won the "Grand Prize" at the Paris Universal Exhibition of 1867 which incidently had the largest numbers of visitors to that time, boasting 10-million visitors.

The circular kiln was restricted in size and some problems were encountered because of uneven temperature distribution said to be due to the circular shape. In 1870, Hoffman introduced an important modification to the kiln by increasing it lengthwise, thus it became oblong in shape. Although the new kiln could be extended to any length theoretically, the very long kilns sometimes required two or more fires burning at one time (for the fast burning of bricks) in order to make it economical. The only real restriction was the capacity and drawing power of the central chimney.

The Hoffman patent kiln was advertised in 1873, "for burning Bricks, Tiles, Pottery, Lime, Cement, and Roast Ores at a saving of 2/3rds of the fuel" and interested people were invited to apply to see it work.

After 1870 the shape of the kiln was once more modified. The kiln shape was changed to a rectangle with two parallel sets of chambers united by a flue at each end, instead of two semi circular tunnels, as in the 1870 patent. The chimney was generally
placed outside the kiln. It appears that Buher, Hamel and Simon were responsible for this innovation. This form was the most commonly used by the first decade of the twentieth century in Britain. With further modifications Hoffman kilns have been used up to the present time, especially for the firing of fire bricks and other refractory goods.

Hoffman was a shrewd businessman and he made sure that his patent was protected in as many places as was necessary. The circular kiln was patented in New South Wales on 01:07:1867. Another patent was taken out on "Permanent ways" on 11:06:1885.

The erection of the first Hoffman kiln in Australia took place at the Hoffman Patent Steam Brick Company, Brunswick, Melbourne in 1870. During the decade following many of the leading brickmakers installed such a kiln, such as at Alfred Cornwell's Brickworks at Brunswick in 1886. The South Brunswick Brick Company had an 18 chambered Hoffman by 1894. The first to be installed in Queensland was at the Albion Pottery Works in 1888, serving the bricks from two semi plastic machines. Early in 1889, one was contemplated for the Mornington Brick, Tile, Pipe and Freestone Quarry Company in Tasmania.

The first Hoffman kiln in New South Wales was erected at Messrs Goodlet and Smith's works at Surry Hills, Sydney, by the late 1870s. This kiln remained in operation until about the early 1920s. Another was built at Goodlet and Smith's works at Waterloo and many brickmakers built similar kilns at St Peters and Newtown. A new patent tunnel kiln was introduced by a Mr Gurney which moved the bricks in trucks through the kiln by a tramway set-up. The first two kilns were set up in Waterloo and Newtown but proved failures which resulted in a reversion to the Hoffman kiln. By 1893 Hoffman kilns were very common, the majority of large Sydney brickworks having them or one on a similar principle but these kilns were rarely specifically mentioned. One had been completed in June 1888 at the Gore Hill Brickworks and was lit on 16:06:1888. The Gore Hill kiln was built on the 1870 model, being oblong and was credited a few years later as being the largest, having sixteen chambers. The Hardy kiln rivalled the Hoffman kiln for a few years at the turn of the century but had little advantage over the Hoffman kiln, except that it was easier to load. Hoffman kilns were still being constructed well into the twentieth century and several were still in operation until the early 1980s. Hoffman kilns, built in Sydney up to the 1920s, commonly had chambers 16-feet wide by 10-feet high and could accommodate 1060 bricks per foot running. The chief criticism of Hoffman kilns was that the smoke flues were placed in the centre of the kiln above the level of the
chamber floor which tended to draw away the heat of the wicket walls and had difficulty in carrying away vapour.\textsuperscript{438}

The large patent kilns burned bricks at a phenomenal rate but they were really only suitable for common bricks which were too costly to burn in intermittent kilns.\textsuperscript{439} Salt glazed ware, "blue" engineering and most silica bricks could not be burned in the large continuous operation kilns.\textsuperscript{440} The late nineteenth century kilns had problems in carrying off the steam when the bricks were being heated, the steam causing damage to bricks and the occasional cool breeze rushing over the bricks caused discolouration.\textsuperscript{441} Double press or patent bricks were excluded from the large kilns because of the inevitable discolouration.\textsuperscript{442} James Nangle complained during the early 1890s that bricks burned in the Hoffman or similar patent kilns were pale and of a most uninviting colour and that if the same bricks had been burned in the old type kilns they would burn to a strong red colour.\textsuperscript{443} The reasons given were that the pale colour was due to the bleaching action of the acidic fumes of the closed chambers and that there was not sufficient oxygen for the oxidization of the iron in the brick to take place.\textsuperscript{444} This did not greatly matter as the vast majority of buildings from the late 1870s to the early 1880s were stuccoed so that the brickwork was rarely seen except perhaps at the sides and back of a building.\textsuperscript{445} A reaction to stucco had been seriously under way since the late 1880s with the promotion of the "Queen Anne" style and became a common style by the late 1890s. Architects, builders and manufacturers became more vocal as the 1890s progressed, one writer in 1891 hoped that the interest in polychromatic architecture would, "terminate the gruesome reign of direly dismal mud-hued stucco that so disfigures the potentially beautiful cities of Australia".\textsuperscript{446}

There were many other patent kilns promoted in Britain, such as Maraud's patent brick kiln,\textsuperscript{438} but these had little impact in Australia.

**Shaped and Special Bricks**

As most categories of shaped or special bricks may be produced by a variety of means, it was thought best to include this section at the close of the discussion of hand and machine made bricks and kilns.

The limitations imposed on the shape and size of bricks by the brick duty had been recognized for many years. By the early 1840s, complaints were being aired publicly in such journals as the *Builder*.\textsuperscript{447} Experimentation had virtually ceased, as duty had to be paid on all bricks moulded, whether they were successful or not. Short cuts had been taken in the manufacture of bricks in order to mitigate the effects of the
brick duty, resulting in a very poor product. The prevailing fashion for stuccoed buildings in Britain hid the inferior bricks produced at the time.

By 1847, it had been pointed out that the brick duty prevented improvements and experimental endeavours. The fashion for stuccoed building had begun to change, the "New Style of Architecture" proclaimed that it preferred brickwork to stucco. Other writers were convinced that the poor quality bricks encouraged the use of stucco:

... I maintain, that to the use of cement as a decorative feature must be attributed the defective and unworkmanlike brickwork of the present age. I look upon every cement-fronted building as a trick and a cheat. It is, in fact, a downright forgery and a lie!

Articles began to appear regarding ornamental brickwork. Thus the framework for change was beginning to develop. The brick duty was repealed as from 27th March 1850.

Hollow and Perforated Bricks

These were generally made by the mechanical extrusion method; the process was largely an outcome of the development of the pipe and tile machines of the 1830s and 1840s. Hollow bricks could also be made by the manual process.

It was claimed that the making of hollow bricks could be traced back to the "remotest antiquity" and that the Chinese had been making them since their earliest historic periods.

The earliest patent for hollow bricks was granted to Benford Denton in 1812. These "tubical bricks" were used to convey warm or cold air to warm, cool or dry objects. The invention seemed to have no consequence. In 1822 a palace was built in Berlin of hollow bricks. Accounts of hollow bricks in Russia were published in 1827. A German language account by V. Packh published in the 1820s gave the French the credit of inventing the hollow brick (used in the harbour of Toulon) and samples were noted in 1825 by V. Packh. Bricks with isometrical projections with two to four longitudinal perforations for vaulting were patented in Vienna in 1841. The writer believed that the English Benford Denton patent preceded all the above innovations and strongly suggested that the basic inspiration was an English one.
The earliest patent with a definite consequence was that of M. Collas who obtained a patent in France in 1842 for making bricks with two longitudinal perforations. The mechanical means of production, however, was not as well formulated as the 1845 patent by Robert Beart and nothing of practical consequence emerged. The patent, however, was taken up in principle by Bourry, Paris, France, possibly via Beart's patent which had been fully described in 1848 and lodged in libraries in Paris. Some problems emerged resulting in litigation by Bourry against two French manufacturers, Chevalier and Company and Mortier, Courtios and Company who had manufactured similar bricks using Clayton's hollow brick machines at the French Exhibition in 1855 (on the Beart principle).

In 1845 Robert Beart, of Godmanchester, Huntingdonshire, obtained a patent for perforated bricks and began to supply the market with them. Beart had long been known in the brick and tile trade, as he had marketed his own drain tile machines by 1833. Beart's brick and tile extrusion machines were displayed at the Great Exhibition of 1851; one machine combined grinding, screening and squeezing clay through dies which could be changed; the other machine was similar but was worked by hand and could not grind the clay. Medals, however, were awarded to Bourry in 1851 and 1854 despite the fact that he had borrowed Collas' and Beart's patents. Beart's patent perforated bricks became well known and all those producing perforated bricks (i.e. bricks perforated by circular sectioned shafts, or holes), were required to pay him a royalty. These machines were said to be "the most generally employed", or "the most universally used", "die machine for perforated bricks". The perforated bricks were said to reduce the weight of the brick by one fifth. The bricks of 24 holes were manufactured by Beart of gault clay at Huntingdon in 1852. At Beart's works at Arlesey, it was found that the number of perforations, or holes, had been reduced to 21 by the 1870s. Beart's name was well known in agricultural circles for his knowledge of drainage and in the brick and tile trade, having even experimented in tunnel drying chambers. Beart's name is constantly found in publications from the 1830s to the 1870s. Clayton's machines if fitted with special moulds could also make perforated bricks and illustrations show that bricks were perforated both vertically and horizontally through the brick.

In 1846 three patents were taken out, by a Mr Franklin, a Mr Warren and another gentleman, the latter patent was for the purposes of heating, ventilation and drainage. These purposes would be used to repeal the brick duty as an argument for healthy housing in 1850. The 1849-1851 period saw a great deal of interest in hollow bricks. Robert Rawlinson was very prominent during this period and contributed a number of articles on the topic. The bricks discussed by this time were hollow, in
In some cases, to the extent of four fifths less than an ordinary brick and were used for ventilation, hollow walls for heating, floors etc. Dies could be modified to create grooving or roughening on the sides so as to create a good bonding for mortar or stucco. The light weight construction and the ease in moulding, drying and burning was considered a great advantage to architects. Special bricks were also made for specific purposes, such as for partitions, angles, reveals, chimneys, copings etc. Beadle and Rodgers of Wokingham, Berkshire, patented ventilating bricks of an "H" shape with the holes forming a semi-cylindrical shape. When the bricks 9x9x3 inches were laid the semi-cylindrical shapes made up an oblong shape, allowing for air to circulate inside the wall. The bricks took the space of two normal sized bricks and as the patent dated to the late 1840s, it was promoted as saving half on the usual cost of brick duty. These bricks were shown in greater detail in Knight's work of many years later. Illustrations of the moulds used may be found in Bourry for the extrusion type machine.

Henry Roberts of Falmouth had patented a rich range of "bonded" hollow bricks, these were used in Prince Albert's Model Houses for the working classes where special hollow bricks were made for all conceivable purposes; door and window jambs, square jambs, chimney stacks, partitions and arch springing bricks (solid) to support the arching bricks and the ordinary solid bricks were of such a shape as to be able to form corbels, cornices, bevels etc. These and other specialized forms were also illustrated in Knight's Dictionary. Various clays could be used; the straw coloured bricks were made at Aylesford near Maidstone; the red from the Buxley Works near Esher; the glazed bricks of a grey tint were made by a Mr Seagar of Vauxhall from a clay from the north of Devon; and the light coloured glazed bricks were made at the Staffordshire Potteries. It is known that a Clayton machine could produce perforated bricks. In an 1851 advertisement it was claimed that the hollow bricks used for the Prince Albert Model Houses were made by "Clayton's Prize Brick and Tile Machines" which would lead one to conclude that Clayton's machines were being used to produce H. Roberts' patent hollow brick range. John Moon's "Patent Bonded Hollow Chimney Bricks" for flues were used in the Model Houses as well. This patent was sealed some years before, on the 25th April 1843. John Ridgeway a potter of Stoke-on-Trent made hollow bricks such as were used on the Model Houses but without the glaze. By 1857, the record suggests, there were several manufactories producing hollow bricks, among them, Beart, Hashbrocqes and Bale but the expectations of the first couple years of the 1850s did not materialize. The articles and advertisements of the time may have painted an optimistic picture. There were disputes over patents; the dispute between English and French patents has been touched upon but there were also internal disputes. One dispute appears to have revolved around the patent of
Henry Roberts, and the *Building News* in 1857 concluded that, "from that day to the present the progress of 'hollow brick' manufacture has been nil".\(^{475}\)

Hollow brickwork did not replace ordinary brickwork as had been forecast but it was used on a modest scale thereafter. Very few appear to have been exported to Australia at any time but fragments of a crude type have been found on some demolition sites, perhaps dating to the close of the nineteenth century and the early twentieth century.

Had hollow bricks replaced ordinary bricks and had the advice been taken of a writer in 1851, these bricks would have been the perfect dating tool. The author of the article entitled, "What our American Brethren ought to have been doing!\(^{1}\) wrote:

... If the Medford and other bookmakers would put the date of the year in the bottom of their moulds, each brick, to the remotest epoch in the New World, would be an unerring chronicle of incalculable importance to future antiquarians.\(^{476}\)

**Moulded and Ornamental Bricks**

The use of stucco reached a high point in Britain during the 1840s, as noted before. Architects such as Nash and Wyatt had promoted it in many of their important constructions as a way to disguise bad bricks but chiefly to save costs on using moulded bricks.\(^{477}\) It was widely recognized that the brick duty was the chief obstacle to the development of bricks of "artistic patterns and moulds".\(^{478}\) The repeal of the duty did in fact stimulate the moulded brick trade but the real effects were not to be seen until the 1860s and 1870s with the promotion of the "Queen Anne" style and the Arts and Crafts movement. Up to 1857 the progress had been slow as the expected shift from plain to moulded bricks and acceptance of hollow bricks had not been realized.\(^{479}\)

Moulded and rubber bricks had been used on and off since the time of Elizabeth I but declined to virtually nothing after the imposition of duty and an especially high duty on "fancy" bricks.\(^{480}\)

There are few specific references to the types of moulded and ornamental bricks as the shapes used were not really patentable (such as, splay, bullnosed etc.), though patterns on the surface of bricks, as with ornamental tiles such as Mintons, could be registered. References dating to 1844 show that machines were patented which had extended tile making principles to the forming of ornamental bricks.\(^{481}\) These patents, however, were probably for producing patterns on bricks. The Patent White Brick Works at Rugby by 1858 produced white bricks "of almost any design" by machinery.\(^{482}\)
Many machines were able to produce bricks of various shapes. The most common machines were the re-pressing machines such as those of Clayton and Fawcett, but any moulding machine could be fitted with special dies to produce any shaped brick. An illustration of a Fawcett machine displays the common range of such bricks. Bourry illustrates a range of "fancy" bricks of both the shaped and fancy impression types and an illustration shows how the mould could be altered to make plinth bricks.

**Glazed and Coloured Bricks**

Up to the end of the eighteenth century the only colours available were due to differential burning in kilns and clamps, producing a variety of pale to deep reds and partially vitrified purple bricks. Grey was also available. These were produced from the iron rich brown clays. White clay, used for pipemaking, did not change its colour when burned but was too pure in alumina to be used for making bricks. By the second decade of the nineteenth century, white bricks were being made from a suitable clay at Ipswich which were sometimes imported into London as facing bricks.

By the end of the eighteenth century a London stock brick, known as a "marl" or "malm" was developed which was of a good yellow colour and was hard and well burned. Marls were used for the external facings of London buildings and as well as for rubbed or flat arches etc., over doors and windows. By the 1840s, or earlier, red bricks ceased to be used for exposed exteriors, the yellow marls being preferred (unless the building was stuccoed). It was thought that the colour was obtained by adding chalk to fine clay. Wilson during the late 1840s described a coloured brick of a pale buff "resembling the colour of Bath-stone" which gave buildings the highly desirable effect of resembling stone. It is not clear if he was referring to the marls which were elsewhere described as being of a "bright uniform yellow colour" and "fine yellow colour". Marl bricks were made from a natural marl clay which was a chalky clay or they were made by adding chalk to clay in the wash mill. Artificial process marls required about 6 per cent of chalk added at the wash mill, the mixture was reduced to a thick cream and allowed to dehydrate in tanks. Screened cinders were added and the whole allowed to weather. Finally the mixture was pugged and ready for moulding. By 1855 most marls were made artificially. Gee calls them marls and the clay, "marl". Marls were divided into three basic groupings, "clayey, sandy and calcareous" according to the proportion of alumina, silica and lime they contained. They also varied in colour, blue, red and yellow etc.
The brick described by Wilson of a "pale buff" colour appears to have been
the type of gault brick of a "pale buff cream" discussed by Winser as having become
popular in London from the 1850s. Wilson thought that this brick was also produced
by mixing powdered chalk with the clay but controlling the heat of the kiln and using a
special fuel. Wilson admitted that the method used was "kept as secret as possible
among the manufacturers". Some of the bricks exhibiting a "beautiful and perfect buff
hue", when broken open, were found to be red and dark on the inside, which suggested
to Wilson that the firing was cleverly controlled and that the fuel was particularly
selected. It may also suggest that the bricks were coated or dipped into a solution,
just as Staffordshire blues were imitated by washing a solution of iron oxide on inferior
bricks.

The light bricks of white, yellow or buff, being porous absorbed the soot etc.
of industrialized areas and soon turned a dull grey colour. This was noticed at an
early stage, leading some to glaze their bricks. In 1851, two rooms of the Prince Albert
Model House were decorated with polychromatic bricks. The bricks had been given a
colour wash and were glazed. Bale's brickworks specialized in coloured, glazed
bricks by 1856; the technique appears to have owed something to the process of
making ornamental flooring tiles, like those of Minton's. Although semi-glazed
bricks were generally advertised over the following decades, they had a limited use
because the mortar could not penetrate the glaze to form a secure bonding.

Bricks were glazed by treating the surface with a flux which melted silica on
the surface of the brick. Other methods included applying a glaze to the surface of
the brick or even throwing salt into the kiln during burning. For waterproofing, resinous
compounds and a soluble silicate of soda were used. Pigments could be added to the
glazing compounds to give the brick colour. Fire clay uniting with iron (iron and
silica) under great heat melted at the surface producing a glaze.

Clays which contained lime but no iron, burned white and required less heat
to burn to a good brick. The kaolin used for making smoking pipes was too pure for
making bricks, though by adding white or yellow sand a white brick would result
without warping. In fact any clay containing no more than 6 per cent of iron and to
which was added chalk, would produce a white brick (if it was strong enough). Close
kilns were chosen for burning to avoid deposits of soot. White bricks were often
perforated or made hollow because of their high specific gravity. Esbury, or Beaulieu
(Southampton) bricks, were made from a local white clay and used largely for facing
bricks as the earlier Ipswich bricks. Suffolk whites were made from sand gault clay.
Gaults in general were white bricks but were often perforated or given a deep frog to
reduce the weight. By 1858 the Patent White Brickworks at Rugby specialized in white facing bricks and "architectural white brick mouldings of almost any design". These bricks were made by patent machinery providing a brick of sharp arrises.

Formulae began to be published from the 1860s on how to obtain colour in bricks by the addition of foreign elements. It was well known that iron oxide produced red bricks. Blue, purple to almost black bricks were produced by adding 8-10 per cent iron oxide and burning at a great heat. These bricks were made in Staffordshire by machine which finely ground the clay and were favoured for docks, canal and river locks, railway bridges and viaducts. These types of bricks were known as the "Staffordshire blues". In Wolverhampton at Dudley they were largely used as paving bricks, and were known as "Staffordshire paving bricks". Manganese was found to darken bricks with an iron content to a blue or black colour. Magnesia imparted a yellow colour to bricks. Iron oxide and lime produced a brown brick, but could also produce a light dun or white, if the lime content was increased. The addition of magnesia to lime and iron oxide also produced a brown brick. A lot of experimentation in colour occurred at the various brickyards but the most successful of these were nearly always kept a secret.

In Sydney shaped and coloured bricks were virtually unknown until the mid to late 1880s, when they made their debut in the first "Queen Anne" style buildings. John Horbury Hunt however, must be credited by being the first to insist on special and well made bricks, exploiting natural colour, especially from the 1870s. The greatest demand for moulded bricks of good colour occurred during the 1890s to the middle of the second decade of the twentieth century.

Fire or Refractory Bricks

Fire bricks were chiefly used in lining furnaces and ovens or in places where they were required to resist the strongest of heat where ordinary bricks would fuse and vitrify as they shrank. This category of bricks was not well documented but is useful for dating certain buildings and structures in that they often had identifying letters or words impressed on them. The manufacture involved both the hand process and machine, makers preferring a semi dry process. Fire bricks were exported from Britain (mainly England and Scotland) and by the late 1850s considered an export trade, those of "common qualities" were most usually shipped to Australia. Fire bricks in Australasia were commonly used in baking ovens and arches of fireplaces, as well as fireplaces for burning anthracite coal and in steam engine boilers, and the occasional
ones are found with the regular building bricks in walls. In smelting furnaces and ovens, they were regularly replaced. The better quality bricks could often survive 250 charges, though in cases where the impurities reacted with the smelted material, brick may not survive 25 heats. Thus fire bricks found in a disused furnace or oven, generally represent the latest relining and it would be unlikely that they were contemporaneous with the construction of the furnace or oven. Where fires were not of a great heat, such as in a fireplace arch or baking oven, the firebricks may date to the original construction.

By about 1820, fire bricks were synonymously known as "Windsor bricks" because they were made at Hedgerley, a village near Windsor. These bricks, red in colour and containing "a very large proportion of sand", were mainly used for coating furances and lining the ovens of glasshouses. Later Windsor loam (clay and loam) was used as a bonding for fire bricks. The loam was beaten to a thin paste and found to work better than mortar. By the 1840s, two varieties were being made for different purposes. The Windsor brick was made below the usual brick size and was of a "deep, but bright red colour". The brick was comparatively soft and composed mostly of sand, cemented together with a "minute" quantity of clay. Although it could be cut with a common saw or knife, it could withstand a greater heat than the other variety and became hard and durable after the first heating in a furnace. The Windsor brick was regularly used to form the arch over wind or reverberating furnaces for smelting iron. It was recommended also for the domes of furnaces and any area which was not subjected to blows by the throwing in of large logs or areas to be raked with large iron pokers. For the latter conditions, the hard fire brick known as the Stourbridge brick was used.

A similar brick to the Windsor brick was made at Cheam in Surrey. By the late 1840s, these bricks were stamped with the letters "PP" and were referred to as such or were called "Non-such" bricks.

The other variety of fire brick was made at Stourbridge and was known by that name. The Stourbridge brick was larger than the common bricks of the time and were of a pale yellow or red colour. It was a non-absorbant brick and could resist the heat of steel. The brick was manufactured from bricks made of Stourbridge fire clay which were then ground to a course powder and remoulded with an additional quantity of fire clay and fired in the usual way. An 1844 account mentioned that they were formed out of old firebricks, crucibles and glass pots reduced to powder and contained an excess of silica over alumina.
By the 1840s fire bricks were often made in a wedge form for building arches and for use in segments of circles for building round furnaces or flues.\textsuperscript{533} Fire bricks were often by necessity moulded in different shapes for different purposes because they could not be dressed and exposed in a furnace without losing power.\textsuperscript{534}

Flemish clinkers which were vitrified were often used for paving but were also used in the construction of ovens.\textsuperscript{535}

Fire bricks began to be made in several localities as the demand increased, the right clays were found and the various processes perfected by the late 1840s. Ward and Company, Honduras Wharf, Bankside, advertised to attract gas companies, builders, engineers, oven builders, shippers etc., to their stock of Stourbridge, Welsh and Newcastle firebricks, lumps and tiles of all sizes. Fire clays, loams, Dutch clinkers, Windsor bricks, oven tiles etc., were also available from the "ships in the river at a great reduction".\textsuperscript{536} Incidentally Welsh "lumps" were also favoured for their heat resistance by this time.\textsuperscript{537}

By 1853 the chief areas for obtaining fire brick clay had been identified, Stourbridge, the Newcastle area and Glasgow. From these areas a silica clay fairly free from lime and magnesia were to be found in association with coal measures.\textsuperscript{538} The \textit{Building News} in 1858 mentioned that good bricks were made and fire bricks were imported to London from Stourbridge, Newcastle and Wales.\textsuperscript{539} By 1860 the names Stourbridge and Newcastle-on-Tyne were the chief centres mentioned.

One part of clay and three parts of coarse pure sand\textsuperscript{540} was considered a good formula to resist high temperatures, but could not resist metals in a fusible state (producing oxidization). For the resistance of great heat, a coarsely powdered and burnt clay was substituted for sand; this formula was found suitable for glass and other furnaces which were subjected to intense heat.\textsuperscript{541}

The perfect fire brick was difficult to come by and experts were continually experimenting with new formulae. By the 1860s, the grinding of hard suitable clays seemed to form the best material for fire bricks. In one instance during the late 1850s "valuable" fire bricks were made from the refuse of the China Clay Works of Devonshire. After washing out the kaolin, the quartz and mica were mixed with a little ordinary clay and made into good heat resisting bricks.\textsuperscript{542} The introduction of the Bessemer process required bricks where the chief ingredient was pure quartz without mica, iron, felspar, copper etc. (lime, magnesia, potash and metal oxides acted as fluxes and made bricks run).\textsuperscript{543} The best class of these bricks required 16 parts of quartz to one of plastic clay; the second class bricks were made of 16 parts of ground first class
bricks and one part of clay; and third class bricks were made of 8 parts of second and third class bricks to one part of clay. Sufficient water was added to the crumbly mixture to allow it to be kneaded into a ball ready for moulding. First class bricks were pressed in a machine for three quarters of an hour under the weight of three tons per square inch. Second and third class bricks were moulded by hand in open moulds.544

Formulae quoted in various publications for fire bricks often seem to conflict; in some publications lime or potash are condemned whereas in others they are represented as an essential ingredient.545 The Ure Supplement of 1879 discusses the problem at length.546 There was no one clay suitable for all furnaces and ovens and even the one clay, depending on how it was ground and moulded, would act differently under different circumstances. A porous brick of large grain was suitable for blast furnaces but a close grain of fine material (some fire clay) was suitable for coke furnaces. Lime was infusible but small quantities with clay made it fusible at high temperatures but with one per cent, without silica, it was supposed to make the most infusible brick known. Magnesia was often condemned in clay as it made the clay fusible but it was found that in large quantities it made a very refractory brick. Iron oxide was found to be harmless if there was an absence of alkalais unless the bricks were used for melting steel. With the absence of silica, a fire brick could contain five of six per cent iron oxide.547

The Ure supplement of 1879 admitted that satisfactory answers to the questions posed regarding fire bricks had not been received.548 The metallurgical world of the time had come to the conclusion that the refractory material of the future had to be made artificially as there was no solution in the use of natural materials. It was found that fire bricks which were good for cupolas were worthless for reverberatory furnaces; bricks used with iron were useless for zinc, crucibles made for steel could not be used for brass etc.549 It was hoped to develop a material which was applicable to all substances and situations. No one formula had been found and certain products were chosen by engineers etc. for their specific properties. Some fire brick manufacturers produced many grades and types of fire bricks by the late nineteenth century, the bricks were often impressed with symbols expressing the type of fire brick, such as "H.A." or "high alumina", "SIL" for pure silica.

The most common of the British export fire bricks originated from Glasgow, Newcastle and Stourbridge, the Cardowan patent being very common. John G. Stein of Bonnybridge, near Glasgow, Scotland (est.1887) exported many types of refractory bricks impressed with names indicating the amount of alumina and silica used, "Stein" (33/35% alumina), "Stein Glasgow" (34/36% alumina), "Thistle" (37/38% alumina),
"Nettle" (43/44% alumina), "JGS & Co" (84/88% silica), "Daisy" (94/95% silica), "Bluebell" (95% silica), "Stein Ladle" (for liquid steel and slag), "Stein 63" (63% alumina), "Stein 73" (73% alumina), "Stein Sillimonite" (high alumina), "Alcro" (high grade chrome - alumina). John Newton and Co were one of the earliest to export bricks. Gartcraig and Glenbolg bricks are to be found all over the world; Heatherbneith, Stourbridge; etc.

Firebricks are usually white or cream in colour and are very similar in appearance to dry press bricks in that they have a granular body, often crumbling at the arrises. Red fire bricks appear more like the ordinary hand made brick but are smaller, heavier and often have a flattened granular surface.

Little research has been done on fire brick manufacturers and there is not sufficient source material in Australia in order to attempt a gazetteer, which would be of inestimable value.

Attempts to rival the imports in Australia by local manufacturers were not successful until after the turn of the century, though they had been produced from some years before.

**Sydney Brickmaking**

During the initial years of settlement, there was a desperate shortage of tradesmen. The few persons who were skilled were quickly utilized as overseers of the various specialist "gangs". The unskilled men who were unfortunate enough to be assigned to the brickmakers gang had the opportunity of learning every aspect of the trade. Any of the more ambitious convicts would have graduated from a mere labourer to a moulder, kiln setter or burner. Any aptitude would have been encouraged because of the great shortage of tradesmen. There was no technical education and one acquired skills by observing and constant practise. For the brick trade, at least, this remained the only means of acquiring the skill until it was superseded by mechanization. Some would have been promoted within the Government service but many would have eventually set out on their own as contract brickmakers.

Developments up to the 1870s would have been an adoption of overseas technology modified by experience gained by local brickmakers of the peculiar conditions of an area. The trade was basically a mediaeval technology but had benefited from years of trial and error (retarded perhaps during the 1784-1850 period when tax was paid on unfired bricks in Britain). There were but few variables in the
trade as it had reached a maturity where only extra time and extra capital outlay could be used to produce a better article. A zenith in quality had already been reached by Elizabethan times after which period only changes in fashion modified appearances until the advent of mechanization.

For the proposed settlement at Botany Bay, it had been anticipated in Sir George Young's Plan of 1785 that bricks would be made, as a list of necessary tools included "Bricklayers tools".555 No provision was mentioned for brickmakers' tools,556 though some were sent out. The practical needs of the settlement were severely underestimated and equipment poorly chosen, as evidenced by the frequent requests for and complaints about the most elementary of tools. Within less than six months for instance, there was already a shortage of bricklayers' trowels.557 With few exceptions, improvisation, adaptation and local tool making made up for the lack of direct importation from Britain.

A list of articles sent by the First Fleet, extracted from the account books of the Admiralty, reveal that 12 brick moulds and 10,000 bricks were sent out.558 The 1784 brick duty law imposed a minimum restriction for London area bricks, 8½x4x2½ inches559 and there is some evidence that the first bricks produced had moulds calculated for such a size. The Mitchell Library has in its collection a brick taken from the Old Government House site, it is very irregular in shape and measures approximately 8¼ to 8-3/4 by 3-3/4 by 2¼ inches.560 This brick was lightly burned, being a flesh-like orange colour. It contained a number of large holes where organic matter had burned out suggesting that the London method of clamp burning was used, where a percentage of the fuel was mixed in with the brick clay. There is little evidence that this method was used again on a large scale until the 1850-1870s period.561

James Bloodworth was "discovered" by May 1788 as being an able bricklayer and apparently a builder. He was put in charge of a gang of labourers who were responsible for the erection of the majority of huts built by May 1788.562 A month previously an unnamed person had been given charge of a gang in order to make bricks in the area subsequently known as the Brickfields.563 There is, no doubt that Bloodworth knew the basics of making bricks as he was appointed superintendent of "Brickmakers and Bricklayers" on the 1st September 1791.564 Curiously, in view of his reputation as the first brickmaker, there is no other contemporary reference to suggest that he made bricks or supervised brickmaking: all subsequent returns refer to Bloodworth as a superintendent employed simply as a "master bricklayer".565

Bloodworth (or Bloodsworth) was recorded in Tench as coming from Kingston upon Thames,566 located in Surrey but within the statutory fifteen miles from
London. He, by inference, worked as a bricklayer/builder in the area, which suggests that he worked with regulation controlled bricks. Two brickmakers, explicitly mentioned as such, Samuel Wheeler and John King, also came from the London area. It is unlikely, in those initial years at least, that an obscure or haphazard system of brickmaking was practised (especially considering Bloodworth and his gang were required to use those bricks). Without going into too much detail, Bloodworth was generally noted for his building/brickwork skill: in 1790 he was given credit for having played a part in the erection of every "house or building"; in 1804, he was acknowledged as "Superintendent of Builders" "for many years". Bloodworth was credited with the erection of the brick built Government House and with the erection of "most of the public buildings since". There can be little doubt that Bloodworth would have ensured as far as possible the good quality and size of the bricks produced up to 1804 for Government work, as he and his men had to work with them. There would not have been time for Bloodworth to make the bricks himself.

The unnamed person who had been placed in charge of a gang making bricks by March 1788 could have been either Samuel Wheeler or John King. Both men arrived on the First Fleet. Samuel Wheeler, like Bloodworth, lived at Kingston-upon-Thames, near London, before his conviction. Wheeler was aged 26 at the time of his conviction (1785) but in the court records he was stated to be a labourer. Tench's account of Wheeler adds to the probability that he was involved in the brick trade around London as he could compare the colonial made bricks and tiles with the London articles and name prices, but he was probably a brickmaker's assistant or labourer. John King, who came from nearby Hammersmith at London, also showed competent knowledge of the brick trade but in his case, even his former employer, a Mr Scot, was mentioned. The Tench account makes it clear that King was working with his own brick gang in 1789, as Tench wrote "last year" under the date, November 1790. The extant records do not add much more to our knowledge of his brickmaking career but it appears that King has more in his favour as Australia's first brickmaker than Samuel Wheeler.

James Becket came in the Second Fleet. By November 1790 he was working at Parramatta with a gang of 52 people, turning out 25,000 bricks per week. Tench states that "18 months ago" he worked at Birmingham. The extra large size of bricks found to date to 1793 at Parramatta Government House might reflect the custom of making larger bricks throughout the mid and north England areas.

Not a great deal is known of Becket but as with the other brickmakers, each must have left an impression on early brickmaking in Sydney. Wheeler was still in the
Colony by 1828. King remained an overseer of brickmakers until he left the Colony in 1810.

By the close of the first four weeks of landing at Port Jackson, brick clay had been found and "8 or 10 Convicts of the trade" were "employed in the Business". Collins entered similar news under the month of March:

... A gang of convicts was employed, under the direction of a person who understood the business, in making bricks at a spot about a mile from the settlement, at the head of Long Cove.

No account survives to record how the first bricks were burned but it is fairly certain that the first lots were burned in clamps as there were no expendable bricks or stone to construct a kiln with. Both King and Wheeler (and even Bloodworth) would have been fully familiar with the London clamp burning method of baking bricks. The Sydney First Government House brick seems to confirm this conclusion. Bricks found on Norfolk Island dating to the 1791/1792 period also showed evidence of having been clamp burned. Although clamp burning seems to have been the custom when starting off for the first time at a new settlement, it appears that the policy was to construct proper brick kilns of a type commonly known as "Scotch" kilns as soon as the necessary materials became available.

The first reference to a kiln dates to 13th May 1788, when Worgan took a walk to the "Brick Grounds". He noted that 20-30,000 bricks had been made, ready for burning. He saw the men "digging out a Kiln for the Burning of them". As noted earlier, it was sometimes the custom to dig out the floor of a Scotch kiln to the extent of four feet in depth. (This would have saved effort in the construction of higher kiln walls.) Disaster struck in August when the brick kiln "fell in more than once". Kiln walls were inclined inwards and generally mud or clay was used to bind the brick or stone of the walls, so it is easy to imagine how heavy rains could wreck such a structure. By the end of the year there were at least two kilns. Tench wrote about an assembled force of about fifty "Indians", "near the brick kilns, which stand but a mile from the town of Sydney" but the convicts working there pointed their "spades and shovels" at them and the natives fled, thinking them to be guns. There must have been some friction between the two groups, as 16 convicts, "left their work at the brick kilns without leave" in March 1789 with the intent of plundering the natives at Botany Bay, armed with their "working tools and large clubs".

Up until July 1789 the brick gang, under the direction of the overseer, had averaged 10,000 bricks per month. By July a large kiln had been constructed which could hold 30,000 bricks which the brickmakers were required to produce per
By inference, thought must have been lavished upon the topic of kilns, as by April 1790 Hunter was able to mention that there were brick kilns and a pottery, "both which articles they made very well".

By the latter half of 1789, James King with two stools and the assistance of 16 men and two boys were averaging 11,000 bricks per week. The average number of bricks made dropped during the period of "short allowance" (June 1790) but his team was increased by four men afterwards to compensate for the increased distance of carrying firewood to the kilns. Samuel Wheeler before June 1790 had one brick stool and two tile stools with the help of 21 men who "cut wood", dug clay etc.". Wheeler was tasked to make 30,000 bricks and tiles per month (the proportion of bricks to tiles was optional). From June 1790 with the same number of stools, Wheeler's 22 men and two boys were tasked to make 40,000 bricks and tiles per month. The return for July 1790 accounted for 40 persons involved in making bricks and tiles and 50 persons involved in transporting the bricks. By November 1790 brick kilns had been built at Parramatta and the recently arrived James Becket, brickmaker from Birmingham, had 52 people to assist him. Becket's output was an extraordinary 25,000 per week.

There had been a shortage of brickmakers which led Governor Phillip to make several requests for a "brick and tile maker" in June 1790, rather exaggerating the situation. It is difficult to tell how many were eventually sent out, though one arrived in the "Kitty" in December 1792.

The bricks produced appeared to have been of a tolerable quality. Wheeler thought his bricks to be of a "moderately good" quality by English standards and if sold at Kingston-upon-Thames at 1784 prices, they would have fetched about 24 shillings per thousand. He thought that the bricks' greatest fault was that they were too "brittle". King considered the bricks made locally were "as good as those made near London" and that they could have been sold there for 21 shillings per thousand, and the best, "picked at the kiln", for 30 shillings (i.e. facing bricks). Becket thought that his Parramatta bricks could have sold for "more than" 30 shillings per thousand at Birmingham, "eighteen months ago".

By the last week of February 1788, a soil had been discovered which was thought suitable for making bricks. The Governor reported the same news in May to Lord Sydney and reported in July that they were making "very good bricks". The main complaint was, and this would be a longlasting complaint, that although the earth made good bricks, the want of lime for cement hindered their usefulness. Some trouble was experienced at Parramatta however, despite Becket's praise for his bricks; Collins was not sure if it was a defect in the process or in the clay itself as they were a
deep red colour after burning and they did not appear to be durable. Collins thought that the bricks produced in Sydney were superior. Hunter was satisfied with the Sydney bricks and pottery. It seems that the first batches of brick made at Parramatta were underfired, being a deep red colour, but in Sydney the bricks and tiles were described (1792) as being of one colour, a "light brown", "which make the buildings quite romantic".

Problems connected with brick buildings were largely due to the lack of lime. In September 1788 the Governor complained that they were obliged to lay bricks and stone in clay and that, by necessity, the walls had to be made "of an extraordinary thickness" and even then were not dependable. Apart from Government House, brick buildings could not be carried higher than one storey. There were no limestone sources and sea shells were used instead. Shell mortar did not improve to a reasonable standard until the time of Macquarie but even then a loam or mud mortar was used for inferior work. At Parramatta all brick buildings were found to be in a ruinous state by 1797; they were repaired during the following year but some were judged as "scarcely able to support their own weight". The problem of the lack of a strong mortar had repercussions for a couple of decades. In 1793 one of the first of a series of escapes/intrusions occurred where the bricks of a wall were simply dislodged. Many more reports of similar occurrences have been noted.

By 1793 the enduring system of contracting brickmakers had already commenced. A brickmaker and his gang were contracted to make 100,000 bricks for an officer's house "near the town of Sydney", charging forty two pounds and ten shillings. This was considered a fairly outrageous price but labour was expensive and in short supply. This incident may have led to an interesting private enterprise. The officer who contracted the brickmaker was said to have an allotment of one hundred acres of land "near the town of Sydney". This appears to have been John Palmer who was granted 100 acres at the "head" of Garden Island Cove, east of the common grounds of the town of Sydney, on the 25th February 1793. Palmer is known to have built a large brick house soon after. Probably realizing that a good profit could be made by establishing a brickyard, he established his own. By 1802, the brickyard was fully in operation, as shown on M.F. Peron's map of 1802. The works were probably established on the site where the contract brickmaker made the bricks for his house, as the earth excavation next to the stream is clearly indicated as part of the brickworks to the west, very close to Palmer's house. The brickworks survived to at least 1822 but very little is known of its activities.
By 1800 most major Government buildings were of brick but private houses were being built of brick also but were very expensive. It was still a luxury to have a chimney and floor of brick for the ordinary person (for which 1400 bricks were generally allowed). Public protests were aired by 1803 about the expense of bricks and the danger of fires caused by wooden and wattle and daub chimneys. It was thought that a regulation of brick charges could remedy the situation. The main problem, as admitted in 1803, was that there were very few brickmakers and these could charge any price they wished. It was thought that if the price could be lowered to a reasonable rate, the use of bricks would become more general.

The figures of men in the Government brick gangs during 1790 were unusually high because of the programme to build enduring Government buildings to replace the timber ones. The numbers, according to Tench appear to have been 98, including some boys. The figures from the end of 1790 must have steadily declined. A number of those involved in brickmaking in Sydney were sent to Norfolk Island by February 1791 when plans were underway to manufacture bricks there. During 1791 bricks were still being made "in numbers and with ease" at Sydney and Parramatta for the building programme. The number of brickmakers is difficult to gauge between 1791 and 1797. During 1797 to 1799 (inclusive) there were 24 men making bricks at a rate of 12,000 per week, and six tilemakers producing 3,000 tiles per week. Parramatta had half the number of brickmakers and half the production rate but produced no tiles for those years.

By the close of 1799 it was decided to form another gang of brickmakers and the carpenters were tasked to make, "brick and tile moulds [sic], tables etc., etc. for a second gang of brickmakers". Curiously, the return for the year 1800 shows no increase in either Sydney or Parramatta. The general muster undertaken during July/August 1800 (convicts and free men not having grants of land) reveal 44 brick and tilemakers in Sydney and only one for Parramatta, Toongabbie and George's River combined. The list seems to suggest that convicts were included but the absence of the Parramatta gang is a puzzle, unless they were helping out in Sydney at the time of the muster. The 1800 return also reveals that two brickmakers' tables were made.

After 1800, the returns are replaced with statements of quarterly employment. Data for the years 1801 and 1802 is lacking, except for a December 1802 request for brickmaker's tools. For the quarters ending in March, August and December, 20, 12 and 13 brickmakers were recorded: in December 10 brickmakers were located at Parramatta and six at the Hawkesbury (Windsor). From 1802 to June 1805, only 12 brickmakers were listed in the returns. No brickmakers were listed in...
Parramatta at all during the 1804/1805 period but 19 brickmakers were listed outside of Sydney and Parramatta in the quarter ending in June 1805 (Newcastle, Norfolk Island etc.). In September 1805, 11 brickmakers were working in Sydney. The returns for December 1805 and August 1806 show no figures under the heading of "brick and tilemakers". A return for October 1807, shows 12 brickmakers again.

Returns for Government brickmakers gradually cease to be incorporated in correspondence to the authorities in Great Britain, this reflects the maturity of the industry.

The pattern in Sydney was repeated in every new settlement founded from Parramatta and Newfolk Island on. As in the case of John Stretton, an ex-brick and tilemaker from Sydney: Stratton had been sent to Liverpool and was the first to make bricks there. As had James Bloodworth, he received a reward for his services as a brickmaker, a ticket of leave. Around 1816 he was sent to George Town as an overseer of brickmakers. Stretton, like his predecessors was slowed down in his work because the men under him were "learners" having been taught by himself. Boys were also recruited to learn the trade.

The Brickfields

It was customary in most settlements to set aside a suitable area for brickmaking. The area was generally founded by the Government but arrangements were made whereby private individuals could use the area too by way of lease. Leases were also sold by individuals who had obtained private property in such an area or a Government lease.

The first brickfield in the Sydney area was located in the depression between the present Town Hall Station and Central Station eastwards of George street. The site, near a number of water sources was chosen for its suitable "brick earth", or clay, by March 1788. The location is shown in Cribb’s plan of April 1788. During July 1790 a road was formed to the Brickfields to facilitate the cartage of bricks into Sydney. By 1793, three brick carts were in operation, drawn by twelve men. Each cart transported either 700 tiles or 350 bricks, one team carting either four loads of tiles or five of bricks per day.

The brickfields, in August 1789, were made one of the four districts of Sydney. The brickfields may be regarded as the first suburb of Sydney. In 1799 the "Brick Fields" were described as, "a suburb of the town of Sydney . . . within a few yards
of the main road. By 1804 the area boasted 72 houses. The area may previously have been of some significance to the aboriginal population, as a number of meetings and incidents involving the aborigines occurred there before 1800.

During the first two decades of the nineteenth century most references to the brickfields are to do with the buying and selling of houses, goods, and major or petty crimes concerning the same. The Brickfields were occupied by tradesmen carrying on their various trades and small or part-time farmers. It seems strange now that a centre for brickmaking could co-exist with such a high degree of domestic and general trade activity. There is no doubt, however, that the area was the primary centre for brickmaking. General Orders, dated 30:06:1806, ordered any empty "Cart or Waggon" passing by the road to Parramatta, to gather a load of brickbats from the Brickfields and off-load them along the Parramatta road etc., as directed by the Overseer.

The Government continued to make bricks in the Brickfields but several convicts made their own bricks for trade after Government working hours. Those requiring a certain amount of bricks, advertised the quantity wanted and would enter into a contract with the brickmaker. There must have been quite a number of private brickyards in operation by the end of the first decade of the nineteenth century as advertisements for the letting of brickyards often mention adjoining leases or properties of private individuals.

The main route between Sydney and the Brickfield before 1811 was via Hyde Park. Government Orders of 05:10:1811 closed the old access road and ordered that communication must be restricted via George street, on the "Turnpike gate or Toll bar". The prime motivation for that Order was to add extra revenue for the Government on all bricks and pottery leaving the Brickfields.

By the time of Governor Macquarie the Brickfields had spread in all directions from the original nucleus. In October 1810 Macquarie wished to prevent "any encroachments from being made on the Park [Hyde Park] by brickmakers". Any future transgressions would lead to the revoking of "permission" to make bricks at the Brickfields. Bricks from the Macquarie period are well represented in surviving buildings, they appear to have been of good quality but the bricks seen were especially selected for facing purposes (suitable for a public building) and do not represent the average brick of the time. The bricks used internally are more representative and those examined from the Hyde Park Barracks, St James' church and the Law Courts vary in size and quality.
Attempts to improve the quality of bricks were made by such men as Druit, who between 1817 and 1819 built a "double covered kiln", for Government bricks, capable of burning 100,000 bricks at a time. At the time it was represented that there were eight men to a stool who were required to make 3,000 bricks per day, when formerly the requirement had been 2,000 bricks.

Interviews by Commissioner Bigge reveal a wealth of evidence and a rather mixed picture. Bigge reported that Government bricks were found to be "very inferior in quality" compared to those made by Government men in their private time, "... although composed nearly of the same materials, and burned in kilns immediately adjoining to those of the government". The moulds used, resulted in bad bricks because of irregularity in the sizes of brick moulds.

Attempts have been made to compile evidence for a brick dating system according to sizes but only the broadest principles apply which are heavily dependent on location. Bricks up to about 1800 tend to the smaller sizes of the British brick laws but vary quite a lot. It was found that after 1800 bricks varied dramatically from building to building to about the 1870s, and even within the same building: this was one of Bigge's main complaints but was obviously never heeded; the real problem was probably due to the differential shrinkage in the kiln combined with the lack of conformity in brick moulds.

Bigge was concerned that good tools should be used in Government buildings and that "in every instance" these should be marked with the Government "broad arrow" to deter stealing and receiving. It appears that irregularities also occurred in the stealing of Government bricks and from about 1823 (no evidence of earlier examples found in precisely dated structures) Government bricks began to be stamped with the broad arrow. The private sector began to mark its bricks in distinctive ways for the same reason by the 1830s and 1840s, although it was not a common practice until the 1850s. More often than not each brickmaker used a distinctive frog on bricks when using a common kiln. During the 1830s and 1840s it was not unusual for the initials of the property owner or property name to be impressed on bricks to discourage theft.

The records became less specific after the 1820s, as various improvements in the brick trade became to be taken for granted.

By 1820 there were 17 brickmakers, either free men or ticket of leavers in all of New South Wales: though this figure did not include convicts for private or
Government use, it seems a small figure. The explanation appears to be that these 17 men were master brickmakers and not those employed with them.

Bricks at this time [1820s] were being made at almost every settlement. In Sydney the Brickfields continued to produce the majority of bricks but there was little improvement really, either in the bricks or the method of producing them. Conditions must still have been fairly primitive; Macquarie reported to Bath in September 1820 that, "vast quantities of Bricks" were destroyed by rain before stacking in the kilns (i.e., no sheds).

By the mid 1820s, Cunningham reported that all of Sydney's bricks were made at the Brickfields, as well as "our coarse Colonial pottery". The Sydney Gazette in 1826 nostalgically recalled that the Brickfields were formerly thought of as a "Sabbath's Days' walk", indicating that they were still in operation and that the availability of transport has been much improved. The bricks or lime cannot have changed much in quality by the time of Cunningham's visit (1826) because he noted that a burglar could pick a hole through a brick wall "in a very few minutes".

In 1838, the Sydney Building Act of 1837 was thoroughly reviewed and interviews were published with various architects, builders etc., on aspects of the Act. Evidently, the variation seen in the brick sizes by Bigge had not been corrected; William Buchanan, government surveyor, advised that a clause to be added to the Act fixing the dimensions of Sydney bricks, because of the "great variation observable in the size of bricks used...". He supported the adoption of the London Bricks size of 8-3/4x4x2½ inches. Henry Robertson, architect, judged the local bricks to be inferior in quality to the standard London article. The Sydney brick was not suitable for foundation work, according to Henry Scope, builder, because they were of such bad quality that they decomposed when used underground. No assessment was made in the Act itself and the advice for standardization was not adopted.

Sydney developed very rapidly during the 1830s and the Brickfields became to be regarded as a blot on Sydney. George street in that area was infamous for its steep, dangerous and dusty road. When the wind blew from the right direction, the famous "brickfielder" would rage down George street and cause some shops to shut their doors. The area appears to have been closed as the general brickfield by the mid 1830s. By the time Maclehose wrote his The Picture of Sydney in 1838, the brickfields had closed down: Maclehose explained the origin of the name of the area, Brickfield Hill, "from the numerous brick kilns formerly in that quarter". Fowles' 1848 work makes no mention of the area at all. A great deal of the remaining ground of the Brickfields was levelled off and used to fill the Haymarket valley, which remained as
swampland and tidal lowlands, it was estimated that one million cubic feet of fill was used.\textsuperscript{663} The craters, or clay pits, remained until 1852 and were then filled in.\textsuperscript{664} A brickmaker, Henry Edwards, who worked during that period, recalled that the Council of the day, refused permission to build on the sites of former pits of buildings higher than one storey.\textsuperscript{665}

Despite the apparent shift from the Brickfields, it is clear that several private establishments remained in the area, though probably mostly to the south, until the 1850s, such as John Cook, Henry Edwards and McConville (the latter around the Central Railway but-stop area, or Hutchesson's Paddock).\textsuperscript{666} One of the earliest new areas (by the late 1820s) was along South Head road.\textsuperscript{667}

The brickmakers of the Brickfields shifted their operations from the Brickfields, fanning out southwards and westwards. Surry Hills, Glebe, Ultimo and Camperdown were one of the first areas to be exploited and at about the same time, the Waterloo Estate, Newtown and the Cooks River. These were the main areas during the 1840s to the 1860s, the latter three remained the chief centres until well into the twentieth century. With the establishment of the railway and the opening of the vast areas for residential purposes during the 1870s and 1880s, the brickyards spread out even further. Centres were established at Leichhardt, Marrickville, Ashfield etc.\textsuperscript{668}

By the time of the expansion away from the traditional brickfields, frogs of various designs became common. The most common frog shapes of the 1840s to 1870s were rectangles of all proportions, lozenges, hearts and heel shapes. The earliest imprints appearing on bricks were broad arrows and later bricks with a letter or initials. Frogged bricks begin to be found from the 1830s onwards of the types as listed above. Panelled rectangular bricks with inverted rounded corners were popular from the 1870s to 1890s, but more commonly in country areas. Earlier examples of broad but shallow depressions have been found in two early structures dating to ca.1806 and ca.1823: whether these were accidentally created by a raised bed fixed to the moulding table or not is unclear. (Examples seen were so subtle that they could easily be overlooked.)\textsuperscript{669}

Many of the early machine made bricks had standard shaped frogs with initials, monograms, trademarks and names impressed upon them. The gazetteer may be found useful in establishing the maker's name and perhaps a date.
The "Stupid" was well known among Sydney brickyards of the 1880s-1920s (Bourry, fig.67).
Mechanization

There was a gradual mechanization of the brickmaking process but the documentation for this is extremely poor. It is quite clear, however, that any mechanization before the 1870s was of no consequence to the trade as a whole.\textsuperscript{670} Machinery used in connection with brickmaking consisted mainly of horsedrawn puddling machines and the first machines for moulding were either simple wire-cut extrusion machines or simple hand presses\textsuperscript{671} but these have a possible range from the 1840s to the 1940s (the latter date is applicable only to country areas).

An official list of manufactories in New South Wales, lists one with "Steam machinery for making bricks" in 1855 and two in 1856.\textsuperscript{672} To which aspect the steam machinery was applied was not stated. G.F. Train, a Boston merchant operating in Melbourne during 1853 to 1855, noted the rich potential brickmaking machinery had in Australia. F. Rossi, in the Hassall Correspondence, in 1861, promised the Rev. Hassall that he would make him bricks as soon as he could have his machine brought over from Sydney.\textsuperscript{673} The New South Wales Statistics for 1869 mention that amongst the metropolitan brickyards, "there are several which manufacture bricks by machinery".\textsuperscript{674} Once again it is difficult to determine what exactly was meant by "machinery". The earliest reference to a "first" appeared in the biographical section of the Centennial History of the New South Wales, published in 1888, which gives the Goodsell-Tye partnership the credit (almost certainly the famous early Bradley and Craven, circular table, plastic brick system).\textsuperscript{675} Wire cutting extrusion machines and hand presses may have been used before this time but the documentation is yet to be uncovered.

Dry Press bricks were being made by the early 1880s and became common by the end of this period. Shale, used to this day, began to be commercially used during the early 1880s.

With the conversion of brickyards from manual to machine production, traditions dating from 1788 became obsolete in the Sydney area. The results of the great mechanical conversion of the 1880s are strongly evident in Sydney to this day: one may stroll through any older suburb and easily distinguish pre 1880s from the post 1880s buildings. Finer dating distinctions require more than a casual stroll of course.

The mechanical conversion resulted in the closure of small brickyards and the amalgamation of the more profitable concerns. The latter often formed companies to raise funds for machinery. The old style brickmakers joined the large brickyards, left for country areas or quit the trade altogether. The 1840s-1870s brickfield areas, successors to the old Sydney brickfield, were being crowded out by the building
Now! The Economical Drypress method of Brickmaking is practical in other states as well as N.S.W.

Tests on George Foster's machinery on Interstate materials prove successful

- In earlier days other States, due to materials available, were forced to use costly methods. Now, with this final proof from George Foster's tests, the economical Drypress method is practical.
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GEORGE FOSTER & SONS PTY. LTD.

Drypress Brick Machine. Produces 10,000 bricks in 8 hours with one operator. Total power 15 H.P.

1-29 PRINCES HIGHWAY, ST. PETERS, N.S.W. Phone LA 3341

George Foster (Australian National Clay, 01:10:1959, p.12).
development of the 1870s and 1880s and many but the largest concerns shifted further afield in tandem with the expansion of Sydney's outer suburbs.

The development of the brick trade became more complex as the second half of the nineteenth century progressed. In order to account for the diverse strands, a gazetteer with annotations was prepared to document the later intricacy of Sydney's bricks, tailored for use as a tool for dating.
GRINDING PANS

Pans can be supplied from 6 ft. to 11 ft. with either solid or perforated bottom for grinding clay or shale. Flat belt or Vee-belt drive as required.

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ENGINEERS AND FOUNDRERS — ESTABLISHED 1898
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HEAVY STEEL FABRICATIONS • BIG CAPACITY MACHINING • GREY IRON CASTINGS

Above:
Total weight: 40 tons.

Notes - Chapter One

1. The Basic process of making common bricks for houses is referred to, whereas the title refers to the variations which are bound into the common process to produce special bricks, such as the slop moulded and London breeze bricks.
4. Ibid., p.533.
10. Young, D. Brickmaking at Sandleheath, Hampshire. Industrial Archaeology, November 1970, p.239.
11. Ibid.
14. Ibid.
19. Ure, A. Dictionary of Arts, Manufactures and Mines, 1860 edition (Robert Hunt was the editor of this work and the later editions), p.447.
27. Wilson, op.cit., p.534.
30. Wilson, op.cit., p.534.
31. Combination of sources.
33. Wilson, op.cit., p.534.
34. Young, op.cit., p.440.
36. Wilson, op.cit., p.534. They were not altogether abandoned.
39. Ibid.
40. BEJANZ, 23:02:1889, p.150.
41. Knight, op.cit., p.378.
42. Building News, 03:06:1870, p.VIII.
43. Hazleton, W. The Charm of Brickwork. Thesis, Bachelor of Architecture, University of Sydney, 1928. Unpaginated. Hazleton may have mistaken a vertical mark along the edge of a brick as a sign of wear or cracking.
45. BEJANZ, 23:02:1889, p.150.
46. Wilson, op.cit., p.534.
47. Burn, op.cit., p.93.
The production of bricks during the first few years of settlement would not allow for a drying period of more than a couple of weeks.

From an 1820s former cross wall uncovered in the north-east ground floor room of the Main Building of the Hyde Park Barracks, 1981 excavation.

Approximately 2,000 bricks were examined. Some good examples survive just out of Mudgee and others may be seen in photographs of the Holtermann Collection in the Mitchell Library.

Some are described as having but two permanent walls. See Burn, op.cit., p.94, and Knight, op.cit., p.372.

Burn, op.cit., p.94. Knight, op.cit., p.372.

Ibid., p.373. This may have been done when the first kiln was constructed in Sydney.

The above account taken largely from Wilson, op.cit., pp.536 and 537.


Ure, op.cit., 1853, p.271 (and 1873 edition, p.522). Miles Lewis pointed out that the information remained unchanged as of the first edition of 1839, (pers.comm.).


Tomlinson, op.cit., p.189.

Wilson, op.cit., p.536.


Spon, op.cit., 1874, p.660: Cressy maintained that the thickness was maintained "throughout", suggesting that the walls actually inclined, op.cit., p.709.

Wilson, op.cit., p.536. Earlier in the century, wood, brush, furze, straw, brake, or fern faggots composed the regular fuel (Rees, op.cit., Brick, p.3). By the early 1850s, Tomlinson, op.cit., p.189, added coal to the list.

At the old kiln at Mudgee, great piles of timber were found in the vicinity during a visit there in 1977.

The above information is a combination of Rees, op.cit., Brick, p.3; and Wilson, op.cit., pp.536 and 537.

See: Tomlinson, op.cit., pp.188 and 189; Knight, op.cit., pp.371 and 372; Burn, op.cit., p.94; Young, op.cit., p.441.

Wilson, op.cit., p.537.


Young, op.cit., p.441.

Tomlinson, op.cit., pp.186 and 189. Well formed clinkers were also used for ovens or where a resistance to heat was required.
155. Ibid.
157. Twelvetrees, op.cit., p.64.
158. Knight, op.cit., p.378.
159. Winser, op.cit., p.229.
160. Ibid.
163. Ibid., pp.165-175.
164. Ibid., p.169.
166. Ibid.
168. Those bricks formed with a large proportion of organic materials or ash would be lighter than those of pure clay and soil.
169. Ure, op.cit., p.443.
172. Ibid., p.25.
174. Tomlinson, op.cit., p.187 and 188.
176. Hazleton, unpaginated.
177. Tomlinson, op.cit., p.188.
178. There is no reliable documentation on this aspect of brickmaking.
179. Private Tasmanian collection.
182. Ibid., 16:05:1846, p.237.
183. Cox, op.cit., p.28.
184. Ibid., p.29.
185. Ibid.
189. Ibid., p.182. Breeze was also described as "ashes" or "domestic ashes". If it could not be obtained, fine refuse coke "small coal" or sweepings from gashouses could be substituted. Coke was reduced from coal in air-free "close retorts". Breeze was produced from coals consumed in an air rich open grate which retained the sulphur needed to combine with alumina to produce good colour.
190. Builder, 1844, p.615.
191. Ibid.
192. Some brickworks began to specialize in making white bricks, which had been made famous through the developments surrounding the Great Exhibition of 1851. See Building News, 08:07:1858 p.VII. By the late 1950s others were specializing in coloured glazed bricks for "Polychromatic Architecture", Building News, 02:01:1857, p.7.
198. Lenman and Gouldie, op.cit., p.342. These were barrel shaped containers, the clay was churned by blades on a turning wheel.
199. One of the earliest to be reported in Britain was the US patent of Mr B.H. Brown. Builder, 20:09:1845, p.449.
201. Cox, op.cit., p.36.
202. Builder, 17:08:1844, Advert. Fletchers Benneuden (portable) tile machine appears to have worked on the same principle.
203. Low, D. op.cit., pp.261-264. This machine could produce tiles "of any shape and size", including flat and roofing tiles and also bricks "of any shape".

204. Ibid., p.264. Earlier editions should be consulted if available, as often further editions were merely reprints of old information.


208. Ibid.


210. Ibid.

211. Cox, op.cit., p.39. Patent?, but it was promoted by William Irving, "and his backer, Lord".


219. Ibid., 31:05:1851, p.343. Mr Roberts, an architect, had patented the actual brick design. None of the bricks are ascribed to Craven but perhaps the makers used his machines as the advertiser suggests.


221. Engineering, 05:01:1866, Advert.

222. Ibid.

223. Ibid., 25:05:1866, p.351.


224. Illustrated in Spon 1874, figures 1304, 1320, 1324, 1328 and 1329.

225. Ibid., figures 1323 and 1327.

226. Ibid., figure 1325.

227. Ibid., figure 1326.


229. The company by the 1870s was also known as Messrs Clayton & Howlett and Clayton, Sons, & Howlett.


234. Spon 1881, op.cit., figures 481 and 483.

235. Builder, 25:11:1843, p.510. It appears that his occupation was mistaken for his surname in the notice.

236. Ibid.

237. Ibid., 05:12:1846, p.585; and 02:05:1846, p.214.

238. Low, op.cit., p.264.

239. Spon 1881, op.cit., p.192, figure 487.


242. Ibid., p.446.


244. Ure, 1860, op.cit., p.452; Ure, 1878, op.cit., p.530, figure 260.

245. Knight, op.cit., p.374, figure 911.


247. See Bradley and Craven.

248. Clark, op.cit., figures 236-239.

249. Clark, op.cit., p.254, figures 236-239.


252. Park, Benjamin, op.cit., p.90ff.


254. Ibid., p.273.


256. Ure, 1853, op.cit., pp.272-274, figure 202; and Ure, 1878, op.cit., pp.525-527, fig.254.

257. Ure, 1853, op.cit., pp.274 and 275, fig.205.
258. Great Exhibition, 1851, Catalogue, VI, p.310.
259. Ibid.
260. Ibid.
261. Especially for railways, bridges, canals etc., which all required strong bricks, as produced by the slope moulding technique.
262. Chamberlains Catalogue, 1859, p.21. Humphrey Chamberlain, an inventor and authority on brickmaking machines, was Bradley and Craven’s agent.
263. Ibid., p.22.
264. Ibid.
266. Knight’s op.cit., p.374.
267. Australian National Clay Journal, Nov., 1963, p.17, confused the early prototype with this machine, the “1859” machine was not the first plastic brick machine.
268. Clark, op.cit., p.255, figure 240.
269. Ibid.
270. English Mechanic and Mirror of Science, 23:04:1869, figures 1 and 2.
271. This was a strong factor in machine brickmaking of the 1880s to 1920s period in Sydney which constantly led brickmakers to return to the reliable Bradley and Cravens and the Piatt Bros machines. See Partridge, T.O. Brickmaking in New South Wales. John Sands Ltd, (late 1920s), pp.3-15.
275. ABCN, 04:10:1890, p.244.
276. Ibid.
277. Since the 1850s as Bradley and Craven machines were promoted in Chamberlain’s Catalogue of 1859. H. Chamberlain patented his inventions during the 1840s and 1850s and probably later.
279. “Press” was often used as a synonym of “machine”, not to be confused with the type of press which re-pressed bricks from a wire cut or a mould machine.
280. The information on the machines Nos 1-3 was found in the R.E. Craven, Letter 1976, pp.1-3; ABCN, 04:10:1890, p.244.
281. ABCN, 04:10:1890, p.244.
282. Based on the illustration, figure 2, published in English Mechanic and Mirror of Science, 23:04:1869.
286. Ibid., pp.1 and 3.
287. Chamberlains Catalogue, 1859, p.20ff. It is not known where it was sent to within Australia.
289. BEJANZ, 14:04:1891, p.55.
290. ABCN, 04:08:1885, p.85.
293. The Australasian Ironmonger, July 1886, p.85.
295. As far as this survey is concerned.
296. Fawcett is often incorrectly rendered as Faucett in publications.
298. ABCN, 14:08:1888, p.38.
301. ABCN, 01:11:1890, p.327.
303. CPIA, September 1947, p.4.
304. Partridge, op.cit., p.4.
305. Ibid., p.8.
307. Ibid.
308. Ibid., figure 3.
309. Ibid., figure 4.
310. Ibid., 02:03:1889, p.167, figure 5.
311. Ibid., figure 6.
312. Ibid., figure 7.
313. Ibid., p.168.
315. Ure, 1853, op.cit., p.278.
316. BEJANZ, 03:03:1889, p.167.
318. Ibid., p.257.
319. Builder, 13:09:1851, p.581. The clay was ground up, pulverized and reduced to a "meal" and was fed dry into slightly moistured moulds and subjected to 600 tons of pressure.
322. Ibid., p.256 and 257. See plates XIX to XXV.
323. Ibid., p.257.
324. BEJANZ, 02:03:1889, p.167.
326. State Brickworks until about 1980/81.
327. ANC, April 1962, p.17.
328. Partridge, op.cit., p.3.
332. ABCN, 23:06:1888, pp.420 and 421.
333. BEJANZ, 14:02:1891, p.55.
334. CIPA, August 1943, p.3. Probably described inaccurately as a "semi dry" machine.
335. Visit to the Brickworks late in the 1970s.
336. Partridge, op.cit., p.3.
337. Ibid., p.8.
338. Ibid. Davis, or Davies, was a local manufacturer.
339. Ibid., pp.3-15.
340. Ibid., p.5.
343. Partridge, op.cit., pp.4, 6 and 12. See also Clark and Spon, 1874, p.658, figures 1332-1336.
344. Spon.
347. Ibid.
348. Partridge, op.cit., p.4.
349. ABCN, 01:11:1890, p.327.
353. Railway Guide of N.S.W., 1881, p.65. Though the descriptions are somewhat confusing.
354. Bourry, op.cit., p.117, figure 76.
357. Partridge, op.cit., p.4.
358. Park, Benjamin, op.cit., p.90.
359. Ibid., p.91.
363. Ibid., pp.95 and 96, figure 5.
365. Ibid., pp.376 and 377.
367. Ibid., pp.130 and 284, figures 92 and 194.
368. Ibid., p.130, figure 93.
369. Spon, 1874, op.cit., p.653, figure 1325.
371. Ibid., p.131, figure 94.
373. Ibid., p.150.
375. One such was being replaced at the Sherwood Brick and Tileworks in March 1891, *ABCN*, 14:03:1891, p.198.


377. Spon, op.cit., p.185, figure 480.


379. Ibid., 18:08:1888, p.126.


381. Knight, op.cit., p.372.


384. Ibid., p.145: Ure, 1860, op.cit., p.446. The Robert Schrivener of Shelton, Staff. was one such patent.


386. Ibid., 05:12:1846, p.585.


391. Spon, 1874, op.cit., p.2182.

392. Griffin, op.cit., p.158. Hudson believed that the first continuous kiln was used from 1856. Hudson, op.cit., p.145.

393. Several are described in Spon, op.cit., pp.2181-2185. See also *BEJANZ*, 21:07:1888, pp.32 and 33; Griffin, op.cit., pp.157-160. Bourry, op.cit., pp.219-221; Knight, op.cit., p.371; *ANC*, November 1963, pp.13 and 17; etc.

394. Griffin, op.cit., p.158.


396. Cox, op.cit., p.42.


399. Spon, op.cit., 1874, pp.2180 and 2181.


401. Griffin, op.cit., p.158.

402. *ABCN*, 04:10:1890, p.244.

403. Ibid., and also *Australian National Clay*, November, 1963, p.17. The *ANC* gives the location as at "Roundwood in the West Riding of Yorkshire".

404. *ABCN*, 04:10:1890, p.244.


408. Griffin, op.cit., p.158.


410. Bourry, op.cit., p.221. Buhrer experimented by replacing the chimney with a fan with positive results.

411. Ibid.


413. Index to *NSW Letters of Registration of Invention*, 1854-. 31:07:1887, No.154.

414. Ibid., No.1254.


419. Ibid., 02:02:1889, p.106; and 15:06:1889, p.559.

420. Partridge, op.cit., p.3.

421. Ibid.

422. Ibid. One was dismantled and set up in Mr Hayes, Oaks Steam Brickworks at Neutral Bay with some success. (See Holden, op.cit., unpaginated.)


428. Ibid., pp.8 and 9.

429. These bricks were used for internal walls and walls receiving stucco.
432. Ibid.
434. Ibid.
435. A similar situation existed in England by the 1840s, where it was said that the general use of stucco was encouraged because of the poor bricks. In Australia, the fashion was followed. *Builder*, January 1848, p.34; reversal 20:11:1847, p.552.
436. The style in Australia was later called the "Federation Style".
440. Ibid., 23:01:1847, p.42.
441. Ibid., 20:11:1847, p.552.
442. Ibid., 01:1848, p.34.
443. Ibid., 02:09:1848, pp.422-424.
445. Ibid., pp.317 and 318.
446. Ibid., M. Chaudet, Jun., received litigation first, soon after the Great Exhibition.
447. Ibid.
448. Cox, op.cit., p.37. A drawing of the machine was published in 1841, see p.38.
452. Ibid., pp.451 and 452: Ure, 1878, op.cit., p.529.
453. Cox, op.cit., pp.44 and 45.
456. Chamberlains Catalogue, 1859, p.22; Clark, op.cit., figure 232.
458. Spon 1874, figures 1320, 1304.
460. Ibid., 02:02:1850, p.53.
461. Ibid., 30:03:1851, p.152.
466. See also Ure 1860, op.cit., pp.454 and 455, figure 281, for a machine patent.
468. Knight, op.cit., p.320.
470. Ibid., 18:10:1851, advert.
471. Ibid. Supplied by Messrs Matthews and Warren, Stevenage, Hertfordshire.
472. Ibid., 10:06:1843, p.224.
473. Ibid., 29:03:1851, pp.206 and 207.
475. Ibid., 06:02:1857, p.135.
476. *Builder*, 12:07:1851, p.438. The article was on the topic of "hollow bricks, etc."
477. Ibid., 17:08:1850, pp.390 and 391.
479. Ibid.
482. *Building News*, 09:07:1858, p.VII.
483. Spon, 1874, op.cit., figure 1325; Bourry, op.cit., figure 197.
484. Bourry, op.cit., figure 94.
487. Ibid., p.305.
489. *Journals of the House of Commons*, 28:02:1725; Cresy, op.cit., p.710. Was of the opinion that red stocks were kiln burned and grey stocks were clamp burned.
490. Wilson, op.cit., p.533.
494. Wilson, op.cit., p.533.
495. Cresy, op.cit., p.710.
496. Wilson, op.cit., p.533.
497. Cresy, op.cit., p.710.
500. Ibid., p.191.
502. Ure, 1878, op.cit., p.520.
504. Wilson, op.cit., p.533.
509. ABCN, 18:06:1887, p.07 (referring to England).
511. Knight, op.cit., p.370.
512. Ure, 1878, op.cit., p.520.
513. Ibid.
515. Building News, 09:07:1858, p.VII.
517. Ure, 1878, op.cit., p.520.
518. Spon, 1881, op.cit., p.190.
519. On manganese and iron oxide.
520. Ibid., p.189.
521. Ure, 1878, op.cit., p.520.
523. Refer to the Australian section.
527. Rees, op.cit., Brick, p.3.
528. Cresy, op.cit., p.710.
530. Ibid.
531. Ibid. Large blocks called "lumps" were also made of Stourbridge clay and were used for the construction of furnaces.
533. Ibid.
534. Ure, 1879, op.cit., p.373.
537. Edward Cresy, Encyclopaedia of Civil Engineering. New Impression, London 1880, p.710. The text and illustrations of the "new impression" appear to date to the 1840s or early 1850s, though neither the brick duty or any mention is made of the famous machines of the 1850s.
540. Ure, 1860, p.455.
541. Cresy, op.cit., p.710.
543. Knight, op.cit., p.369.
544. Ure, 1878, op.cit., p.532.
545. Compare the general statements in Spon, 1881, op.cit., p.188 with Ure, 1879, op.cit., p.373. There are many such examples.
547. Ibid., pp.372 and 373.
548. Ibid., p.372.
549. Ibid., pp.373 and 374.
552. Brickmaking and lime and charcoal burning were considered very unpleasant occupations, usually reserved for intractable types.


556. Ibid., p.16. Forty wheelbarrows, however, were ordered but this was for general purposes (18:08:1786).


560. Bricks on Norfolk Island dated to about 1792 measure 8-15/16x3-3/4x2-3/4.

561. Sporadic examples may have occurred. The irregularity of this brick leads me to suspect that it was deliberately selected for its "charm". It also displays grass and gum leaf impressions.


563. Ibid.


567. Collins, op.cit., p.115


572. Ibid. He also made the distinction in prices between delivered and "at the kiln".

573. Cobley, op.cit., p.158.


575. Freeland, op.cit., p.146 (9x4x2-3/4).


577. See *Gazetteer of Sydney Brickmakers*.

578. Worgan, George B. *Journal of a First Fleet Surgeon*. Sydney, 1978, p.39. Worgan was referring to between the 23rd and 27th of February, "this last week", written on the 28th February 1788.


581. Found in the vicinity of the First Government House site.

582. Worgan, op.cit., p.44.

583. Collins, op.cit., p.30. It should be noted here that clamps were sometimes referred to as "kilns".

584. Tench, op.cit., p.137 (18th December 1788).

585. Ibid., p.144. The plural for "kiln" was again used here.


591. *HRNSW*, vol.1, part 2, pp.352 and 353.


594. Ibid.


597. Ibid., p.147.

598. White, op.cit., p.146.

599. Collins, op.cit., p.117.


601. Thompson, George, *Private Journal in Slavery and Famine*, London 1794. (He was in the Colony in 1792.)


604. Collins, op.cit., vol.I, p.275. This was an escape from gaol.

613. Sydney had 46 and Parramatta 52 but some could have been transferred from Sydney to Parramatta but as Tench gives us these figures under the date of November 1790, this seems unlikely.
614. *HRNSW*, vol.1, part 2, p.435. There were 12 men "most of whom" had been employed at brickmaking in Sydney. The venture was unsuccessful because of a deficiency in the "clay". (There are no suitable clays on the Island.)
615. Ibid., p.788 (29:10:1791).
617. Ibid., pp.340, 525 and 752.
618. Ibid., p.750.
620. Ibid., p.186.
621. Ibid., p.922.
623. Ibid., p.616; vol.5, pp.183, 312 and 500.
625. Ibid., p.616.
626. Ibid., pp.662 and 780.
627. Ibid., vol.6, p.179.
629. Ibid., p.232.
631. Brickfield Hill as defined during the late Eighteenth Century was most likely the rise up towards Central Railway Station not the side where Anthony Horderns built their Emporium.
633. Ibid., p.103.
634. Ibid., pp.27 and 278.
639. For example: *Sydney Gazette*, 17:04:1802, p.4; 16:08:1803, p.4.
642. Ibid., 23:03:1811, p.2; 13:07:1811, p.1, etc.
643. Ibid., 05:10:1811, p.1.
645. Ibid., vol.7, p.429.
646. Richie, op.cit., p.144. Kitchen judged the "outside Bricks" as "extremely good -- a proof of what this part of the Colony is capable in that way".
648. Ibid., p.29.


652. Ibid., pp.19 and 20.


655. Cunningham, op.cit., p.66.

656. Ibid., p.63.


658. Ibid., p.15.

659. Ibid., p.27.


663. *JRAHS*, vol.2, p.245.


666. See the Gazetteer of Sydney brickmakers.

667. Ibid.

668. Ibid.

669. The above information was abstracted from lists of precisely dated brick.

670. None of the brickmakers of the 1870s to 1890s who left records assert anything prior to the close of the 1860s at the very earliest.


675. See *Gazetteer and the Centennial History of NSW, 1888*, biographical section which differs from volume to volume).
Names and initialed bricks from various places. Note Bradford/Balmain in 113 (prob. 1860s). Note the Red Cross brick in 114 (Warwick Gemmell Collection).
Chapter Two

Gazetteer of Sydney Brickmakers

1788-ca.1956

In a previous study on brickmaking, I recommended that a gazetteer of brickmakers should be compiled as an aid to dating bricks. Apart from the obvious applications of a gazetteer, common bricks found in association with marked bricks, (often double-pressed for decorative purposes), may have been produced by the same brickmaker. If several instances can be found to confirm this, other common bricks may be identifiable on form and function alone. Such identification may also be possible when bricks may be studied from buildings which are known to have been supplied by a particular brickmaker.

The greater value of the following gazetteer applies to the latter half of the nineteenth century and later when brickmakers sometimes stamped an initial or initials on their bricks to distinguish them for crediting after burning, (as sometimes several brickmakers burned their bricks in the same kiln). Sometimes the moulds of machine-made bricks included initials or even names set in the frog, for example: "R.COOK", Rupert Cook; "R+C", Red Cross Brickworks; "G T NEWTOWN", Goodsell and Tye, Newtown; "NB", National Brickworks, etc. However, initials before the 1850s quite often refer to a property name or property owner for which the bricks were intended, (mainly to discourage theft). From about the 1840s to the 1870s, symbols were often used, such as a heart, diamond etc., to distinguish brick moulder from brick moulder; unfortunately, many yards used the same set of symbols. An arrow indicated that a brick was Government property and usually date from the early to mid-1820s to the 1830s; the more elaborate arrows sometimes found in buildings of a much later date indicates a mischievous brickmaker who adopted this symbol as his own.

The gazetteer spans the period 1788 to about 1956. The chief sources are all the available post office and manufacturing directories from 1839 to 1956, but even this period is not covered uniformly. The period from 1857-1932 is fairly reliably covered because of the Sands' Directories which give fairly specific details of address.
Directories before this period are sporadic and incomplete (rarely mentioning the lowly trade of brickmaker). The manufacturing directories from 1919 rarely provide more information (under the particular headings) than the name of the company or maker and the suburb: unfortunately, gaps exist in the run of these directories (in available collections) during the 1950s and 1960s. Telephone directories have been used to supplement the other directories but few are available for reference.

It should be remembered, in the case of the directories, that the information was collected during the year previous to that issue but this has not been allowed for in the gazetteer. In a few instances the list for the previous year was duplicated in toto for the next. The spelling of names often varies but is usually corrected in subsequent issues. Not too much emphasis should be placed on the exact wording of a company name (though variations are acknowledged in the text). In some cases certain names have been omitted from one directory but continue to be listed in others, resulting in a weakness in the gazetteer. Changes of address, which have been noted in the gazetteer, often only indicate a change of name of a street, suburb or area. Formerly, some suburbs were only roughly defined, creating anomalies because of overlaps with other suburbs. In some cases where a brickyard was surrounded by two of more streets, it was not unusual for the access to the works to be changed from street to street without any shift of the actual yard. By consulting early maps or street directories, ostensible shifts of site may be confirmed or otherwise. A typical case involved the site of the present day Camdenville Park, Newtown which was in the hands of a Goodsell by the late 1840s and was probably known at first as "Goodsell's", it was subsequently known as "Goodsell and Tye's", "Alfred Tye's" and "Newtown Brickworks", "Frederick Goodsell's", "Goodsell Brothers", "Newtown Steam Brickworks", "Spear's Brickworks", "D. Spear's", "S. Spear's", "Mrs F. Spear's", "Spear's Brick and Pipe, Tile Works Ltd". Just about every member of the Goodsell family was given an address location at that site at some time in Sands' Directories. The earliest address for the site was simply given as "Cooks River road, Newtown" (or St Peters) and later as "May street", "John street", "Lord street" and "Goodsell street". One could be forgiven for assuming that there were a score of brickyards involved over the years, whereas an examination of early maps, with the help of some incidental references, reveal that only one site is involved.

Incidental references have been used to flesh out some entries. In some cases the inadequacy of the directories may be observed when a more reliable source has been found. Rupert Cook's career is an interesting example; he was still listed in 1873 when he had actually left for England and had returned for about five years before he was included in Sands' Directory, even though he was still active in the brick trade.
Recent studies on brickworks such as Thornleigh Brickworks have not been incorporated in the gazetteer. It is interesting to note however that despite the works having been opened in 1902, one would find nothing in the directories under "Thornleigh" but one would need to know that the works were listed as "National Brickworks Company Limited". A similar case is the Lion Tile Company: this company was not listed in the directories as such until 1952, which could lead the researcher to conclude that it was a very recent company, if the researcher did not know that it was called the Australian Brick Company or the Australian Brickworks Limited, established in about 1911.

The period 1788 to 1856 is poorly represented in the gazetteer because of the nature of the source material. Up to 1800 only four brickmakers were mentioned by name by contemporary sources, James Becket, James Bloodworth, John King and Samuel Wheeler, as they headed various gangs of brickmakers. Each "master" or " overseer", however, may have represented between 20 and 50 or more men, ranging from actual brickmakers to labourers with no skill. The richest sources for brickmakers from 1800 to 1839 are the various censuses but only the 1828 census has been culled because of easy accessibility. Incidental references have been used from primary and secondary sources covering this period. Every directory dating between 1839 and 1857 has been painstakingly culled for references to brickmakers but the results were very disappointing. It is hoped that eventually the newspapers, court records and Government contract records will be processed to close the gaps. The value of the gazetteer, however, is chiefly applicable to the period when some brickmakers began to identify their bricks with initials, names or unusual symbols (apart from such symbols as diamonds, hearts, rectangles etc., which are fairly useles for definite identification) from the 1840s onwards but chiefly from the 1870s.

There are not many categories of building materials which would benefit from the compilation of a gazetteer as an aid to dating. The only materials for which this would be beneficial would be those with individual markings and were of an enduring nature. Tiles (wall, floor or roofing) would make a worthwhile subject for such a study. Most wall and floor tiles were imported from Britain before the 1920s and studies of markings and makers have been published within recent years. Some work has also been done on the major producers of roofing tiles (local and overseas). Though the subject of tiles would make a more worthwhile subject for a gazetteer, as they were more distinctly marked, they make little general impact until the 1890s and even then on a very restricted scale. Bricks have been continuously made (and imported) from the initial year of settlement to the present day.
ABBOTT - see Riley
ACOTT, George - see George Ascott
ACTON, Thomas By 1814-1819: Parramatta
ADAMS, George
1828: Sussex street, working for Thomas Street
ADAMS, Thomas
1880: Frenchs road, North Willoughby
ADDISON BROTHERS BRICKWORKS
1907-1909: Denby street, Marrickville
ADDISON ROAD BRICKWORKS
1907-1909: Denby street, Marrickville
AEROCRETE NSW LIMITED
1930-1932: Bay street, Botany
AHERN, Nathaniel
1884: Elizabeth street, North Willoughby
ALBION BRICKWORKS
1884-1894: Unwins Bridge road, St Peters
ALDERTON, W.S.
"Secretary and Manager", 1915-1917, of the City Brick Co. Ltd.
ALEXANDRIA BRICK and TILE COMPANY PTY LIMITED
1953: Alexandria
ALGIE - see Excelsior and Metropolitan Brickworks.
ALLEN, John
1863-1873: 1863, Cooks River road, Newtown; 1869, Camperdown road, Camperdown; 1863,
1873, Ross street, Parramatta road, Camperdown
ALLEN, Richard
1887-1890: 1887 and 1888, Landowne street, Granville; 1890, Granville parade, Granville
ANDERSON, D. (Standard Brickworks)
1885: Sydenham road, Marrickville; office, 16 Bond street
ANDERSON, D.M. (J.P.)
1911-1916: Rhodes street, Meadowbank
ANDERSON, Francis
1858-1859: Wilson street, Newtown
ANDERSON, H.P.
1926-1932: Pacific parade, Dee Why
ANDINA, Giuseppe (abstract of article)
1891: son of the most noted Italian brickmaker, Firma Andina at Tortona, Piedmont. Installed
two extensive brick factories and a limeburning factory at Buenos Aires on his own patent (Italy
and USA).
Engaged with Baron Cavalcini in a series of experiments on Sydney area clays. Small
experimental kiln at his home at North Sydney. Signor Tailarico supplied fine white clay from
Gosford, (a type of pure kaolin), which was modelled into a bust. Clay from Signor Favesi's
property at Merrylands and some from Lane Cove were found good for floor and roofing tiles,
(the terracotta turned out a 'light Venetian red').
Andina machine to produce 50,000 bricks per day, ("and similar articles"). Uranium, Iridium,
Cobalt and Iron etc., to be imparted to produce bricks and tiles to any colour, glazed and
unglazed. Italian workmen to come out for a while. Andina to return to Italy end of September
and return to Sydney in March.11
Nangle (or the president) made roofing tile dies "for a maker named Andini".12
ANDREW, E.T.
Secretary of the City Brick Co. Ltd., in 1911 (as listed in the Directories)
ANDREWS, William
1886: George street, Burwood
ANNABEL, Ernest
1893 and 1894: Mary street, St Peters
ANNABEL, John
1889-1898: Mary street, St Peters
ANNABEL, Thomas
1889-1892: Mary street, St Peters
ANNABEL and COMPANY - see Albion Brickworks
1890 and 1891: Unwins Bridge road, St Peters

ANNABEL and JONES BRICKYARDS
Listed in "The Echo" as one of the principal industries of St Peters

ARGYLES, A.R.
Manager, 1913-1915, of the Northern Suburbs Brick Co. Ltd.

ARGYLL BRICK and TILE COMPANY
1920-1932: Park road, Enfield

ASCHE, John
Formerly of the Warren Brick Co., and later representative of the Metropolitan Brick Co., for the North Sydney area by 1902. He was manager of the Austral Brick Company in 1912.

ASCOTT, George
1871-1904: 1871, Balmain road, Petersham; 1873, George street, Leichhardt; 1884-1892, Brixton road, off Joseph street, Rookwood; 1893-1904, Kerr's road, Rookwood.
Note: the surname is often rendered as "Acott".

ASHCOTT, George
1819-1828: Arrived in Sydney in 1819. By 1828 was working for John Harris, Bathurst.

ASHFIELD BRICK COMPANY LIMITED
A long gap occurred from 1932 to 1947 in the directories. In 1947 it emerged as, "Ashfield Brick Co. Pty. Ltd" at the same address. Frederick E. Greenwood (ACIS), was listed as manager from 1916 to 1918 and Eric Gudgeon from 1927 to 1932.
Products; 1916, "Lace Bricks a Specialty"; 1917, "Manufacturers of every description of Bricks.

ATKINSON, D.
1883: Sydenham road, Marrickville

AUBURN BRICK COMPANY LIMITED
1907-1945: 1907-1924, Princes road, Auburn; 1927-1945, Park road, Auburn (Regents Park). The works were always situated with the corner of Princes road and Park road.
The company was styled as the Auburn Brick, Tile and Pottery Company (Limited by 1922), during the years 1907-1919, 1920-1926; and the Auburn Brick Company Limited during the years 1911-1945.
Products: 1911-1914, "Manufacturers of all classes of Bricks".

AUBURN BRICK, TILE and POTTERY COMPANY - see Auburn Brick Co. Ltd.

AUSDEN, A.C. and PROSSER, R.
1914-1965: Waterloo

AUSTEN, Thomas - see Thomas Austin

AUSTIN, J. and E.
1888 and 1889: Archer street, North Willoughby

AUSTIN, Thomas
1888: Archer street, North Willoughby. In 1889, Thomas Austen [sic] was listed as the manager of the North Willoughby Brickyards

AUSTRAL BRICK COMPANY LIMITED
1910-1965: King street (now Princes highway), and Cowper street
David R. Rogers was listed as manager from 1913 to 1927 and Leonard E. Rogers from 1928 to 1931. By 1935 the manager was William K. Dawes. Dawes was the great grandson of George Dawes, representing the fourth generation of the family to engage in brickmaking in Australia.
Although the first directory reference to the company dates to 1910, the company appears to have been established a few years before. See New Austral Brick Company.
Products; 1910-1931, "Manufacturers of all classes of bricks".

AUSTRALIAN BRICK COMPANY
1911-1919: Liverpool road, Enfield
T.E.Rolfe was listed as the proprietor from 1912 to 1914. Thomas Cottrill was manager in 1915.
The company was registered by 1911 as the Australian Brickworks Limited. The name of this company was also called, by 1919, the "Lion Tile Company" which operates to this day.

AUSTRALIAN BRICKWORKS LIMITED
1911:- Liverpool road, Enfield
This company first appeared in 1911 with a registered office at 58 Hunter street. It was also known as the Australian Brick Company. Their chief works were at Liverpool road, Enfield and to the present day operates as the Lion Tile Company. The French's Forest "Australian Brickworks" may have been a branch of their operations.

AUSTRIAN PIGMENT and FIRE BRICK COMPANY LIMITED
1925-1938: Botany road, Waterloo

AUTO BRICK INDUSTRIES PTY. LIMITED
1965: Marsden Park and Blacktown

AYLES and SANDS - see Eyles and Saunders
AYLES and SAUNDERS - see Eyles and Saunders

BAGNALL, W.H.
Manager (?) of Shannon's Brick, Tile and Pottery Co. Ltd., listed in 1928 and 1930.

BAILEY, J.
1885: Railway road, Prospect and Sherwood

BAKER
One of the elected directors in 1886 of the Eight Hours Co-operative Brick, Tile and Pottery Co.

BAKER, John
1819 and 1820: Although at the time employed as a brickmaker at Newcastle, he may have begun his Australian career in Sydney.

BAKER, Thomas
1890-1894: Highgate street, Auburn - see Baker and Hilton

BAKER and HILTON
1891-1897: Highgate street, Auburn - see Thomas Baker - see R. Hilton

BAKEWELL BROTHERS, "BEULAH" BRICKWORKS
1886-1956: Concord and Coulston streets, Erskineville
By 1890, it was claimed to be the largest brickworks, along with Ives' brickworks in the Colony and had received a wide reputation during the 1880s. A description of 1893 revealed the manufacture of "bricks, drainpipes, terracotta and sanitary ware". A fuller description was given in 1894 where skillful burning (and use of clay), resulted in bricks of red hues and white bricks. The works also produced terracotta, sanitary ware, pots, garden vases, finials, panels and "crestines".
Some of the better class wares were said to have been used at the residence of a Mr Phillip Charley at Richmond. The figures and other works were made by "Mr M. de Leysalle". Naason Dawes was listed as the manager from 1892 to 1904 and Mr Symonds as "superintendent" in 1894.
Messrs Bakewell Bros. were comprised of three brothers, William, John and Thomas. The latter two died in their 40s and William died late in 1916 or early in 1917, aged about 65. William had five sons but only two survived him.
Sands Directory lists Bakewell Bros. as "Brick and Pottery Works" for the first time in 1897 but were listed under "Potteries and Potters" since 1891.
William Bakewell applied for a contract to make 500,000 machine made bricks at £2/5/0 per 1,000 in 1902. A double pressed and moulded brick machine by Fawcett's of Leeds was first used at the Beulah brickworks. By 1902, they advertised common, double pressed, fire and glazed bricks; drain and agricultural pipes and connections; architectural and artistic terracotta; chemical and sanitary goods; and "Pottery Ware of all descriptions". By 1908/1909, they advertised, "Chemical and Sanitary Goods and Pottery Ware of all descriptions". Part of their operations included the Beulah Brickworks.

BAKEWELL and CURLEWIS
Proprietors of the Warren Brick Co., listed from 1912-1915.

BALDOCK, F. and H., "London Pottery"
1882: George street, Camperdown

BALLAH, Joseph C.
1887: Terry street, St Peters

BANKSTOWN BRICK and TILE COMPANY LIMITED
1921-1937: Oxford avenue, Bankstown

BANKSTOWN BRICK WORKS
1914-1920: Oxford avenue, Bankstown. After 1920, operated as the Bankstown Brick and Tile Co. Ltd.

BANKSTOWN TEXTILE BRICK COMPANY
1952: High street, Bankstown

BARHAM, John
1818-1828: By 1828, employed by John Martin, Castlereagh street

BARKER, Benjamin
1827-1828: Employed by Thomas Street, Sussex street

BARLING, Charles
1867: Unwins Bridge road, Marrickville

BARNES, James
1844-1845: Glebe

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BARNES, Thomas
1817-1828: By 1828, employed by Thomas Whitfield, Parramatta
BARNEY, Philip
1813-1818: By 1828, employed by Simeon Lord at Botany
BARNEY, Thomas
1863: Redfern street, Redfern
BARR, Joseph
1863: Cooks River road, Newtown
BARTLETT, Thomas
1828: employed by Thomas Street, Sussex street
BARRY - see Ryan
BATES, Robert
1880: Raglan street, Alexandria; 1886-1889: 412 King street south, Newtown
BATHGATE, A.
1877: Sydenham road, Marrickville
BEACON BRICKS LIMITED
1921-1924: Brookvale via Manly
There was also a Beacon Bricks Ltd at Lithgow from 1921
BEATIRO, Daniel
1884: Elizabeth street, North Willoughby
BEAUCHAMP, George
1887-1888: Calvert street, Marrickville - see Model Brickworks
BEAZELEY - see Langton and Beazeley
BEBB, John
1883: 336 Cleveland street, Redfern
BECKET, James
1790: Arrived in June 1790 and by November had a gang of 52 men at Parramatta. He was sent from Sydney in September in order to make bricks for a large storehouse and a range of barrack. Becket may have remained in the area, as he was permitted a grant at Toongabbie on 05/08/1806.
BECKET'S GANG - see James Becket
BEDFORD BRICKWORKS
1893-1909: Barwon Park road, Alexandria; 1910-1932, King street, St Peters; 1952, St Peters Bridge, St Peters
Josiah Gentle was listed as the proprietor from 1895-1932. The Brickworks were founded by Josiah Gentle and specialized in the dry process. After his death it was sold to the Austral Brick Company but the name was retained. Products stamped “J.G.” for Josiah Gentle.
BELL - see Brittleff and Bell
BELL, Robert
1884: Elizabeth street, North Willoughby
BENNETT, William
1884: Croydon road, Ashfield
BENSON, WALKER LIMITED - see Walker, Benson Limited
BENTLEY, George
1877: Sydenham road, Marrickville; 1885-1886: Coventry road, Strathfield, late Homebush
BENTLEY, James
1869: Victoria road, Marrickville
BERLIN, Charles
1869: May street, St Peters
BERRY, Robert
1819-1828: By 1828, he was employed by James Chisholm, St Andrews, Minto.
BEULAH BRICKWORKS (BAKEWELL BROTHERS LIMITED)
1908-1932: Mitchell road, Alexandria
BILL and HALLORAN
1921: Mona Vale
BIRCH, William
1820-1828: By 1828 at Parramatta
BIRNIE, Henry
1871: Lord street, Newtown
BLACKALL, John
1866: Glebe street, Glebe
BLACKHALL, William
1858: Franklin Place, Glebe. 1871: Abattoire street, Petersham
BLAMIRE, Anthony
1870-1886: 1870, Sydenham road, Norwood; 1871, Sydenham road, Marrickville; 1875-1876, Wardell's road, Marrickville; 1883, Dunstaffenage street, Canterbury; 1884, Beaconsfield street, Canterbury; 1886, Dunstaffenage street, Canterbury
BLAMIRE, Anthony and Son
1880: New Canterbury road, Petersham - see Blamire, Anthony
BLAMIRE, Richard
1883-1897: 1883, Dunstaffenage street, Canterbury; 1884, Critchau street, Canterbury; 1886-1887, Dunstaffenage street, Canterbury
BLAMIRE, Thomas
1887: George street, Canterbury
BLIZZARD, James
1884-1889: 1884, Tebbutt street, Leichhardt; 1886, Davies street, Leichhardt; 1887, Lord's road, Newtown; 1889, Tebbutt street, Leichhardt
BLOODWORTH, James
1788-1804: He may have been the first to make bricks in Australia (in 1788), and instructed many in the trade as he supervised the first gangs. He was also a master bricklayer and the first builder.
BLOODWORTH, James Bellamy.
A son of James Bloodworth, was said to have supervised convict gangs as a master brick maker during Governor Bourke's time.
BLOOMFIELD, James
1863: Marrickville
BLOOMFIELD, S.
1904-1908: French's Forest road, Manly
BLOOMFIELD, Samuel
1867-1880: Chapel street, Marrickville
BLUMISE, A.
1877: Sydenham road, Marrickville
BLUNT, Charles
1883: Manager of Waddington's Steam Brickworks, Waterloo road, Alexandria - see Waddington's Steam Brickworks.
BLUNT, George
1882-1887, 1882, Bishop street, St Peters; 1883, Victoria street, St Peters; 1885, Lane Cove road, North Willoughby; 1886-1887: Victoria parade, North Willoughby
BOARD, T.A.
Listed as secretary of the Standsure Brick Co. from 1889 to 1897.
BOULTON, William
1869: Silver street, St Peters
BOOTS, Harry
1890: George street, Enfield
BONES, E.
1886: Punchbowl road, Canterbury
BONDI BRICK COMPANY LIMITED
1919-1921: Matilda street, Bondi
BONDI SAND-LIME BRICK COMPANY (LIMITED, 1926)
1912-1923: Sophia street, North Bondi, (Waverley)
BONNIEDOON FIRECLAY BRICK, TILE and POTTERY COMPANY
1932 and 1932: March street, Arncliffe
BONYER, Edward
1863: 2 Bay street, Glebe - see Boyer
BOOTH, John
1844-1834: Frankford, Newtown
BOSTOCK, William
1886: New Canterbury road, Canterbury
BOTTLE, William
1871: Parramatta road, Burwood
BOWEN, Charles
Listed as proprietor during 1893 and 1984 at the Crown Plastic Fire Brick Co., and during 1896 and 1897 at the Chatswood Brickworks.
BOWEN, John (senior)
1882: Homebush
BOWEN, John (junior)
1882: Homebush
BOWYER, Samuel
1811-1828: By 1828 he worked in Sydney, Sussex street.
BOYCE, William
1819-1828: Employed by John Raine by 1828 at Parramatta.

BOYD, John
1883: Bluegum Creek road, North Willoughby

BOYER, Edward
1866: Bay street, Glebe - see Bonyer

BRADFORD and COMPANY
1867 and 1868: Donnelly street, Balmain.
Bradford and Co. exhibited at the Paris Exhibition of 1867 the following pieces: one square fire brick; fire tiles, 6 x 12, 12 x 12, 15 x 12, 18 x 12 and 24 x 12 inches; one cupular brick; one skew-back brick; two chimney pots; and two garden tiles. His bricks were marked "Bradford/Balmain".

BRADSHAW, Samuel - see Emery and Bradshaw

BRADSHAW, Thomas
1890: Mitchell road, South Alexandria

BRADSHAW, William
1873: Cooks River road, Newtown; Mitchell road, South Alexandria; Crown street, St Peters.

BRAND, R.
1883: Off Boundary street, Burwood

BREEDON, J.
Listed as manager of the Merrylands Steam Brick works from 1896 to 1898.

BRENNAN, Peter
1884: The Crescent, Ashfield

BRETT, James
1880s/1890s: After the introduction of steam machinery, he became a shopkeeper for many years.32

BRIAN BROTHERS
1885: Sydenham road, Marrickville

BRIANT, William
1885: Woodlands street, Marrickville

BRICK COMPANY - see Brickmakers Association

BRICK and PIPE COMPANY LIMITED
1920-1934: Enfield

BRICK and TILE WORKS
1897: Herbert street, Willoughby. (Possibly associated with J.D. Wilson).

BRICKMAKERS ASSOCIATION
1893 and 1894: Commonly referred to as the "Brick Trust", "Brick Company" and "Brickmasters Association". It was an amalgam of various manufacturers to control the trade. It caused the price of bricks to fall by providing cheaper bricks in January 1894.33 Some brickmakers accused the Association of causing bankruptcy by September 1894, by being selective in the work handed out to its members.34 The Association may have been disbanded before the formation of its successor, the NSW Brick Co., around the turn of the century.

BRICKMASTERS ASSOCIATION - Brickmakers Association

BRICKS and TILES (GOULBURN) LIMITED
1926-1930: An agency with an office at 67 Castlereagh street

BRICK TRUST - see Brickmakers Association

BRICKWORKS (PTY) LIMITED
1934-1965: This was formed in 1934 by a number of Sydney brick manufacturers. It purchased the Thornleigh Brickworks in 1938 from the Suburban Land and Investment Co. Ltd.35 The company was recorded with other brick manufacturers from 1941 to at least 1965. In 1952, their office was located at 12 Castlereagh street. The company purchased the Burwood Brickworks and made it its headquarters.

BRIGGS, T.
1871: St Marys street, Camperdown

BRITTLEFF and BELL
1931 and 1932: Castle Hill

BROCKWELL BROTHERS LIMITED
A misprint for Bakewell Brothers

BROWN - see Lloyd

BROWN, A.H.
Listed in 1898 as proprietor for the Crown Plastic and Fire Brick Company

BROWN, G.
1817: Supplied bricks for Sydney Gaol.36

BROWN, Henry
1880-1882: 1880, Off Unwins Bridge road, Marrickville; 1882, Homebush

BROWN, Henry (junior)
1880: Off Unwins Bridge road, Marrickville
BROWN, John Alfred
1880: Canterbury

BROWN, John Alfred
1880: Canterbury

BROWN, Robert
1797-1828: By 1828 he was operating as a brickmaker at South Head road.

BROWN, W.
1877: Norton street, Ashfield.

"William Brown, of Ashfield", "among the builders I knew in those days", (1880s/1890s), "he was a man of wonderful disposition, a thorough gentleman, as honest as the sun, and esteemed by all who came into contact with him". A son of the founder of the original firm of Brown and Sons, builders of Sydney. The father, "a small, active man, known in the trade as "Possum Brown" on account of his manner and ability to climb and run on very high buildings". William and his brother, John, under the trade name of "W. and J. Brown", did the brickwork of a large portion of the Technological School at Ultimo.37

BROWN, William
1799: He arrived in July 1799, as a brickmaker.38

BROWN and COMPANY
1889 and 1890, Beach street, Rockdale

BROWNING, William
1890 and 1891: St Peters street, St Peters

BRUTON, Thomas
1885: "Linda Cottage", Inkerman street, Parramatta

BRYAN, John
1854, 1864 and 1865: Waterloo
John Bryan of Newtown exhibited bricks for smelting purposes at the Paris Exhibition of 1855.39

BRYAN, William
1844 and 1845: Glebe

BRYANT, Henry
1880: Wyndham Grove, Alexandria

BURLING, Charles
1877: Waterloo Estate, Alexandria

BURLING, John
1870-1888: 1870-1886, Maria street, Newtown; 1887-1880, Brickfields, Alexandria

BURRELL, W.
Listed as secretary of the Gurney Patent Brickmaking Co. in 1890.
BURWOOD BRICKWORKS
1913-1932: Cheltenham road, Burwood
Began production in 1913, on part of the former estate of John Dawson. Originally controlled by the Suburban Land and Investment Co. Ltd., which was taken over by the Brickworks Ltd., where it established its headquarters. Many Burwood houses in the area were built of the bricks from this company.43

BUSHELL, A.
Listed as proprietor of the Crown Plastic and Fire Brick Co. in 1899

BUTCHER BROTHERS and COMPANY, (LIMITED by 1920)
1903-1956: Hotham parade, Artarmon. (Formerly styled "Gore Hill, North Sydney").
Applied for a Central Railway Station contract in 1903 to supply 125,000 O.K. bricks at - per 1,000; £4/8/- for splayed bricks; and £4/10/- for bull-nosed. The successful tender went to Metropolitan Brickworks.44

BUTLER, Joseph
1802-1828: By the latter date, he was operating at Windsor

CADMAN, Martin L.
1887: Waterloo road, St Peters

CAIRNCROSS, D.
1889: Cooks River road, St Peters

CAMPBELL, James
1869: Cooks River road, St Peters

CAMPBELL, William
1844 and 1845: Enmore, Newtown

CANTERBURY BRICK COMPANY
1915: Canterbury road, Campsie
From 1916 this company was styled, Canterbury District Brick Co. Ltd.

CANTERBURY DISTRICT BRICK COMPANY LIMITED
By 1950 the company had become a proprietary limited company.

CARD, E.J.
1919: Lenthall street, Kensington

CARD, John
1873-1877: 1873, Mitchell road, South Alexandria; 1877, Waterloo Estate, Alexandria

CARD, BRICK and TILE COMPANY LIMITED
1922-1925: Dean street, Enfield

CARDIN, W.
Listed as Manager of the Excelsior Brickworks from 1900 to 1902

CARLTON BRICKWORKS see Federal Brick Co. Ltd.
1918-1956: Forest road, Hurstville
Founded by Henry Woodley at Hurstville. James Edwards joined the Carlton yard after Woodley sold out.45

CARR, John
1871: Church street, Cooks River

CARRINGTON BRICK COMPANY PTY. LIMITED
1941-1953: Barwon Park street, St Peters
This company is a later name adopted by the Carrington Steam Brick Co., founded around 1885.

CARRINGTON STEAM BRICK COMPANY
1885-1953, (note change of name): Barwon Park road, Alexandria
These works began business operation in about 1885 on a site where brickworks had earlier existed. By 1888 the works used the "latest" steam machinery available during the mid 1880s, including two Platt Brothers machines and patent kilns that had been built.
They used the dry press process for common bricks, producing about 200,000 per week.46
The works were supervised by John Turner as managing director to at least 1892, (as listed); Henry Turner was listed in 1893. R.J. Nicholson was listed as secretary during 1893 and 1894. Arthur H. Lenn remained as secretary from 1895 to at least 1930, (as listed).
There appears to be a break in the listings of the company from 1931 to 1940.

CARTWRIGHT see Keene

CARTER, Edward
1828: Worked for Thomas Street, Sussex street

CARTER, William
1888-1890: 1888, Railway crescent, Prospect; 1889, Mehan street and Railway crescent, Prospect.

CARTWRIGHT, George
1851: Pyrmont road

92
CARVER
One of the elected directors in 1886 of the Eight Hours Co-operative Brick, Tile and Pottery Co.

CASTLE HILL BRICK and TILE COMPANY
1930-1932: Castle Hill

CASTLE HILL BRICKWORKS
1952: Cranes lane, Castle Hill

CASTNER, G.L.
Proprietor of the Excelsior Brickworks, 1893 and 1894.

CAVALCHINI - see Andina

CAVEY, Thomas - see Soudan Brickworks
1880-1889: 1883, Duntroon street, Canterbury; 1884, Crinan street, Canterbury; 1886, New road, Canterbury, and Hurstville road, Kogarah; 1887, Duntroon road, Canterbury; 1889, Croydon road, Kogarah; 1880, New Canterbury road, Petersham

CENTRAL BRICK COMPANY LIMITED
1915-1965: 1919, Barwon Park, Victoria street, St Peters, "Rear of Council Chambers"; 1920-1965, 2 Albert street, St Peters, "Rear of St Peters Town Hall".
One authority believed that the Company was formed around 1900 or a little later. Products: 1915 and 1916, "all classes of Bricks"; "Highest quality of Common Place and Moulded Bricks". By 1936, the company had a showroom at the Metropolitan Building, corner of Hunter and Bligh streets.

CHALKING, John
1875-1886: 1875 and 1876, Elswick street, Leichhardt; 1880, Piper street, Leichhardt; 1882-1886, Flood street, Leichhardt

CHALKLAND, John
1873-1879: Elswick street, Leichhardt

CHALLIS, Nathan
1877-1888: New Cooks River road, Marrickville

CHAMBERLAIN, Charles
1858-1859: Camperdown road

CHAPMAN, E. and COMPANY - see Ingham, W. and Sons
(He was also listed as a Tilemaker and Potter).

CHAPPLE, Henry
1863: Cooks River road

CHARLESWORTH, J.
Manager of the Jubilee Steam Brickworks, 1902-1904; and the Sydney brickworks, 1903-1915

CHARLESWORTH and COMPANY
1920-1932: 1920-1929, Marrickville; 1930-1932, Unwins Bridge road, St Peters

CHATSWOOD BRICKWORKS
1896-1897: Archer street, Willoughby
Charles Bowen, Proprietor.

CHEESEMAN, Henry
1863: Cooks River road

CHRISTIANSEN and COMPANY
1911-1925: Orange Grove road, Liverpool

CHRISTIE, Robert
1880: Mitchell road, Alexandria

CITY BRICK COMPANY LIMITED
1911-1930: Euston road, Alexandria
As listed; E.T. Andrew, secretary in 1911 and S.P. Pitman in 1913 and 1914: W.S. Alderson was secretary and manager from 1915-1917.
Products: 1911, "All classes of Bricks supplied"; 1915 and 1916, "Manufacturers of every description of Bricks and Fire Bricks".

CLARK, G.T.
Listed as secretary during 1890-1892 at the Crown Plastic and Fire Brick Company.

CLARK, George
1814-1828: By the latter date he was working at Pitt Town.
CLEMENTS, Edward
1819-1828: By 1828, working at Parramatta.

CLEMENTS, Samuel
1819-1828: By the latter date, working at Parramatta.

CLEWS, Charles
1904-1909: Brickfields, Parramatta

CLEWS, John
1884-1909: 1884, off Kissing Point road, Parramatta; 1886-1890, Isabella and Gladstone streets, Parramatta; 1891-1909, Gladstone street

CLISSOLD, George
1886: Francis street, Marrickville

CLYDE BRICK COMPANY LIMITED
1912-1965: Works; Newtown street, Auburn, Their city office varied; 1912, 1918 and 1919, Challis House, Martin Place; 1913, 1915 and 1916, Stanway House, 77 King street; 1914, 14 Martin Place. The April 1919 telephone book lists three suburbs: Clyde, Auburn and Rose Bay.

CLYDE BRICK and TILE WORKS
1911-1913: 1911 and 1912, off Chisholm road, Auburn; 1913, Newtown street, Auburn

COCHRANE, George (also Cockran and Cockrane)
1877-1886: 1877, Capel street, Marrickville; 1879 and 1880, at Reserve road, North Willoughby. In 1879, he received good comments and an "honourable mention" for his fire and common bricks at the Sydney International Exhibition. In 1886 he received the following comments for exhibited material at the Scientific and Mechanical Exhibition at Sydney: " shows some very excellent specimens of fire brick, fire clay, terracotta clay, ornamental plaques, and bricks for building purposes " He was congratulated for his good taste and having the services of a "clever and artistic designer".

COLCLOUGH, J.
Listed as secretary at the Refractory Brick Co. in 1919.

COLE, J.
1877: Victoria road, Marrickville

COLLINS, A. Harrison
Manager of the Gore Hill Brickworks, 1890-1893.

COLLINS, William George and COMPANY
ca.1878-1885: 1880, Cooks River road, St Peters and Victoria road, Marrickville; 1882-1884, Unwins Bridge road, St Peters.

It was claimed by Freeland that the first steam or dry process brickworks was started at St Peters by W.G. Collins and Company in 1878 and by about 1884 and that there were six such works in Sydney and seven in Melbourne.

COLLISON, James
1863: Silver street, Cooks River road

COLLYER, William
1822-1828: By 1828 he was working at John Martin's, Castlereagh street.

COLSON, George
1828: By this date, was working for William Cape at Brisbane Waters.

CONSTABLE - see Roversy

COOK, George
1883: Shellow road, Marrickville

COOK, J.
Elected as one of the directors in 1886 of the Eight Hours Co-operative Brick, Tile and Pottery Co. Ltd.

COOK, James
1871: St Mary's street, Cooks River road

COOK, James
1892-1894: Macarthur street, Granville

COOK, John
1844 and 1845: George street

COOK, Joseph
1870: Mary street, Cooks River road

COOK, Reuben (Possibly a mistake for Rupert?)
1864: Waterloo

COOK, Rupert (LIMITED in 1918)
Continued under the name Cook's (Rupert), Brick Works Limited. 1863-1922: 1863, St Peters, Newtown; 1865, Silver street, Marrickville; 1873, Unwins Bridge road, Marrickville; 1885-1905, Denby street, Marrickville; 1906-1922, corner of Burwood road and Mitchell streets, Enfield. Rupert Cook was born about 1831 and died in August 1919. He had evidently been introduced to the trade by the mid 1840s, probably as part of a family concern.
In 1873, he returned (?) to England for six years and worked in the brick trade at Manchester. In about 1880, he established his new works at Denby street, Marrickville. Before going to England, his works had been established on the Sydenham and Unwins Bridge roads. Rupert Cook, by 1888, used the "latest improved" machinery and was famous for his special ornamental and terracotta works "of all kinds", not to mention the commons. His white double pressed bricks were considered the best in the Colony, so much so that he could barely keep up with the orders. He was credited with production of plastic bricks, wire-cut and double pressed bricks and was believed to have been the first or one of the first to have produced white glazed or enamelled bricks "to any extent" in the Sydney district.

In 1888, his bricks were used throughout the Central Railway Station and factory for the NSW Electric Light and Power Supply Company Limited. The best of Cook's red facing bricks were used for facing work. Glen Boig fire bricks were also used.

Cook's white and red bricks were apparently made from about the early 1880s. The frequent occurrence of his "coloured" bricks, including those of special shapes seen around Sydney with "R. Cook", impressed in the frogs, suggest that he was one of the major producers of such bricks. The works survived to about 1962 under the name, Rupert Cook's, Brick Works (Pty) Limited.

COOK, William
1815-1828: By the latter date was working in Sydney, Clarence street.
1858-1871: 1858, 17 John street; 1861, Foster street; 1871, Abattoir road, Petersham
1923-1962: corner Burwood road and Mitchell street, Enfield. By 1952, the address given was 'Mitchell street, Enfield'. The abbreviation, 'Pty', appeared in 1952 and 1962.

COOPER, Charles and COMPANY
1920: Oxford Avenue, Bankstown
He began steam driven brickworks at Ryde and Bankstown.

COOPER, William
1818-1828: By the latter date, was working at Newcastle

CO-OPERATIVE BRICK and TILE WORKS LIMITED
1953-1956

CO-OPERATIVE BUILDING and BRICK MANUFACTURING COMPANY LIMITED
1916: Registered office, 2a Castlereagh street

COTTLE
1884-1895: Hampton street, Croydon Park, Canterbury - see Cottle Brothers; Cottle and Sands and Cottle and Son

COTTLE BROTHERS
1884: Hampton street, Canterbury
Cottle Brothers were composed of Israel, William, George and Elijah of Croydon Park, Croydon. They obtained a patent for a kiln for burning bricks, tiles and pottery in 1888.

COTTLE and SANDS
1892-1895: Hampton street, Canterbury

COTTLE and SON
1892-1895: Hampton street, Canterbury

COTTREL, Thomas
Listed as manager of the Australian Brick Co. in 1915

COVER, Peter
1890: Chisholm road, Auburn

COULSON, W. - see Howlett's Brickworks and Try's Brickworks

COX, Abe and Jack
They left brickmaking later in the nineteenth century to become jockeys. Abe being famous in Western Australia.

COX, John
1828: South Head road (stayed at Robert Taylor's).

COX, R.
1877: Prospect place, Leichhardt

CRIGG AND CHAPPLE - see Grigg and Chappel

CRITTENDEN, James
1890-1894: Grose street, Parramatta

CROFT, Frederick
1861-1882; 1861-1868 and 1877, Camperdown; 1865, Burton street, Camperdown; 1875 and 1876-1880, Elswick street, Leichhardt

CROFT, James
1863-1879: 1863, Glebe road; 1875 and 1876-1879, Elswick street, Leichhardt

CROFT, James (junior)
1882: Elswick street, Leichhardt
CROKER, Charles  
1828: William Warmagh, Pitt street

CROSS, Ephraim  
1864 and 1865: Ultimo

CROSS and YOUNG  
1886-1887: Hurstville road, Kogarah

CROWN PLASTIC and FIRE BRICK COMPANY  
1890-1899: 1890 and 1891, Walker street, Victoria (Sydney); 1892-1899, Archer street, Willoughby.  
G.T. Clark was secretary from 1890 to 1892. The listed proprietor for 1893 and 1894 was C. Bowen. In 1895, A. Falder was listed as proprietor (?) A.H. Brown and A. Bushell were listed as proprietors for the years 1898 and 1899 (respectively).

CROYDON STEAM BRICK COMPANY  
1879 1886-1945: 1886 and 1919, Boundary street, Burwood (Croydon); 1887-1945, Webb street, Burwood.  
David E. Schofield was listed as secretary from 1887 to 1901 and "manager" by 1894.  
A later source claimed that the works were established in Webb street in 1879 using capital from David Jones' (who owned the land). The works were said to have closed in 1930 and the pit was utilized as a dump and a factory site by W.E. Smith and Co., but the works continued to be advertised until 1945.  
By 1888, they were producing "plastic pressed bricks of a rich mahogany colour". These bricks were used in Normal Self's residence at Ashfield.  
In 1889, Button, Peters and Goodsell, constructed their "Centennial kiln" with 18 chambers, each burning 35,000 bricks.

CUMBERLAND BRICKWORKS  
Lamb Brothers were the proprietors in 1884 but by 1892, Frederick Lamb was listed as proprietor.

CUMBERLAND TILE and BRICK PTY. LIMITED  
1941-1965: Blacktown

CURLEWIS - see Lloyd and Bakewell and Curlewis

CURLEWIS, Frederick C.  
1885-1902: 1885 and 1886, Chapel street, Marrickville.  
In 1887, he was at the brickfields, Mitchell road, Alexandria. 300 to 400 of fire damage had occurred to his machinery and engine room.

Curlewis was listed as the proprietor of the Warren Brick Co. from 1902 to 1911.

CURRAN, E.  
1877: Unwins Bridge road, Marrickville

DALEY, Thomas  
1886 and 1919: Sydenham road, Marrickville  
Managing director and proprietor of Standsure Brickworks from 1886 to 1910.

DALEY, T. Stanley  
Listed as proprietor of Standsure Brickworks from 1916 to 1924.  
T.S. and Thomas Daley appear to be two different people as they were listed as such in the April 1919 telephone directory with different telephone numbers but both at Sydenham road, Marrickville.

DALTON, William  
1867-1888: 1867 and 1877, Waterloo Estate; 1877, Cooks River road, St Peters; 1885-1887, Brickfields, Alexandria; 1886, Brickfields, Alexandria and Rockford street, Macdonaldtown; 1888, Brickfields, Alexandria

DALY - see Daley

DAN, George  
1884: Elizabeth street, North Willoughby

DAVENTPORT  
1887: A brickmaker who noted that imported German bricks were cheaper than those produced locally.

DAVIES, R.W.  
Listed as secretary of the Croydon Steam Brick Co., 1910-1914.

DAVIES', CENTENNIAL AMALGAMATED PATENT BRICK PLANT MANUFACTURING COMPANY LIMITED  
1891 and 1892: Manager, H.S. Pieremont, Post Office Chambers, 114a Pitt street

DAVIES' PATENT DRY PRESS BRICK MACHINE COMPANY  
1890: see Davies Centennial Amalgamated Patent Brick Plant Manufacturing Company Ltd.  
This company did not produce bricks but brick making machinery.

DAVIS, Joseph  
1885 and 1886: Colvert street, Marrickville
DAVIS, William
1889: Rocky Point road, Rockdale

DAWES, Alfred - see Austral Brick Company
He was involved in the Sydney brickmaking scene since a boy (around 1881) and in later years wrote a series of articles for the CPJA (1935).

DAWES, A.H.
He was a son of W.K. Dawes and managed the New Austral Brick Company at Wallgrove around 1962.

DAWES, George
1863: St Mary street, Cooks River road
George Dawes was a native of Sussex, England. He was the grandfather of Alfred Dawes and great grandfather of William K. Dawes of the Austral Brick Co. He started making bricks in Sydney about 1845.

DAWES, Naason
1880: Mitchell road, Alexandria
A son of George Dawes. He married the daughter of Alfred Tye of Brickmaking fame. He was listed as manager of Bakewell Brothers' from 1891-1904 and of the NSW Brick Co. Ltd. from 1904-1906.

DAWES, Phillip
1877: Harrington street, Marrickville

DAWES, William K - see Austral Brick Company
He was a great grandson of George Dawes and a manager of the Austral Brick Company. He was the founder and managing director of this company.

DAWS (usually spelled DAWES) - see Tye

DEAN, HENRY and SON
Products: 1912-1915 "Makers of Sewer Pipes and Fittings also Terra Cotta Roofing Tiles, Ridging, etc."
Henry, Dean and Son operated Petersham Brickworks, 1901-1912. Dean was better known as a potter.

DEAN'S LIMITED
1924 and 1925: Mayfield
de LAYSALLE, M.
Made figures etc. for the fancy ware for Bakewell Brothers by 1894

DENARO AIRFLOW BUILDING BLOCKS PTY. LIMITED
1952: 129 Pitt street, Sydney

DESPONTES BROTHERS - see Frogmare Brickworks
1883-1890: Sydenham road, Marrickville

DESPONTES, Mitchell T. - see Frogmare Brickworks
1891-1897: Sydenham road, Marrickville

DICKIN, Thomas
1791-1828: By 1828 he lived at Robert Browne's at South Head road.

DIVE, Edward T.
1894: Botany road, Botany

DIVE, S.

DIVE, Samuel
1880-1918: 1880, Bank's Meadow, Botany; 1894, Botany road, Botany; 1903-1910, Long Bay road, Botany; 1911-1918, Beauchamp road, Botany.

DIVE, Samuel (senior)
1908-1917: 1908-1910, Long Bay road, Botany; 1913-1917, Beauchamp road, Botany.

DIVE BROTHERS
1918-1928: Bunnerong road, Botany

DIXON, Henry
Dixon, "a gentleman well known in commercial circles", was the general manager for Messrs Goodsell by 1888.66

DOBSON - see Gannon

DOWNTON, A.G.
Proprietor of the Excelsior Brickworks, 1895 and 1896, (as listed)

DOWNTON, H.G.
Proprietor of the Excelsior Brickworks, 1894, 1897 and 1898, (as listed)
DOWTON, W.J.
Proprietor of the Excelsior Brickworks from 1903-1915. The works were in the hands of Trustees in 1916. However, even by April 1919, he was listed at Church street, Croydon.

DOWSE, Thomas
1821 and 1822: Sydney
Dispute over payment for bricks made for a well etc. at Burn’s farm.67

DOWSE, Issac
1803-1828: By 1828, lived with his family at Airds.

DOYLE, Andrew
1882: North street, Leichhardt

DOYLE, John
1865-1877: Elizabeth street, Camperdown

DOYLE, M.
1887: Elizabeth street, Camperdown

DOYLE, M. and SONS
1893 and 1894: Ramsay street, Ashfield

DRANE, David S.
1880: Mitchell road, Alexandria

DRANE, James - see J. Drayne
1867-1888: 1867, Alexandria; 1873-1880, Mitchell road, Alexandria; 1885-1888, Brickfields, Alexandria

DRANE, Samuel
1885-1888: Brickfields, Alexandria

DRAPER - see Tabret

DRAYNE, J. (Possibly James Drane)
1887: Waterloo Estate, Alexandria

DRIVER, George
1906-1919: French’s Forest street, Manly

DUNBRICK (NSW), PTY. LIMITED
1953: Revesby

DYER, J.
1863: Elizabeth street, Camperdown

EAGLE - See Lampson

EAGLE, James
EAGLE - see Lampson

EAGLE, James
1863: Marrickville

EAGLE and OGDEN
1885-1887: Unwins Bridge road, Marrickville

EAGLE BRICK COMPANY
Founded by Thomas Saywell before 1888.68

EAGLE BRICKWORKS LIMITED
1921-1952: 1921, Wentworth road, Enfield; 1926-1928, Juno parade, Enfield; 1929-1932, Wentworth road, Enfield; by 1952, Juno parade, Lakemba (same address throughout)

EAGLES, Frederick and Raymond
1880: Victoria road, Marrickville

EASON, Edward
1880: Reserve road, North Willoughby

EASON, Hugh John
1880: Reserve road, North Willoughby

EASTWOOD BRICKWORKS
1919: Midson road, Eastwood (see Epping Brickworks)

EASTWOOD LAND and BUILDING COMPANY LIMITED
1911-1912: Sutherland road, Eastwood

EDWARDS - see Garden and Woodley

EDWARDS, E. - see Tabrett and Draper

EDWARDS, George L.
Listed as manager of St Peters Brick Co. Ltd., 1915-1919

EDWARDS, Henry
1864-1888: 1864 and 1865, Waterloo; 1867-1876, Cooks River road, St Peters; 1877, Waterloo Estate, Alexandria; 1880, Cooks River road, St Peters; 1885-1888, Brickfields, Alexandria.
His first brickyard was in the Brickfields area in George street. He had four sons. William, James and Henry had their own brickyards and David worked with him.69
EDWARDS, James
1886: Harbour View, Cooper street, St Leonards
At 80, he was still active in the brick trade in 1935. He established the Waterloo and Waratah Brickworks. James had a brickyard at Waterloo. He started a brickyard with Mr Gardener at Neutral Bay making bricks by hand. They later moved to Hurstville and lived in adjoining houses. The partnership failed. James started a works at Mortdale and Mr Gardener at Enfield. Henry had 2,000 of shares in the Mortdale Co. Jones left and joined a Company in Waterloo and then the Carlton Brickworks at Hurstville (formerly Henry Woodley's). He managed the Waterloo Fire Brick Co. Ltd. from about 1902 to 1920.

EDWARDS, William - see St Peters' Patent Dry Brick Company
1882 and 1883: Crown street, St Peters
Mr Edwards was an alderman of Newtown and a resident there of 57 years by 1912. From 1908 to 1914, he was manager of the St Peters' Brick Co. and a large shareholder in the company. He owned a lot of property in the Newtown and St Peters district. He was also manager St Peters' Dry Press Brick Co. from 1902 to 1907.

EDWARDS and COMPANY
1893-1895: Morts road, Kogarah

EDWARDS and GARDENER
1883-1892: 1883-1885, Military road, St Leonards; 1891 and 1892, Morts road, Kogarah

EGGLINTON - see Eggleton
EGGLESTON - see Eggleton
EGGLETON, William
1858-1888: 1858 and 1859, Erskineville road, Newtown; 1864 and 1865, Waterloo; 1880, King street and also Norfolk street, Newtown; 1885-1888, Brickfields, Alexandria.
William Eggleton came to Newtown about 1852 behind Gowrie House (Chambers?), and the public school. This property around Norfolk street was earlier known as Gussed's (Brickworks or Paddock), and later as Eggleton's or Eggleton's Paddock.

EGLETON, William S.
1892-1894: Norfolk street, Newtown

EIGHT HOURS CO-OPERATIVE BRICK, TILE and POTTERY COMPANY LIMITED
1886-1889: Merrylands/Granville.
The first bricks were manufactured on 7th September 1886. The directors were Messrs Baker, Wiley, Symons, Gillespie, Riley, Carver and Cook. The Works were formally opened on 6th August 1887 with Mr James Cook as the manager. The area of the Works was 14 acres, containing an estimated volume of clay to last for 50 years. The Works boosted the latest improved machinery, sheds and kilns. The shares were taken out by the workmen themselves, working for 8 hours per day. The capacity was for 10,000 to 15,000 bricks per day. Arrangements were being made to manufacture enamelled tiles "and various descriptions of pottery ware". The Works appear to have closed, never to reopen, around 1889 and 1890.

ELDRIDGE, James
1889-1893: Lower Bankstown, Rookwood

ELLIOIT and McCLOSKY
1884: Off George street, Canterbury

ELLIS, Andrew J.
1880-1895: 1880, Mount Pleasant, Ryde; 1882, Parkes street, Ryde; 1884, Church street, Ryde; 1886-1895, Princess street, Ryde

ELLIS, Thomas J.
1884: Princess street, Ryde

EMERY, Simeon
1863: University street, Newtown
According to a family account, he started in the old Brickfield area in Sydney and eventually he and/or a brother moved to the Tumut area and was involved in brickmaking for many years there.

EMERY and BRADSHAW - see Bradshaw

EMPIRE BRICKWORKS
1912-1915: Josephson's road, Strathfield; City office, 2b Castlereagh street.
ENFIELD BRICK COMPANY - see following entries:
ENFIELD BRICK and PIPE WORKS
1915-1919: Madeleine street, Enfield.
A. Jolly was listed as manager in 1915
ENFIELD BRICKWORKS PTY. LIMITED
1956-1965: Enfield
ENFIELD PARK BRICK COMPANY LIMITED
1913-1920: Park road, Enfield. City office, 12 O'Connell street
ENFIELD STEAM BRICKWORKS
1893 and 1894: Water street, Enfield.
This company was founded by J. Gardiner. On 13th February 1894, the machinery was started for
the manufacture of the "Knox Improved French Ball-Bearing Tiles".77
The company's pit was later used for the dumping of rubbish.
ENMORE, Benjamin
1851: Pyrmont road
EPPING BRICKWORKS
1919-1943: Midson road, Eastwood
The Eastwood Brickworks appear to be part of the same company, sharing the same address and
telephone number.
EYLES, Alexander
1890-1891: Blaxland and Flagstaff roads, Dundas.
Alexander's father received a grant of land in Dundas and he opened a brickyard at Terry road.
He served in the local council as an alderman.78
EYLES and SAUNDERS
1884-1888: off Kissing Point road, Parramatta; 1886-1888, Blaxland road, Ryde.
See Saunders and Eyles. The names were often misrepresented as "Ayles and Sands", "Ayles and
Saunders" etc.
EXCELSIOR BRICKWORKS
1891-1936: 1891-1893, Lang street, Ashfield; 1893-1901, Church street west, Ashfield; 1902-1911,
(7) Church street, Croydon; 1912-1919, Jones street, Croydon; City office, listed from 1920-1932,
12 Castlereagh street. From 1930 to 1932 the works' address was Penshurst street, Lakemba.
The company became a "Company Limited" by 1920 and a works address was not included during
the years 1920 to 1929. The last works address seems to suggest a shift of site.
The following is a list of managers and proprietors as noted from Sands: Donald Vernon,
manager, 1891; G.L. Castner, proprietor, 1893 and 1894; A.G. Downton, proprietor, 1894, 1897
and 1898; W.J. Downton, proprietor, 1903-1915, trustees of W.J. Dowton, 1916; W. Cardin,
manager, 1900-1902; and Thomas J. Joiner, manager, 1910-1918.
FALDER, A.
Listed as proprietor in 1895 for the Crown Plastic and Fire Brick Co.
FARNHAM, Thomas
1816-1828: By 1828, he was working for Simeon Lord at Botany. He may also have worked at
Liverpool.
FARR, George
1875-1877: 1875, Crown street, St Peters; 1877, Waterloo Estate, Alexandria
FEDERAL BRICK COMPANY LIMITED
1901-1947: Mitchell road, Alexandria
From 1901 to 1907 the company was styled "Federal Brickworks". By 1918, another branch was
established at Hurstville and referred to as the "Carlton Yard" or "Carlton Brickworks".
The proprietor and founder was H. Woodley. The H. Woodley and Company Steam Brickworks,
listed from 1902 to 1907, appears to refer to this company (as H. Woodley was the proprietor and
the same telephone number, 277 Newtown, is given under both headings). A.E. Taylor was listed
as secretary from 1915 to 1925 and F.G. Phippard from 1926 to 1931.
The company started strongly. By October 1902, 15,521,000 bricks had been made there,
14,500,000 of which had been sold and delivered. Wages had amounted to 17,000 pounds.79
Products; "all classes of Bricks, Drain Pipes and Fittings" (1915-1931).
FEDERAL BRICK COMPANY LIMITED, (CARLTON YARD)
1918-1956: Forest road, Hurstville. see Federal Brick Company Limited and Carlton Brickworks
FEDERAL BRICKWORKS
This was the earlier name of the Federal Brick Co. Ltd., (from 1901 to 1907)
FELL, Charles
1820-1828: By 1828, Fell was operating at Windsor.
FERGUSON BROTHERS and COMPANY
1926-1923: McFarlane street, Merrylands
The Ferguson Brothers were responsible for the "Ferguson Dry Press Brickmaking Machine".
The had other branches at Holbrook NSW and Wangaratta, Victoria.
FIELD, Thomas and Son
1879-1882: Balmain road, Leichhardt
Though better known for their pottery, they received a first degree of merit for their bricks and
tiles in 1879 (as well as drainpipes, terracotta vases, brackets and keystones).80 They were listed
under "Brickmakers" for the years 1880-1882.
FIFIELD MAGNESITE and REFRACTORIES COMPANY LIMITED
1920-1937: Grand Australia, Granville/Camellia
FINCH, William
1815-1828: By the latter year he was with John Martin at Castlereagh street

FITZGERALD, James
1890-1828: Meehan street, Prospect and Sherwood

FIVE DOCK BRICK and TILE COMPANY LIMITED
1925 and 1916: 24 Moore street, Five Dock

FLEMING, Michael
1871: Harris street, Pyrmont

FLEMING, William
He was supposed to have established works in Castlereagh street, Penrith in 1886. His bricks, stamped "W.F.", have found their way in some buildings on the outskirts of Sydney, (such as Bella Vista, Seven Hills).

FLEMINGTON BRICK COMPANY
1919-1932: This appears to be another name for the Flemington Brick Tile and Pottery Pty. Co. Ltd., (1910-1932).

FLEMINGTON BRICK COMPANY LIMITED
1930-1934: Bankstown
This appears to be another branch of the company mentioned above.

FLEMINGTON BRICK COMPANY LIMITED
1934-1937: This appears to be an extension of the Flemington Brick, Tile and Pottery Pty. Co. Ltd.

FLEMINGTON BRICK, TILE and POTTERY PTY. COMPANY LIMITED
1920-1932: 1911, Flemington; 1917 and 1918, Lidcombe; 1919-1932, Parramatta road, Flemington. In 1910, they had a registered office at 107 Pitt street. In 1911, it was at 2b Castlereagh street (Castlereagh House, 2,3,4 and 5 First Floor). From 1924 to 1932, their office was at 12 Castlereagh street.

FLETCHER, P.P. - see Sydney Brick Company
A Peter Fletcher was listed in 1861 as at 25 Kensington street and in 1879, at Balmain road, Leichhardt.

FLETCHER PART
1889 and 1890: Arthur street, Marrickville.
William Moyse appears to have been the proprietor

FLYNN, Christopher
1844-1845: 57 George street

FOLLAN, Charles
1887-1894: 1887 to 1891, Causeway, Druitt Town; 1889, Brooklyn street, Druitt Town; 1892-1894, Maria street, Enfield

FOLLAN, John
1890 and 1891: Causeway, Druitt Town

FOLLAN, W.
1898: Madeline street, Enfield

FOREMAN, Thomas
1885: Flood street, Leichhardt

FOWLER, Enoch. (Fowlers).
1866-1883: 1879, Parramatta road, Camperdown; 1883, George street, Camperdown.
Enoch Fowler was listed under brickmakers in 1879 and 1883. As a potter, however, he appeared in 1844/1845, 1851 and from 1863 to 1880.
He was producing bricks by 1866 as they advertised, "crown and fire bricks" as well as fire clay, oven tiles, fire lumps, chequered and plain tiles (12 x 16 inches), and offered "bricks of every description made to order". Air and Louvre Bricks were made two years before. In 1867, they offered a greater range and styled themselves as Fowlers Pottery and Fire Brickworks. In 1935, it was maintained that Fowlers had the "next oldest" power steam brickworks, (Goodlet and Smith after Tyre and Goodsell). In 1877, they advertised themselves as "Fowlers Pottery and Patent Brickworks". Enock Fowler was born in Tyrone, Ireland and came to Sydney by the mid 1830s. He established his works in 1837.

FOWLER, Robert
1880-1894: George street, Camperdown. For the years 1887 and 1889, Fowler's address was given as "Australia street, Camperdown".
As his father Enoch, he was primarily concerned with pottery. Robert Fowler was born in 1839 at his parents' home "in Parramatta street, Sydney". He had been active in local government since the 1860s and became Mayor of Sydney in 1880.

FOWLER, R. LIMITED, POTTERY and BRICKWORKS
Fowler, of course, made bricks continually from the 1860s but it was not until this period that they were regularly included in the lists under brick manufacturers.
Various branches were established outside the Camperdown works. By 1909, the Darby street, Newcastle, branch or depot, was included in the Sands' advertisements and by 1910, the Macquarie street, Parramatta works. By 1913, Fowler had a branch at Robert street, Bankstown. (Listed to at least 1919). By 1919, North Sydney, Fitzroy street, Marrickville and George street, Camperdown are included. By 1920, advertisements included: drain pipes; agricultural pipes; sanitary ware; Bristol ware; chemical goods; terracotta ware; insulator and porcelain; fire bricks; fire lumps and fire clay. By 1921, tesselated tiles were offered. By 1931, they offered: sanitary earthenware, pedestal pans, lavatory basins, glazed wall tiles, tesselated floor tiles, Bristol ware, drain pipes, insulators, fire bricks and "all classes of pottery".

FOWLER, Samuel
1815-1828: By 1828, working at Bathurst.

FOX, James
1867: Petersham

FOX, Patrick
1883: Bramshot, Canterbury

FRIAR, John
1819-1828: By 1828, working at Parramatta.

FROGMORE BRICKWORKS - see Despointes
1885-1894: Sydenham road, Marrickville
These works were built by the Despointes Brothers. William King was manager by 1887; Mitchell T. Despointes apparently replaced him by 1892.

FRYS, William Grey
1893: Pitt row, Prospect
"Manager"

FULLAGHER, Henry, W.
1886-1890: 1886-1888, Western road, Prospect and Sherwood; 1890, Fullagar street, Prospect and Sherwood

FULLAGHER - see Fullagar

FULLLEN, John
1864 and 1865: Waterloo

FULLIN - see Fullen

FYLE, John
1882: Long Cove creek, Ashfield

GALLAGHER - see Hart

GALLAGHER and EDWARDS - see Gardiner and Edwards

GARDNER and WHTTMORE
1921-1924: North Ryde
Usually styled as Whitmore and Gardner

GARNETT, Lewis F. - see Strathfield and Enfield Steam Brickworks

GARSH, R.
1839: Parramatta.
This might have been a mistake for Robert Gooch, or Gorch, of Parramatta (but he was listed in full that year as well as Garsh, R.).

GARWELL, William
1873-1886: 1873, Cooks River road; 1886, 131 Union street, Newtown

GASSED'S - see Eggleton

GASSED'S - see Eggleton

GEERING, H. - see Gerring

GEERING, H. - see Gerring

GENTLE, Charles
1875-1888: 1875 and 1876, Cooks River road, St Peters; 1877, Waterloo Estate, Alexandria; 1880-1883, May street, St Peters; 1885-1888, Brickfields, Alexandria

GENTLE, Joseph
1887: King street south, Newtown
GENTLE, Josiah. (Bedford Brickworks).
1870-1931: 1870, Mitchell road, Alexandria; 1873, Maria street, St Peters; 1877, Waterloo Estate, Alexandria; 1880-1883, Cooks River road, St Peters; 1885, Brickfields, Alexandria; 1886, Brickfields, Alexandria and Cooks River road, St Peters; 1888, Brickfields, Alexandria and 544 King street south, Newtown; 1889-1891, King street south, Newtown; Barwon Park road, Alexandria; and Cooks River road, St Peters; 1892-1907, Barwon Park road, Alexandria; 1895-1898, 494 King street, Erskineville; 1908-1920, King street, St Peters; 1921-1931, King street, St Peters' Bridge
Josiah B. Gentle founded the Bedford Brickworks, first mentioned in Sands' under his name in 1890.86 From 1908, the entry was simply, "J. Gentle", with the mention of Bedford Brickworks in the text of the listing.
Products: 1908-1931, "Manufacturer of Every Description of Bricks".

GENTT, C. and J.
1873: Mitchell road (South?), Alexandria

GERRING, Henry
1880: Sydenham road, Marrickville
In 1888, he lived in Emily street, where he was recorded as having lived there as early as 1877. He was born in 1820 in Kent and learned the trade there. He emigrated in 1839, landing in Sydney. He lived in Newtown for 40 years and then shifted to Marrickville where he became an alderman. He practised building, contracting and brickmaking. He erected St John's Tavern, Newtown, in 1844 and assisted in building St Stephen's church.87

GIBBENS - see Gibbons

GIBBON, Martin
1864-1870: 1864-1866, Newtown; 1869 and 1870, Australia street, Newtown.
Gibbons was a horse dealer, brickmaker, farrier and general contractor.88

GIBBONS (AUSTRALIA), LIMITED
1919; French's Forest, Manly

GIBSON, John
1885-1892: 1885, North Willoughby; 1886-1896, Herbert street, North Willoughby; (1888 and 1889, addition of "Gore Hill" and in 1889, "Herbert street and Weltham street").
John was listed as potter at Herbert street between about 1883 and 1887. The works for bricks, tiles and pottery continued to at least 1896 at that address.

GIBSON, John T.
1889-1892: 1889, Frederick street, Gore Hill, North Willoughby; 1890, Waltham street, North Willoughby; 1891, Herbert and Waltham streets, Willoughby; 1892, Waltham street, Willoughby

GIBSON'S BRICK and TILE WORKS
1893-1896: Herbert street, Willoughby
O'Masters was a lessee in 1893.

GIBSON and LAMB
1883 and 1884: Gore's Hill, North Willoughby
Gibson's appears to have been in the same area from about 1883 to 1896.

GILL, William
1886: Shaftesbury road, Burwood

GILLES, A.W. - see Redcross Brickworks
1885 and 1886: Victoria road, Marrickville

GILLESPIE
One of the founding directors of the Eight Hours Co-operative Brick, Tile and Pottery Co. Ltd., in 1886.

GLAZED BRICK and POTTERY COMPANY LIMITED
1914: Madeline street, Enfield

GLAZED WATERPROOF TILE COMPANY LIMITED
1921: Carrington

GODFREY, E.
Manager of the Industrial Brick Co. Ltd. from 1911-1913 (as listed).

GOGCH, Robert
1817-1839: Gooch (also Gorch etc.) was usually noted as a builder or bricklayer. He had made his home at Parramatta by 1828, having a young family, five "servants" and two apprentices. William Buick, brickmaker, was his partner by 1838 in the building of the famous Lennox bridge.
In 1839, "Robert Gorch", Marsden street, Parramatta, was listed as a brickmaker. (A reference during the same year to "R. Garsh, Parramatta", as brickmaker, may refer to the same person).

GOODLET and SMITH
1875-1965: 1875, Riley street, Surry Hills; 1879, 493 George street, (office); 1880, Botany road, Waterloo; 1883, Botany road, Botany; 1886, Government road, Prospect and Sherwood; 1889, 2 Bathurst street; Harris street; 496 Kent street; New street, Ultimo; potteries, Riley and Goodlet streets and at Marrickville and Prospect; 1890, Railway crescent, Prospect and Sherwood; 1893, Junction Brickworks; from 1895 to 1908, only Railway crescent, Prospect, is mentioned, (probably
the result of cut backs due to the 1893 depression); 1909, 767 Harris street; 1913-1915, Harris street and Sherwood; 1916-1918, Pyrmont and Granville; 1919-1927, 2 Harris street (head office, sawmills and wharf), and Granville, (terracotta and brickworks); 1928 and 1929, 56 Hunter street; 1930-1965, Granville. For 1952, the address was expanded to Crescent street, Granville.

Goodlet and Smith were better known for their extensive sawmilling works. By 1855, John May Goodlet and James Smith formed the company and established the first sawmill using machinery. For the rest of the century they had one of the largest sawmilling concerns producing machine saw timber, machine mouldings and a great variety of ready made doors, windows etc. By 1865, they expanded into the pottery business, establishing works at Riley street, Surry Hills, (which operated until 1915). By 1880, they established a large "patent" works at Botany road, Waterloo but it appears to have failed as a result of the building of one of the first Gurney tunnel kilns. A brick plant was established at the Government road, Prospect and Sherwood (Merrylands - see Great Western and Junction), by 1886 which operated until at least 1915. Works were also established by 1889 at Marrickville. By 1916, the works at Granville had eclipsed all the others in producing bricks and terracotta. Although it is said that the Granville works (Crescent street) ceased operations in 1956, entries in the Directories still refer to it up to 1965 and possibly later. Equal with Fowlers, Goodlet and Smith were credited as having the second earliest steam, or power, brickworks, (after Goodsell and Tye). Though, Holden maintained that the plant was the first of its kind with a (patent) continuous kiln and steam powered brick machines. It was claimed from time to time that they were the first to produce machine made bricks. J. Goodsell of Bowral (- see Goodsell), claimed that all the other claims were incorrect and that it was F.J. Newton, three or four years before Goodlet and Smith. Goodlet and Smith, however, did secure the first patent rights for making dry press bricks in NSW.

Goodlet and Smith's products were not confined to Sydney during the late nineteenth century. Apart from their ships, their goods were widely distributed around NSW by railway.

GOODSELL, Albert
1880: King street, Newtown

GOODSELL, Alfred
1868-1876: Cooks River road, Newtown

Alfred Goodsell may have been a brother of Frederick John Goodsell. His nephews took over his current brickworks at Newtown by the late 1840s (1849).

GOODSELL, Charles
1880: May street, Newtown

GOODSELL, Frederick John
1863-1880: 1863-1870, Cooks River road, Newtown, 1877, Waterloo Estate, Alexandria; 1880, May street, Newtown

Goodsell and his young family came out from Sussex, England and arrived in Sydney about 1838/1839. They settled along the banks of the Lane Cove river, which was considered "the country" in those days. Goodsell was apparently a farmer as he was listed as such at the time, living at "Lane Cove". Another source mentioned that he started out as a timber merchant.

Around 1848 and 1849, his sons settled in Newtown and took over a brickyard established by their uncle. Frederick John Goodsell was still living at Lane Cove in 1851 but must have shifted to Newtown soon after. Frederick J. Goodsell formed a partnership with Alfred Tye by the late 1860s or about 1870. The works became known as the Newtown Brickworks or "Goodsell Brothers", after the death of Frederick by about 1882. An 1888 account stated that the first brick machine installed in NSW was installed at these works in 1869 and operated for ten years, producing many fancy bricks for which the firm was famous. Several accounts state that bricks from this machine were used in the facade of Farmer's "new building" on the corner of Pitt and Market streets: one stated that the very first bricks made by the machine were used on Farmer's new building.

An 1880 account acknowledged that the Farmer's building bricks came from the first brick machine to be installed in the Colony but mentioned that, although plans were made to construct the building in 1869, it was not begun until 1873. It could be the case that the machine did not operate until 1872/1873 as there is a gap in the Directory entries for Goodsell from 1871 to 1876 (inclusive) but the last solo entry for Alfred Tye occurred in 1867. Judging by a description given by a grandson of Alfred Tye, this early machine must have been the famous early Bradley and Craven with a circular table, from which the plastic bricks were removed. Early bricks produced by Goodsell were stamped "G.T. Newton" (Goodsell and Tye, Newtown). The brickyard was sited between Lord, John and May streets, and like many former large brickyards, after being used as a dump, became a park (Camdenville Park). - see Goodsell Brothers for a continuation of the account of this brickyard.
GOODSELL, Henry Wesley
1873-1887: 1873-1876, Cooks River road, Newtown; 1880-1883, King street, Newtown; 1887, Alice street, Newtown.

Henry Goodsell, as he was generally referred to, was a son of Frederick John Goodsell and came with his family to Sydney around 1838/1839. He was working in Newtown by 1848/1849. He is credited with being the first to make plastic shale bricks (by hand, as an experiment it seems), in 1871; before that shale was considered as useless for making bricks and it was a few years before they were fully accepted by builders and bricklayers. Shale was commonly used by brickmaking machines during the 1880s.

GOODSELL, J.A.
1893 and 1920: 1893, Lord street, Newtown; 1920, 640 King street, Newtown

This may have been John Goodsell, another son F.J. Goodsell. In 1920 he had a business supplying brick moulds, barrows, arch keys, wall and ceiling ties, window sills, “and general ironwork”.

GOODSELL, John
1868-1887: 1868, Newtown; 1871, May street, Newtown; 1873, Cooks River road; 1875 and 1876, George street, Macdonaldtown; 1879, Botany road, Alexandria; 1880, King street, Newtown; 1887, Wells street, Newtown

John was one of the Goodsell Brothers, son of F.J. Goodsell. He formed a partnership with his brother Henry.

GOODSELL, John and Henry Wesley
1883: May street, Newtown.

After the death of their father (about 1882), they formed themselves into Goodsell Brothers using Goodsell and Tye’s brickyard as their works (surrounded by Lord, John and May streets, Newtown). The partnership, as Goodsell Brothers, was probably formed in 1884.

GOODSELL BROTHERS
1885-1890: 1885, Lord street and May street, Newtown; 1886-1890, John street, Newtown (the actual works were surrounded by Lord, John and May street, now Camdenville Park)

John and Henry Goodsell (and possibly Charles), formed their “Steam Brickworks” by about 1884. The old Bradley and Craven machine was superseded by a large Platt dry press machine. By 1888, they had two large Platt dry press machines, producing 200,000 bricks per week (“along with ordinary ‘common bricks’”). Wire cut bricks were also made and they produced 50,000 fancy bricks per week. The fancy bricks were mainly wire cuts which were then pressed in a manually operated press; these bricks were known as “double pressed” bricks and were used for facing the fronts of buildings.

They installed a huge Centennial continuous kiln but it failed due to the unsuitability of the clay and it was demolished and the fittings sold. Goodells had been famous for their fancy bricks since the 1870s and were considered the leading firm in this class of bricks by 1888. The bricks for the Railway Institute of NSW, opened on March 14, 1891, came from Goodsell’s works. The exterior was faced with double pressed bricks, with cornices, string courses, sills, of brick. The plain bricks were considered to be excellent for making angle moulded bricks.

In part, the Railway Institute building may have been the downfall of Goodsell Brothers. During the early part of 1890, there was an unusually prolonged period of rain which retarded the drying of bricks. Goodsell Brothers were not able to supply on demand or by order. Financial difficulties led to the yard being handed over to an official assignee as a result of bankruptcy in 1890. A desperate move to keep the works financial resulted in the offering of shares to form a new company in March 1890 but nothing came of it. The works which had been so long in the hands of the Goodsell family was sold to Peter Speare in 1890. It operated under the name, Peter Speare, until about 1897, after which it passed on to S. Spear. It was renamed, the Newtown Brickworks with J. Charlesworth as manager in 1898; Elias J. Harber was listed as manager in 1899 and 1900. S. Spear, from 1902 to 1914, styled the works as the “Newtown Steam Brickworks” but in 1915, it reverted to the earlier name “Newtown Brickworks” until 1919. S. Spear seems to have died in 1916 or 1917 and in 1919 the works were in the hands of Mrs F. Speare. - see P. Speare; S. Speare; Newtown Brickworks and Newtown Steam Brickworks.

GOODSELLS STEAM BRICK COMPANY LIMITED
Shares were offered for this “promising company” in February/March of 1890. The real reason for the forming of this company seems to have been the result of imminent bankruptcy - see Goodsell Brothers.

GOODSELL and TYE - see Frederick J. Goodsell

GOULD, Mrs
1864 and 1865: Marrickville

GORE HILL BRICKWORKS
1888-1893: 1889, Lane Cove road, North Willoughby; 1889, Victoria parade, North Willoughby; 1890, Lane Cove road and Elizabeth street, North Willoughby; 1891, Elizabeth street and Gordon road, Willoughby; 1892, Reserve road, Willoughby.
This brickyard is one of the few reasonably documented of the early machine brickworks. It was opened in 1888 and was owned by the Land Company of Australasia Limited, but had operated earlier as "Gore Hill Brickworks", 1883. (see Whiting, G.R.).

The works were commenced in October 1887, on the designs of A. Harrison Collings (managing director), by T. Southgate. The Hoffman kiln was built on the oval plan instead of the original circular one. It had 16 chambers holding 375,000 bricks. The kiln measured 200 x 80 feet and took up 2 million bricks as well as 100,000 fire bricks to build. The chimney was 140 feet in height. Two of Platt's four stamper brick machines were installed (dry press), and a plastic machine by the Sydney firm, G.H. Blanks. The clay was ground by a Carr's disintegrator. The machinery was driven by 45 horse power. Two boilers on the Cornish principle with "Galloway Tubes" run by coal, were used.

The managing director, Mr Collings, had been manager of the "Hoffman" Patent Steam Brick Company's works at Brunswick, Victoria. By June 1888, Gore Hill had secured the contract for 2 million bricks for the Lands Office which had begun building in May. Though by late 1890 some, perhaps 250,000, were also supplied by Woodley and Company of St Peters. Gore Hill also supplied the bricks for the bridges and tunnels for the North Shore Railway Company. A slack period and a strike forced the company to put out their kiln fires in October, 1890. In February 1891, the fires were relit and Mr Collings hoped to treble their output as well as to produce a "superior" facing brick and one to rival the "Staffordshire blues". By this time a dry press machine had been supplied by Blanks and Levebure of Invicta Ironworks at Glebe. The Bradley and Craven machine produced semi plastic bricks and were being used in the Australia Hotel (4 million), and were also on order for the Walker Hospital, Land Office and the North Shore Railway. An advertisement of March 1891, claimed that they produced the cheapest and best bricks on the market. They offered "all descriptions of plain and fancy bricks", including dry press and plastic. An immense pit had been created by 1891, the shale having been exploited to the full. Coal was used as the main fuel. The Gore Hill works also produced white brick, which were used in the Newcastle cathedral.

Mr A.H. Collings was manager from 1887 to 1893 at least. He appears to have been relieved by 1889 by G.R. and J.F. Whiting. A.H. Green was supposed to have been a manager for 4 years before 1888. (See Land Company of Australia and Vulcan Brickworks).

GRANT, Robert
He was managing director of the Oakes Steam Brick Co. during 1886 to 1888 at least. He had an extensive timber trade and fuel business (as well as being a dealer in galvanized iron), and by 1888, his monthly output of coal averaged 700 tons. He was probably one of the major suppliers to the brick manufacturers of the St Leonards/Neutral Bay area.

GRAY, William
1851: Pyrmont road

GREAT NORTHERN BRICK COMPANY LIMITED
1913-1941: 1913, Midson road, Epping; 1914-1932, Midson road, Eastwood. In 1916, a city office was listed at 375 George street; 1919, Eastwood.

GREAT WESTERN STEAM BRICK COMPANY
Merrylands
This company was established in 1878 by Arthur Todd Holroyd ("Judge" Holroyd). In 1886, it was taken over by Goodlet and Smith and in 1891, it received a Hoffman kiln with the earlier model central chimney. This company was also known as the Junction Brickworks. Several works were operating in this area, (formerly referred to as Government road [now Clarence street], Prospect and Sherwood).

GREEN, Mr
A native of Manchester who spent his whole career (England and Australia) in the brick trade. He arrived in Australia in 1877 and became a manager for Messrs C. and E. Millars, railway contractors, on the Tabarook and Yea line in Victoria. Subsequently he became manager of Vickery's Vulcan Brickworks.

GREEN, Thomas
1894: Brickfields, Alexandria

GREENHATCH, John
1826-1828: Greenhatch probably did not operate in Sydney, as he was working for George Forbes at Edinglassie, Hunter River, by 1828.

GREENWOOD, Frederick E. (ACIS)
He was listed as secretary and manager of the Ashfield Brick Co. Ltd. from 1916 to 1918.

GREGG - see Griggs
GREIGG - see Griggs
GREY, Thomas
1819-1828: By 1828, he was working for John Piper at Allaway Bank, Bathurst.
GREY, W.
Grey was manager to John Try in 1887 and Try's Brickworks from 1890 to 1894 at Prospect and Sherwood.

GRIEGG - see Griggs

GRIGGS, Charles
1863-1887: 1863, Lord street, Cooks River road; 1869, Cooks River road; 1880-1887, Mary street, St Peters

GRIGGS, John
1885: Warren road, Marrickville

GRIGGS and CHAPPEL
1880-1888: 1880, Unwins Bridge road, Marrickville; 1885-1888, Brickfields, Alexandria

GRIGGS and LOVEDAY
1885 and 1886: Greenbank street, Marrickville

GRIMAWAY, George
1822-1828: By 1828, he was working for John Chisholm at St Andrews, Melville.

GUDGEON, Eric
Listed as manager of the Ashfield Brick Co. Ltd. from 1927 to 1932

GUILFORD FIRE and GLAZED BRICK COMPANY
1915-1918: Military road, Guildford

GUNTHORPE, George
1887: Unwins Bridge road, St Peters

GURNEY, Henry. STEAM BRICKWORKS
1880-1884: Botany road, Alexandria

GURNEY PATENT BRICKMAKING COMPANY
1890-1892: 1890, 108 Pitt street, (office); 1892, Victoria road, Marrickville.
In 1890, W. Burrell was listed as secretary and in 1892, Alfred Leggatt as manager.

HAILER, A.
1886: Cooks River road, St Peters

HALL and PYNE
1947-1965: Marrickville

HALLIDAY, John
1820-1828: By 1828, he was assigned to Joseph Heaps, Toll Gate, South Head.

HALLORAN - see Bill and Halloran

HALLORAN - see Reuss and Halloran

HALLORAN, H.F. and COMPANY
1920-1924: 1920 and 1921, Pittwater; 1924, Sydney

HALVERSON and WRIGHT
1885-1888: Brickfields, Alexandria
Walter Halverson became a grocer after the introduction of steam machinery.

HAMMOND, G.
1883: Reimyre road, Burwood

HANDLEY, Jabez
1844 and 1845: Newtown
By 1851, Handley had become a butcher at Sussex south.

HANDSHAW, Owen
1820-1828: By 1828, he was operating at Newcastle.

HANFIELD BRICKWORKS PTY. LIMITED
1953: Lakemba

HANMORE, Joseph
1818-1828: By 1828, he had been assigned to James Chisholm, St Andrews, Minto, Airds.

HANNAN, Reuben
As a convict, he eventually became an overseer of the Government brickworks at Brickfield Hill. He was instrumental in making the first sandstock bricks composed of lime, ash and sand. As a reward, he was allocated a grant of 100 acres along the southern bank of Walli Creek. The grant later passed to the Bucknell family, the Hannans moving to the opposite side of Arncliffe street (number 112). Reuben died in 1852, his son David resided there for many years.

HANSON, Charles
1890-1893: Albion street, Parramatta
In 1891, the words "brick mould", appear between his name and his address.

HARBER, Abel - see Harber, Abel and Company, and Patent Plastic Brickworks
1867-1884: 1867, Unwins Bridge road, Marrickville; 1868, St Peters; 1869-1873, Chapel street, Marrickville; 1871-1877, Fitzroy street, Marrickville; 1883 and 1884, Waterloo road, Alexandria
Abel Harber was born in England in 1834 and arrived in Sydney in 1854. From the start he was involved in brickmaking. In 1867, he accepted a railway contract on the Toombie line, supplying
the bricks for three large tunnels. After the contract expired, he returned to Marrickville where he conducted brickworks for 13 years. He made a visit to England and returned, setting up a new plant with all the latest improvements in machinery, (during the 1880s).  

HARBER, Abel and COMPANY  
1886-1894; 1884, Brickfields, Alexandria; 1886, Brickfields, Alexandria and Waterloo road, St Peters; 1887, Brickfields, Alexandria; 1888, Alexandria; 1889-1894, Barwon Park road, Alexandria  
When setting up his Company, after his visit to England, he used two large semi plastic machines, each producing about 1,000 bricks per hour. Abel Harber was the first to have made a success of the Gurney patent tramway kiln before 1888. He was assisted by two sons at his works.  
He was also one of the Guarantors for the Sydney Brick Company in 1893.  

HARBER, Elias J.  
Manager of Newtown Brickworks during 1899 and 1900  

HARBER, Emanuel  
1863-1883: 1863, Cooks River road; 1875 and 1876, Silver street, St Peters; 1883, Edinburgh road, Marrickville  

HARBER, William R.  
1883-1885: 1883, Victoria, Marrickville; 1885, Edinburgh road, Marrickville  

HARBOUR - see Harber  

HARCUS, Daniel  
1884: Off George street, Canterbury  

HARCUS, Jeremiah  
1880: Grose street, Canterbury  

HARDAKER, Arthur W.  
1906-1908: Pitt street, Prospect  

HARDER - see Harber  

HARPER, E.  
1886-1888: 1886, Franklin street, Prospect and Sherwood; 1887, Crown street, Prospect and Sherwood; 1888, Franklin street, Prospect  

HARRIS, J.  
1890 and 1891: Mort street, Kogarah  

HARRIS, Thomas  
1827-1887: Harris arrived in Sydney in 1827 by the Manilus. He was allocated to Thomas Street of Sussex street as a brickmaker. He married Harriet Bullen (1817-1884), at Sydney in 1842. He afterwards moved to Cambelltown.  

HARRIS, William  
1880: Cooks River road, St Peters  

HART, Frederick  
A representative for the Carrington Steam Brick Company, Metropolitan Brick Company (for the Eastern suburbs), and a guarantor for the Sydney Brick Company since about 1893.  

HART and GALLAGHER  
They are listed as the proprietors of the Standard Steam Brick and Pottery Works from 1886-1891.  

HASELHOE  
1818-1828: By 1828, he was assigned to Thomas Perkins of Castlereagh street as brickmaker.  

HASEMER, James  
1886-1902: 1886 and 1887, Off Railway street, Prospect and Sherwood; 1888, Railway crescent, Prospect; 1889-1891, Railway street, Prospect and Sherwood; 1892-1902, Inkerman street, Prospect  

HAWKINS, John  
1821-1828: By 1828, he was employed at David Hayes, George street  

HAYES, E.J. - see Oaks Steam Brick Company  

HAYES, Patrick  
1880-1886: 1880, Military road, St Leonards; 1886, Aubin street, St Leonards east  

HAZELWOOD, D. - see Standsure Brick Company  

HEATON, Joseph  
1889: Notting Hill road, Rookwood  

HEMSLET, Joseph  
1883: North road, Gladesville  

HEMSLEY, William  
1884: Linsley street, Ryde  

HENRY, Rolfe  
1888: Deon street, Druitt Town  

HEWS, George  
1885: Livingstone street, Marrickville
HEWS, William
1886 and 1886: Fraser street, Marrickville

HILL, George
1887: Parramatta street, Granville

HILL, John
1887: Sutherland street, St Peters

HILL, Joseph
1861-1885: 1861-1864, Camperdown; 1865-1867, Australia street, Camperdown; 1866, Parramatta street; 1873-1876, Balmain road, Leichhardt; 1877-1879, Catherine street, Leichhardt; 1882-1885, Hill street, Leichhardt

In 1879, the word 'senr' was added after the name, suggesting that a like-named father and son were both in the trade at that time.

HILLARD, Thomas
1883: Belmore, Canterbury

HILTON - see Baker and Hilton

HILTON, R.
1898-1901: Highgate street, Auburn

HINE, Allen
1884-1887: Excelsior street, Concord

HINES, John
1920-1934: 1920, Enfield; 1921-1934, Burwood

HINES and SIMPSON
1885 and 1886: Redmyre road, Redmyre (Strathfield area)

HITCHCOCK, John
1828: Employed as a brickmaker at R. Crawford's, Prospect

HOBSON - see Whiting

HODKINSON and WRIGHT
1910: 23 North street, Manly

HOGAN, J.
1870: Sydenham road, Marrickville

HOGG, Stephen
1884: Elizabeth street, North Willoughby

HOLLEY, Thomas
1888-1891: Redmyre road, Strathfield

HOLROYD, Arthur Todd - see Sherwood Brick and Tile Company

"Judge" Holroyd established the Great Western Steam Brick Company.126

HOMOBRICK MANUFACTURING COMPANY LIMITED
1925-1928: 15 Newton street, Alexandria

HOOKHAM, William
1885: Sydenhamville, Sydenham road, Marrickville

HOPE, Frederick
1884: Long street, Ashfield

HOPETOWN BRICK, TILE and POTTERY COMPANY
1906-1908: Smith street, Tempe

These works (1902-1908) were first styled Hopetown Brickworks and then Hopetown Brick and Tileworks.

HOPETOWN BRICK and TILEWORKS
1904 and 1905: Smith street, Tempe

HOPETOWN BRICKWORKS
1902 and 1903: Smith street, Tempe (or Cook's River)

The brickworks were opened by a Dr Vause in 1902. Mr Samuel Westwood, the Manager, had previous experience in England and in several large brickworks in NSW.

HOPPING, B.
1895: Kings road, Fivedock

HOPPING and WEST - see West
1880: Parramatta road, Ashfield

HOPWOOD, John
1820-1828: Employed at Robert Taylor's, South Head road by 1828.

HORDER, T.
Secretary of the Enfield Park Brick Co. Ltd. during 1913 and 1914 (as listed).

HORNER, Charles
1880-1883: Lane Cove road, North Willoughby

HORNER, G.
1888: Clanwilliam street, North Willoughby
HORNSBY, TILE, POTTERY and BRICKWORKS LIMITED
1913-1921: 1930 1941 1947: 1912-1914, 273 George street, (office); 1915-1917, Gordon road, St Leonards; 1918 and 1919, Lane Cove road, St Leonards and also "Hornsby"

HORTON, William
1819-1828: By 1828, he was working for Robert Raine at Parramatta.

HOWARD, James
1888: Kingsgrove road, Hurstville

HOWARD, Jesse
A brickmaker who worked on the Waterloo Flat (Alexandria).

HOWELL, Charles
1884: Lane Cove road, North Willoughby

HOWLETT'S BRICKWORKS
1898: Pitt row, Prospect
Mr William Coulson, manager

HOWLETT, W.G. and COMPANY
1897: 237-239 Castlereagh street (agent in tiles?)

HUDSON, John H.
1873: Elswick street, Leichhardt

HUDSON, John T.
1871: Norwood, Petersham

HUDSON, Thomas
1871: Elswick street, Leichhardt

HUDSON BROTHERS LIMITED
1886-1889: 1886, Parramatta road, Strathfield late Homebush; 1887, Homebush; 1888 and 1889, 19 Macquarie place and Parramatta road, Homebush

HUDSON AND WARREN
1880: Old Canterbury road, Petersham

HUGHES, Arthur
1894: French's Forest road, Manly

HUGHES, Henry. (Two people appear to be involved in this entry)
1868-1897: 1868, Petersham; 1875-1880, Abattoir road, Leichhardt; 1879-1880, Petersham; 1879, St John's road, Petersham; 1884-1897, Hill street, Leichhardt; 1888, Charles street, Petersham

HUNTINGDON, William
1883: off West street, St Leonards
Huntingdon was born on April 16, 1822, at Reading Berks, England and arrived in Sydney around 1850. He married Charlotte Crisford at St Peters on October 5, 1854.

HUNTER, William
Hunter began proceedings against Rowe and Smith (contractors), in the Metropolitan District Council. In 1887 the sum claimed, was 30 for "setting and baking a quantity of bricks". The defence claimed that the work was not properly done, half of the bricks being unburned.

HURSTVILLE BRICK COMPANY LIMITED
1941-1965: Mortdale
This is the later styling of the Hurstville Steam Brick Co. Ltd., though the telephone book for 1930 styles it this way, Sands' styles it as "Judd's Hurstville Brick Co. Ltd."

HURSTVILLE STEAM BRICK and LAND INVESTMENT COMPANY LIMITED
1904-1921: 1904-1908, 18 Bridge street (office), and Mortdale; 1919, Mortdale

HURSTVILLE STEAM BRICK COMPANY LIMITED
1886-1935: 1887, Mort's Hill, Hurstville; 1891-1899, 60 King street (office); 1902, 28 York street (office), and Mortdale; 1903, 75 York street (office); 1909-1920, Mortdale - see Hurstville Brick Company Limited, and Judd's Hurstville Brick Company Limited.

W.G. Judd founded the Company and became manager after Edwards and Gardiner, from at least 1891 onwards. He was a member of the Legislative Assembly. He had three sons, James,
Percy and Harold (the latter, a famous Rugby Union forward). The sons were all involved in their father's management. Harold was manager by 1935. W.G. Judd died on 6th December 1929, aged 82.130

The works were opened late in August of 1886 with Messrs Edwards and Gardiner as managers and about 100 hands.131 The works were closed temporarily in 1888 because of the heavy railway freight charges, throwing about 125 men and boys out of work and deprived the railway of about £3,000 per annum. The Company was to remain closed until the railway charges were reduced.132 The Company was a guarantor for the Sydney Brick Company in 1893. Their bricks were stated to weigh (on average), 8lbs 4-1/2ozs and measure 9x4-1/2x3 inches.133 By 1921, the name was generally given as "Judd's Hurstville Brick Co. Ltd.".

HUTTON, S.E.
Listed as manager of the State Brickworks during 1912 and 1913

HYDE, Arthur
1884: Elizabeth street, North Willoughby

ILLAWARRA FIRECLAY and BRICK COMPANY LIMITED
1909-1965: 1909-1912, 2 Bridge street (office); 1916-1927, 68 Pitt street (office); 1921-1932, 19 Bridge street (office); 1920-1925, Bellambi; 1952, 19 Bridge street (office)

INDUSTRIAL BRICK COMPANY LIMITED
1911-1952: 1911-1929, Botany road, Waterloo; 1930-1932, Botany road and Bourke street, Waterloo; 1952, Botany road, Waterloo
Products, as listed during 1930-1932: firebricks, blocks, fireclay, baker's oven lumps and tiles.

INGHAM, A.C. and COMPANY LIMITED
1919: Bridge road, Pyrmont

INGHAM, William and SONS
1887-1897: 1887-1891, Bond street (office); 1892, 13 Bond street
Edward Chapman and Company were their agents from 1887 to 1897, at least. They were famous for their "prize medal glazed bricks".

ISDALE, William
1892 and 1893: Clyde street, Canterbury

IVES, Frederick - see Ives, George
1861-1890: Erskineville lane, Newtown; 1864, Waterloo; 1865, Newtown road; 1880-1889, Rochford street, Macdonaldtown.134 Frederick Ives and his family arrived in NSW in 1855 and started the Macdonaldtown brickworks. He resided in Rochford street, Macdonaldtown. By 1890, Ives' works were seen as one of the principal industries at Macdonaldtown (with Bakewell's).135

IVES, George
Son of Frederick Ives and resided with his father. He was born in 1853 in Brentwood, Essex. He was educated in Sydney and in 1883, was elected for four years as a member of the local council and became Mayor for one term.136

JACKSON, George
1882-1886: 1882, Daniel street, Leichhardt; 1884, Foster street, Leichhardt; 1886, Marion street, Leichhardt

JACKSON, Henry
1871-1876: 1871, Abattoir road, Petersham; 1873, Catherine street, Leichhardt; 1875 and 1876, Abattoir road, Leichhardt

JACKSON, James
1880-1887: 1880-1886, Marion street, Leichhardt; 1887, Parramatta road, Leichhardt

JACKSON, William
1879-1887: 1879, Moore street, Leichhardt; 1887, Walter street, Leichhardt

JACKSON BROTHERS
1888-1891: Marion street, Leichhardt

JACOBS, William
1882: Nelson street, Balmain

JANES, George
1880-1883: Mowbray road, North Willoughby

JOHNSTON, A. - see Johnston Brothers

JOHNSTON, John
1887: Victoria street, St Peters

JOHNSTON, Leslie
1891, Fitzroy street, Marrickville

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JOHNSTON BROTHERS PATENT STEAM BRICKWORKS
1877-1888: Fitzroy street, Marrickville
Mr W. Stunz became a partner of the firm when Mr A. Johnston died, ca.1886. Mr Stunz managed and supervised the work from its commencement. The business employed 65 hands and produced about 250,000 bricks per week. The works concentrated on common bricks, but the 17 acre freehold property had suitable clays for "any purpose". The machinery used was patented to Mr Stunz.137

JOINER, Thomas J.
Manager of the Excelsior Brickworks from 1910-1938 (as listed).

JOLLY, A.
Manager of Enfield Brick and Pipe Works, listed in 1915.

JONES, D. 1844 and 1845: Glebe
Listed as "bricklayer etc."

JONES, David
1882: Church street, Balmain

JONES, G.
Listed as manager of the Punchbowl Brick and Tile Works in 1914

JONES, Jacob138
1817-1820: Parramatta

JONES, John139
1817-1820: Sydney, Parramatta

JONES, John
1887: Unwins Bridge road, St Peters

JONES, Joseph
1801-1828: A free settler working at Parramatta by 1828.

JONES, W.
1914 and 1915: Harvard street, Gladesville

JONES, W.H.
1921-1937: Drymmoyne

JONES, William
1814-1828: Employed by John Good at Seven Hills by 1828.

JONES and ANNABEL BRICKYARDS
Listed as one of the principal industries of St Peters by 1890.140

JUBILEE STEAM BRICKWORKS
1900-1904: Barwon Park road, Alexandria (1903 and 1904, "St Peters")
J. Charlesworth, manager.

JUDD, Harold T.
Listed as manager of the Hurstville Steam Brickworks Ltd. from 1909 to 1920.

JUDD, W.G. - see W.P. Judd

JUDD, W.P.
Listed as lessee of the Hurstville Steam Brickworks Ltd. from 1900 to 1903. In 1900, the office was given as 28 York street and the works at Mortdale.

JUDD'S HURSTVILLE BRICK COMPANY LIMITED
1921-1965: 1921-1932, Colbourne avenue and Judd street, Mortlake, (Mortdale after 1931); 1952, Judd street, Mortdale
Products, as listed in 1922; "Plain and Fancy Bricks", "Bricks delivered to any part of Illawarra district".

JUNCTION BRICKWORKS - see Sherwood Brick and Tile Works, and Great Western Steam Brick Company
The bricks for Granville Public School, opened on November 1, 1881, were from these works. The tiles came from the Sherwood Tile Works.141

KAY, William
1887: Mitchell street, Enfield

KEAN, George
1871-1873: 1872, Donnelly street, Bankstown; 1873, Balmain road, Leichhardt

KEBBLEWHITE, A.
1879: Balmain road, Petersham

KEEN, Frederick
1877-1885: Long street, Ashfield

KEEN, Silas
1890-1892: 1890 and 1891, Long street, Ashfield; 1892, Church and Long streets, Ashfield

KEEN, William
1882-1889: 1882, Emma street, Ashfield; 1883-1886, Cheltenham road, Burwood; 1886-1889, Long street, Ashfield

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1790-1810: A master bricklayer in Sydney who had a workforce of 18 by November 1790. He worked for a Mr Scot of Hammersmith, London, by 1784. He was listed until September 1810 as a brickmaker 'in the Brickfields' and left for England soon after. He remained a superintendent of brickmakers until he left the Colony.

KING, Joseph
1887: Sutherland street, St Peters

KING, William - see Frogmore Brickworks
1889: Malakoff street, Marrickville

KING, William (junior)
1888: Malakoff street, Marrickville

KING, Joseph
1886: Western road, Prospect and Sherwood

KIRBY, F.R.
1893: Kirby street, Dundas

KIRBY, Mrs Matilda
1894-1896: Kirby street, Dundas

KIRBY, Thomas
1890-1892: Quarry road, Dundas

KNIGHT, Henry
1844-1873: 1844 and 1845, Newtown; 1864, Newtown; 1873, Pleasant street, Macdonaldtown

KNIGHT, James
1865-1868: Cooks River road

KURING-GAI BRICK and POTTERY WORKS
1910-1913: 28 Norton street, Manly - see Kuring-Gai Brickworks

KURING-GAI BRICKWORKS
1914-1924: French's Forest road, Manly

Later styling of the Kuring-gai Brick and Pottery Works.

LANCELEY, Edward
1884: Elizabeth street, North Willoughby

LANCELEY, E.R.
Listed as one of the proprietors of the North Sydney Brick and Tile Co., from 1894 to 1911.

LANCELEY BROTHERS
1921-1937, Blacktown; 1941-1956, St Leonards

LANCLEY, RJL - see E.R. Lanceley

LAND COMPANY OF AUSTRALIA LIMITED
A large investment company who financed the setting up of the Gore Hill Brickworks, Lane Cove road, North Sydney. Their office was located at the corner of Pitt and Bridge streets.

LANGTON and BEAZELEY
1851: Brickmakers at Pyrmont road

LAPPIN, Mark
1920 and 1921: Merrylands

LARKINS, James
1868-1870: Parramatta road, Petersham

LAWLER, James

LAWLER, Thomas
1884: Brickfields, Alexandria

LAWS, Benjamin
1882: Catherine street, Leichhardt

LAWS, Robert
1867-1880: 1867-1876, Abattoir road, Leichhardt; 1879, Style street, Petersham; 1880, Moore street, Leichhardt
LAY, James
1819-1828: By 1828, he was working with Simeon Lord at Botany.

LEAK, Jonathon
1819-1840s: Listed in 1839 as ‘potter and brickmaker’, Market lane, Elizabeth street. He arrived on a life sentence in 1819. By 1828, he was a ticket of leave man working as a potter at Brickfield Hill.

LEAR, Thomas
1828: During 1828, he was employed by William Cape at Brisbane Water.

LE CLERC, Francis
1861-1863: 1861, Camperdown; 1863, Stephen street, Camperdown

LEE, Alfred
1887: Unwins Bridge road, St Peters

LEE, Robert
1888-1890: Sydney road, Granville

LEGGATT, Alfred
Listed as manager of the Gurney Patent Brick Co. in 1892 and from 1893 to 1896, at the Phoenix Steam Brick Works.

LEICHHARDT BRICKWORKS - see O'Neil Brothers
1890: Allen street, Leichhardt

LEIGH, Henry
1887-1898: 1887, Brixton road, Rookwood; 1889-1898, Notting Hill road, Rookwood

LEIGH, John
1887-1896: Brixton road, Rookwood

LEIGH, Thomas
1885 and 1902, Brixton road, Rookwood; 1886, Brixton road, off Joseph street; 1903, London road, Rookwood

LEIGH BROTHERS
1904-1907: Kerrs road, Rookwood

LEMON, William
1864-1871: 1864-1866, Camperdown; 1867, Perkins street, Camperdown; 1871, Lambert street, Camperdown

LESLIE, Robert
1890: Warren road, Marrickville

LINES, William
1821-1828: Employed by Richard Taylor at South Head road, by 1828.

LINNEY, Arthur
1907: Chisholm road, Auburn

LINNEY, Charles
1868-1907: 1868-1871, Abattoir road, Petersham; 1873-1877, Catherine street, Leichhardt; 1880, Foster and Style streets, Leichhardt; 1882-1887, Style street, Leichhardt; 1884-1888, Harrow road; 1884, 1894, Harrow road, Auburn; 1904-1907, Chisholm road, Auburn

LINTON, John
1810-1828: By 1828, he was employed by John McHenry at Evan.

LION TILE COMPANY
1911-1986: Formerly called the Australian Brick Company. The name change occurred about 1915 according to some sources. The trade directories consulted, do not mention this name until 1952, though telephone books from at least 1930, do, (but not before 1920).

LIPSCOMBE, George
1863: Raglan street, Waterloo

LIPSCOMBE, Henry
1877-1880: 1877, Waterloo Estate, Alexandria; 1880, Mitchell road, South Alexandria; Unwins Bridge road, Marrickville. Enfield Yard by 1873?

LITHGOW VALLEY COLLIARY COMPANY LITHGOW and SYDNEY
1943-1965: Address (office), from 1956, 14 Martin Place, Sydney

LIVERPOOL STEAM BRICKWORKS COMPANY LIMITED
1907-1932: 1907 and 1908, 2 Hunter street; 1909-1922, 12 Castlereagh street (office).
The works were at Liverpool. A.S. Travers junior was listed as manager from 1911 to 1915.

LIVERPOOL TILE and TERRACOTTA COMPANY LIMITED
1923-1965: This is a continuation of the above company. The office during this time was 8a Castlereagh street and the works at Liverpool. In 1952, the works address was elaborated to Atkinson street, Liverpool.

LLOYD, CURLEWIS and BROWN
1885-1889: Brickfields, Alexandria

LONDON, H. - see Baldock
LONGBOTTOM'S
1887 and 1888: Lucas road, Burwood
In 1888, Mr Thomas West was listed as manager.
LOTZE, E. - see Red Cross Brickworks
LOUDON, John
1875-1877: 1875 and 1876, Silver street, St Peters; 1877, Edinburgh street, Marrickville
LOVEDAY, E.
1892: Greenbank street, Marrickville
LOVEDAY, Eliza
1885: Warren road, Marrickville
LOVEDAY and GRIGGS
1889-1891: Breenbank street, Marrickville
LUKINS, William
1858 and 1859: Mary street, Surry Hills

MACARTHUR, Gilbert
1882-1884: George street, Camperdown
Gilbert MacArthur was listed from 1858 to 1900 in Sands' under "potteries". In 1883, "Clyde Pottery" was included under Gilbert MacArthur's name.
McCLINK, Edward
1818-1828: Employed by William Rudgley, South Head road.
McCLOSKEY - see Elliot
McCOWEYVILLE, R.
1844 and 1845: Hutcheson's Paddock, Sydney
McCORMICK, James
1885: Garners avenue, Marrickville
MACDONALDTOWN BRICKWORKS - see Frederick Ives
McGILL, Thomas
1880-1892: 1880, Long Cove Creek, Ashfield; 1882, Dobroyd, Ashfield; 1883, Parramatta road, Ashfield and John street, Canterbury; 1884, Dobroyd estate, Ashfield; 1885-1892, Ramsay street, Summer Hill; 1890, Charles street, Summer Hill; 1890, Barker street, Petersham; 1891, Charles street, Canterbury and Barker street, Petersham.
McGRAW, Daniel - see McGrath
1890 and 1891: Beamish street, Canterbury
McGUIRE, Duncan
1863: Shepherds' Paddock
MACHON, Joseph
1880-1882: 1880, Young street, Leichhardt; 1882, Homebush
MACKENZIE, David A.
1886: Broughton road, Strathfield, late Homebush
MACKENZIE, William
1863: Harris street, Pyrmont
McKIVETT, John
1883-1885: 1883, Bramshot, Canterbury; 1885, Liverpool road, Ashfield
MAGNEY, John B.
1883-1901: 1883, North Willoughby; 1886-1889, Frederick street, North Willoughby; 1894-1896, 295 Pitt street; 1897, 108 Pitt street; 1898-1903, 114a Pitt street
J.B. Magney was listed as a proprietor of the North Sydney brick and Tile Co. from 1894 to 1911.
MAGNEY, J. and WEYNOTON - see Gore Hill Brickworks
1891-1893: Herbert street, Willoughby
MAHER, Thomas
1882-1884: Liverpool road, Ashfield
MAIER, William. "Shirley Brickworks"
1882-1886: 1882-1884, Dobroyd Estate, Ashfield; 1885 and 1886, Duckarma street, Ashfield
MANLY BRICK and TILE COMPANY
1919-1943: 1919-1924, 12 Castlereagh street (office); 1925-1943, Consul road, Brookvale
MANLY BRICK and TILE COMPANY LIMITED
1920-1928: Beacon Hill - see Beacon Bricks
MANSFIELD - see Marsfield
MAQUIRK, William
1814-1828: By 1828, he was employed at Richmond.
MARMON, Patrick
1795-1828: By 1828, he was employed at Lower Partland Head.
MARSHALL, J.
1877: Sydenham road, Marrickville
MARSHALL, Robert
1802-1828: By 1828, he was employed at Bathurst.
MARTIN, John
1817-1828: He resided in Castlereagh street by 1828.
MARTIN, John S.
1885 and 1886: 1885, Fitzroy and Sebastal streets, Marrickville; 1886, Fitzroy street, Marrickville
MARTIN, Joseph
1880: May street, St Peters
MASTER, J.B.
1884 and 1885: Glebe street, Parramatta
MASTERS, O.
In 1893, he was listed as lessee of Gibson's Brick and Tile Works.
MEAD, Charles
1871-1882: 1871, Norwood, Petersham; 1879, Old Canterbury road, Petersham; 1880-1882, Long Cove Creek, Ashfield
MEAD, John
1820-1828: He was employed by James Smith, Parramatta, by 1828.
MEADE, J.
1883: Parramatta road, Ashfield
MERRYLANDS STEAM BRICKWORKS - see Morris Brothers
1890-1898: Works, Pitt row, Prospect and Sherwood, office 81-89 Hay street (until 1895).
The proprietors were Morris Brothers. In 1893, Thomas Pendelberry was listed as manager, and from 1896 to 1898, John Breedon. A typical brick measured 9x24x3.147
METRIN, JOHNIAN BRICK COMPANY LIMITED
1902-1952: 1902-1908, 296 Pitt street (office); 1909-1952, 12 Castlereagh street (office). - see Sydney Brick Company
During October or November of 1902, Mr W.H. Nicholls became manager (listed from 1902-1915), and the firm began operations from their office at 296 Pitt street.148
The Company answered a Central Station tender to supply 1,000,000 patent bricks at 2/6/- per 1,000, but the tender was awarded to S. Spear.149
John Asche, late of the Warren Brick Company, was the representative for North Shore by 1902.150
MITCHELL, Frederick
1869: Mary street, Newtown
MOBILE OIL AUSTRALIA LIMITED
1965: Sydney
MOBRIAN, William
1858 and 1859: Camperdown road
MODEL BRICKWORKS
1889: Calvert street, Marrickville
George Beauchamp, manager
MONARCH TILE and BRICK COMPANY LIMITED
1925 and 1926: Sutherland
MORRIS BROTHERS - see Merrylands Steam Brickworks
1962-1965: Villawood
MOORE, S. and M.
1884: Lang street, Ashfield
MOORE, Thomas
1802 and 1820-1828: employed by Thomas Street, Sussex street.
MOOREVIEW BRICK COMPANY
1921-1930: 1921, Gladesville; 1924-1930, Ryde
MOOREVIEW BRICKWORKS
1921-1930: Barlow avenue, Tennyson
MORLEY, James
1815-1828: By 1828, he was employed at Newcastle.
MONORAY, M.
1844 and 1845: Frankford, Newtown
MORRIS, John. - see Petersham Brick Company
MORRIS BROTHERS - see Merrylands Steam Brickworks
1886-1894: 1886 and 1887, Government road, Prospect and Sherwood; 1889-1894, Pitt row, Prospect

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In 1891, the Sydney office was at Darling Harbour. Morris Brothers (John, Benjamin, William and Henry), were patternmakers who founded their business in 1878. In 1888, they had recently completed a double press brick machine. In 1893, they became one of the guarantors for the Sydney Brick Company.

MOSELY, William
1867-1880: 1867-1871, Chapel street, Marrickville; 1873-1880, Sydenham road, Marrickville

MOYES, William - see Fletcher Park

MOYES, William (junior)
1886-1888: 1886, Bridge street, Marrickville; 1887 and 1888, Arthur and Bridge street

MUNRO, David
1883: King street, south, Newtown

MUSTON, George
1885-1896: 1885 and 1886, Railway street, Prospect and Sherwood; 1893-1896, Railway street, Prospect.

MUSTON, Harry
1890: Railway crescent, Prospect and Sherwood

MUSTON, John
1890: Railway street, Prospect and Sherwood

MUSTON, Thomas
1886-1893: 1886-1891, Marsden street, Parramatta; 1893, Railway street, Prospect.

MUSTON, William
1890-1904: Railway street, Prospect

MUSTON and SONS
1887-1891: Railway street, Prospect and Sherwood

NASH, A.
1818 and 1819: Sydney and Parramatta

NATIONAL BRICKWORKS COMPANY LIMITED

The first annual meeting held on April 20, 1903 on the burners floor of the new Hardy kiln. At the time the works were 10 miles from the nearest works. The company produced at the time, "the unique interlocking hollow brick". They produced the usual common and open kiln shale bricks and apart from the interlocking bricks, made other forms of hollow bricks and even terracotta lumber. The property covered 7 acres.

The works became known as the Thornleigh Brickworks. The bricks, in later years at least, were stamped "N.B." with the letters run together like a monogram.

NEW AUSTRAL BRICK COMPANY
Commenced production in September 1962 at Wallgrove. The company was managed by A.M. Dawes who was the son of the founder and managing director, W.K. Dawes.

NEWBOLD SILICA FIRE BRICK COMPANY
1912-1932: 1912-1914, 77-79 Elizabeth street, (office); 1915-1919, 77 Elizabaeth street; 1920-1930, Challis House; 1931 and 1932, 109 Elizabeth street

NEWMAN, John
1820-1828: By 1828, he was at John Martin's at Castlereagh street.

NEW SOUTH WALES BRICK COMPANY LIMITED
1902-1962: Huntley street, Alexandria

This company was founded around the turn of the century. Naason Dawes was manager from its founding to at least 1906.

Products, "every description of bricks", (listed 1905-1932).

NEW SOUTH WALES BRICKMAKERS PROTECTIVE ASSOCIATION
1874

NEW SOUTH WALES BRICKMASTERS ASSOCIATION
The 1940 styling of the successors of the Brickmasters Association. Office 12 Castlereagh street

NEW SOUTH WALES GOVERNMENT STATE BRICKWORKS
1913-1937: 1913, 28 Elizabeth street; Works, Botany and Homebush; 1914, Botany and Rookwood; 1919-1927, Lidcombe; 1928-1932, Pyrmont Bridge road (office), Lidcombe (works); 1930-1937, Pyrmont

NEWTON, F.J.
It was claimed that F.J. Newton of Newtown, was the first to produce machine made bricks and not Goodlet and Smith (as had been claimed by J. Goodsell of Bowral when writing to the Sydney Morning Herald). Newton was said to have produced machine made bricks three or four years
before Goodlet and Smith's first venture. However, Goodlet and Smith did secure the patent rights for making dry press bricks in New South Wales first.155

NEWTON, Joe
Became a produce merchant after the introduction of steam machinery and was still in business by 1935.156

NEWTOWN BRICKWORKS - see F.J. Goodsell and P. Speare
1840s-1914: 1902-1916, John and Goodsell streets; 1919, John street
The original works were owned by a Mr Goodsell, an uncle of F.J. Goodsell and was transferred to him in 1838. It was said that these brickworks had the distinction of producing the first machine made brick in New South Wales. A valuable plant was introduced to cope with the demand for bricks. The claim for the first machine brick also goes to F.J. Newton, to Goodlet and Smith and H.W. Goodsell: the latter was supposed to have made the first machine made bricks here in 1871, made from shale.157 The Centennial History of 1888, states that the first machine bricks were made here in 1869, "the first used in the colony".158 Further work will need to be done to sort out the problem of "firsts", the available documentary sources being of a fairly poor standard.

The brickworks were taken over by P. Speare by about 1891 and was worked under his name until S. Speare took over. Mrs F. Spears was listed in 1919. By 1898, J. Charlesworth was manager and Elias J. Harber in 1899 and 1900.
In 1902, they advertised 'Best Common Bricks, Double Pressed, Plastic, Fancy and Moulded Bricks in Stock and to order. Sewer Bricks a Specialty'. - see F.J. Goodsell, P. Speare, and S. Speare, for other details concerning this site.

NEWTOWN STEAM BRICKWORKS
Styling of the name, Newtown Brickworks, from 1902-1914

NICHOLLS, William H.
Manager of the Excelsior Brickworks in 1889 and of the Metropolitan Brick Co. Ltd., 1904-1915.

NICHOLSON, R.J.
Secretary of the Carrington Steam Brick Co. during 1893 and 1894

NORTH ANNANDALE BRICK COMPANY
1880-1887: 1880, Young street, Leichhardt; 1887, Nelson street, Leichhardt

NORTH SYDNEY BRICK and TILE COMPANY (LIMITED by 1912)
The proprietors for 1894-1911 (as listed), were, J.B. Magney, H.O. Waynton and E.R. Lanceley. These brickworks stood on the site where the first bricks were made at Gore Hill during the mid 1830s (or possibly later). Messrs J.B. Magney and G.T. Wyenton [sic], according to E.A. Holden, selected the site in 1880 and set up a small machine capable of producing 10,000 bricks per day. They were produced by the manual process before that. By 1935, Lanceley's two sons had full control of the brickworks.159 In 1940, the works seem to have been divided between Herbert street, St Leonards and the 'Old Yard, Gore Hill'.

NORTH WILLOUGHBY BRICKYARDS
1889: Archer street, North Willoughby

NORTHERN SUBURBS BRICK COMPANY LIMITED
A.R. Gyles was listed as manager from 1913 to 1915. Products, 'Fire Brick Manufacturers' (1930).

NORTHERN SUBURBS CO-OPERATIVE BRICK COMPANY LIMITED
This company was part of the Northern Suburbs Brick Co. Ltd. By 1972, it was owned by "Subsidiary of ICD Limited".

OAKS STEAM BRICK COMPANY (NEUTRAL BAY)
1884-1891: 1884-1888, Military road, St Leonards; 1890 and 1891, Ben Boyd road, St Leonards
Edward J. Hayes was "manager" from at least 1884-1891, though another reliable source stated Robert Grant as "managing director" from about 1886 to at least 1888. It appears that Mr Hayes was in charge of the practical aspects of the running of the brickworks.160 Hayes set up the third Gurney tunnel kiln in New South Wales. It was the first to have any success. The kiln was built on the site of the later tram/bus depot along Military road, Neutral Bay. The cost for maintenance eventually made it a financial failure. The bricks in the Gurney kiln travelled upon trucks though varying intensities of heat until they emerged ready for use. The gear (trucks etc.), was purchased by Mr Hayes from the failed Waterloo set up. The last successful Gurney kiln was set up at Vickers's, St Peters.161 Mr T.O. Partridge became engineer at Mr Hayes works to maintain the wire cut machines. The wire cut machine was the first type of machine introduced to the North Shore. These machines
were replaced by Fawcett's (revolving drums, four moulds), semi dry process. A "Kennedy" and other machines were also used at Haye's works.162

O'CONNOR, James
1869: Harris road

OFFLARD, Michael
1863: Derwent street, Glebe

OGDEN, Peter
1880: Church street, St Peters

O'HARA, James
1890: George street, Enfield

O'NEIL, Alexander
1879: Allen street, Leichhardt

O'NEIL, Alexander and Thomas
1880: Allan street, Leichhardt

O'NEIL, Thomas
1884-1894: 1884, Allen street, Leichhardt; 1894, Francis street, Leichhardt

O'NEIL BROTHERS
1887-1894: 1887-1889, Allen street, Leichhardt; 1890-1892, 79 Allen street, Leichhardt
In 1890, the works were called "Leichhardt Brickworks". In 1892, another works was added to the list, being the Petersham Brick Company, Constitution road, Petersham.

OSBORNE, H.
1877: Cooks River road, St Peters

OXLEY and FORD
1886: 139 Pitt street (office)

PAGE, Thomas
1864 and 1865: Elizabeth street south

PALMER'S BRICKWORKS
Between 1793 and 1802 to early 1820s: This was one of the activities of John Palmer and must have been one of the first private brickworks outside of Brickfield Hills. It was located southwest of Palmer’s residence. The pit along the stream (Woolloomooloo).163 It was still in operation by the early 1820s.164

PARRAMATTA BRICKYARD
1890: Brickfield street, Parramatta

PARRAMATTA RIVER BRICK, TILE and POTTERY COMPANY LIMITED
1913-1932: 1913, 82 Pitt street; 1914, 82 Pitt street and Spurway street, Ermington; 1915 and 1916, 68 Pitt street and Spurway street, Ermington; 1917-1920, Spurway street, Ermington; 1920-1932, Rydalmore

PARSONS, Frederick W.
Listed as secretary of the National Brickworks Co. Ltd., 1903-1908.

PARTRIDGE, R.
1819: Parramatta165

PATENT STEAM BRICKWORKS - see Johnston Brothers

PATENT PLASTIC BRICKWORKS
1894 and 1895: 1894, Alexander street, Alexandria; 1895, Barwon Park road, Alexandria
A Harber was listed as manager in 1894, while in 1895, the owners were listed as: "The Colonial Finance, Mortgage, Investment and Guarantee Corporation Limited".

PATRICK, Robert
Listed as secretary of the Vale of Clwyd Brickworks from 1913 to 1915.

PAUL, William
1866-1879: Botany road, Waterloo

PAVESI - see Andina

PEARSON, Rolf
1844 and 1845: Frankford, Newtown

PEARSON, Thomas
1820-1828: By 1828, he was working for Robert Taylor, South Head road.

PEARSON, Thomas
1858 and 1859: 15 Mary street, Surry Hills

PENDLEBERRY, Thomas - see Merrylands Steam Brickworks

PENDLEBURY, Elijah
1884-1897: 1884, Hampton street, Croydon Park, Canterbury; 1890-1897, Hampton street, Canterbury

PENDLEBURY, James and Son
1886 and 1887: Crinan street, Canterbury
PENDLEBURY, Robert
1884: Elizabeth street, North Willoughby
PENDLEBURY, T. and SON LIMITED
PENDLEBURY, William
1883-1895: Crinan street, Canterbury
PENDLETON, William
1867-1869: 1867, Waterloo; 1869, Lord street, Enmore
PENFOLD, Henry
1884: Elizabeth street, North Willoughby
PENN, Arthur H.
Secretary of the Carrington Steam Brick Company from 1895-1930 (as listed)
PEREMONT - see Piermont
PETERS, Edward - see Petersham Brick Company
1888: Constitution road, Petersham
PENRITH BRICK COMPANY LIMITED
1919: 34 or 36 Moore street
PETERSHAM BRICK COMPANY
1885-1895: Constitution road, Petersham
From 1887 to 1894, Edward Peters was listed as manager. Peters and John Morris were both listed in 1894 and the latter solely in 1895.
PETERSHAM BRICKWORKS
1902-1912: Constitution road, Petersham
Henry Dean and Son appear to have been the proprietors.
PETTIT, J.
1898: Madeline street, Enfield
PHIPPARD, F.G.
Listed as secretary from 1926 to 1931 at the Federal Brick Co. Ltd.
PHOENIX STEAM BRICK WORKS
1893-1896: Victoria road, Marrickville
Alfred Leggatt, manager. The company was also styled "Phoenix" or "Phoenix Brickworks".
PICKVANCE, Thomas
1886: Calvert street, Marrickville
PITMAN, S.P.
Secretary of the City Brick Company, 1913 and 1914, as listed.
PITT, William
1821-1828: Worked with William Rudsley, South Head road by 1828.
PLAYFORD, Richard
1880: Windsor road, Petersham
PLAYFORD, R. and W.
1877: New Canterbury road, Marrickville
PLAYFORD, William - see Morris Brothers
1869-1880: 1869, Hutchinson street, St Peters
PLAYFORD BROTHERS
1875 and 1876: New Canterbury road, Marrickville
PLOWMAN, John
1871-1876: 1871, Macdonaldtown, Newtown; 1873-1876, Pleasant street, Macdonaldtown
PORTER, Robert
1875 and 1876: Wardell's road, Marrickville
POWELL and COMPANY
1888-1894: Redmyre road, Strathfield
POWNIER, John
1867: Waterloo
PRITCHARD, Edward
1851: Newtown
PRITCHARD, Samuel
1864-1873: 1864 and 1865, Waterloo; 1873, Unwins Bridge road, Marrickville
PROSSER, R. - see Auden, A.C. and Prosser, R.
PUCKERIDGE, Charles
1885 and 1886: 1885, Jasmine Cottage, Inkermann street, Parramatta; 1886, Rosehill street, Parramatta
PUCKERIDGE, John
1865: Ultimo
PUCKERIDGE, J. and W.
1884 and 1845: Parramatta road, Camperdown
PUCKERIDGE, Richard
1851-1880: 1851, Pyrmont road; 1864, Ultimo; 1867 and 1868, 265 Harris street, Pyrmont; 1871, Harris street, Pyrmont; 1875-1880, Harris street

PUCH, J.
1877: Enmore road, Marrickville

PUNCHBOWL BRICK and PIPE COMPANY
1952: Bond's road, Punchbowl

PUNCHBOWL BRICK and TILE COMPANY LIMITED
1914-1965: 1915, 94 Pitt street (office); 1916-1919, Punchbowl; 1920-1952 (at least), Bond road, Punchbowl.
G.A. Jones was listed as manager in 1914 and J. Wiley as secretary in 1915. In 1914, "Limited" was added to the name.

PURDY
1844 and 1845: Glanmore, Newtown

PYLE, Edward W.
1885: Queen street, Ashfield

RAILWAY BRICKWORKS
1886: Blaxland road, Ryde

RALFE, Henry
1887-1889: Dean street, Druitt Town

RAWLINGS
1870, May street, Newtown

RAWLINSON, Thomas
1802 or 1820-1828: Employed by Isaac Dale, George street by 1828.

READ, John F.
1882: Hampton street, Balmain

RED CROSS STEAM BRICKWORKS
1886-1888: Victoria road, Marrickville
A.W. Gillies appears as manager between 1886 and 1888. Edward Latz was listed as manager in 1890.
The Works were designed and built by Humphreys and Cracknell, consulting engineers and architects for Mr Gillies. The prospectus was established by April of 1886 with a capital of £22,000 and shares of £1 each with the proprietor retaining 7,000 shares. The land desired for the Works belonged to Gillies and was located in Marrickville.
The bricks were stamped "R + C" and are often found on whitish bricks.

REFRACTORY BRICKS LIMITED
1919-1930: 1919-1928, 58 Pitt street (office); 1929 and 1930: 22 Bridge street (office).
J. Colclough was listed as secretary from 1919 to 1928. In 1930, the company was in liquidation.

REILLY, John
1884: Dobroyd Estate, Ashfield

REISNOZANSKI, L.
1884: 9 Burnett lane

REUSS and HALLORAN
This partnership applied for a brick lease in Newtown in 1881.166

RICHARDS, James 1851: Pyrmont road

RIGGS, Charles
1883: Waterloo road, Alexandria

RILEY
Riley was elected as one of the founding directors of the Eight Hours Co-operative Brick, Tile and Pottery Co. Ltd. in 1886.

RILEY, John
1866-1891: 1866, Casey's lane, Cooks River; 1880-1882, Long Cove creek, Ashfield; 1883, Parramatta road, Ashfield; 1885 and 1886, Tenandra street, Ashfield; 1889-1891, Ramsay street, Summer Hill

RILEY and ABBOTT
1892: Ramsay street, Ashfield

RIVERSTONE BRICK COMPANY
1883 and 1884: 410 George street (office).

ROACH, W.
1890 and 1891: Aird street, Parramatta.

ROBERTS, John
1818-1828: By 1828, he was employed by Richard Wellington at Parramatta

ROBERTSON, John
1882: Pashley street, Balmain

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ROBINSON, John
1887-1890: 1887, Terry street, St Peters; Archer street, North Willoughby.
    J. Robinson listed as manager.
ROBINSON, Matthew
1863: Bullanaming street, Redfern
ROCKLEY, William
1867: Waterloo
RODGERS, Charles
1882: Milton street, Leichhardt
ROFE, T.E.
    Listed as the proprietor of the Australian Brick Co. from 1912 to 1914.
ROGERS, David R.
    Listed as manager of the Austral Brick Company from 1913 to 1927.
ROGERS, Leonard E.
    Listed as manager of the Austral Brick Company from 1928 to 1931.
ROOKWOOD BRICK COMPANY LIMITED
18890: Joseph street, Rookwood
ROOKWOOD QUARRY, ASPHALT, POTTERY and BRICK COMPANY LIMITED
1891-1893: Joseph street, Rookwood
    In 1890, the company was known as the Rookwood Pottery Company Limited and listed under
    "potters".
ROSMAN, B.G.
1928-1932: Waterloo
ROSSI, RR.L.
1861: Took a machine to Rev. Hassan's property from Sydney.167
ROTER BROTHERS - see Rutter Brothers
ROUSWELL, George
    Rouswell became a very successful sanitary contractor after the introduction of machines.168
ROVERY and CONSTABLE
1888: Sydney road, Granville
RUSSELL, Frank
1886-1888: 1886, Brickfields, Alexandria and Lackery street, St Peters; 1887 and 1888, Brickfields,
    Alexandria
RUSSELL, Henry
1880-1886: 1880-1882, Lane Cove road, North Willoughby; 1885 and 1886, Albert avenue, North
    Willoughby
RUSSELL, James
1869: Silver street, St Peters
RUTTER, Robert
1886-1890: 1886-1888, Crimea street; 1890, Old Prospect road, Prospect and Sherwood
RUTTER, William
1888-1890: 1888, Crimea street, Parramatta; 1890, Old Prospect road, Prospect and Sherwood
RUTTER BROTHERS
1884-1887: 1884, Glebe street, Parramatta; 1884, Crimea and Glebe streets, Parramatta; 1887, off
    Pitt row, Prospect and Sherwood
RYAN, James
1869: Johnson street
RYAN and BARRY
1882: Cooks River road, St Peters
RYDE BRICK COMPANY
1911-1915: Great Northern road, Ryde
    Thomas Williams was listed as manager during 1912 and 1913. The company changed its name to
    Ryde Brickworks Limited.
RYDE BRICK and TILE WORKS PTY. LIMITED
1952: Victoria road, Ryde
RYDE BRICKWORKS LIMITED
1916-1956: Great Northern road, Ryde; 1932-1952, Victoria road, Ryde - see Ryde Brick Co.
ST PETERS BRICK COMPANY LIMITED
1908-1950: Barwon Park road, Alexandria
    W. Edwards was listed as manager from 1915 to 1919. The earlier name for this company was St
ST PETERS BRICKWORKS
1919: Barwon Park road, Alexandria
    Another listing for St Peters Brick Co. Ltd.
ST PETERS PATENT DRY PRESS BRICK COMPANY
1894-1907: 1894, Alexander street, Alexandria; 1895-1907, Barwon Park road, Alexandria - see St Peters Company Ltd.
Mr Henry Woodley was listed as manager from from 1894 to 1899, when he retired but was listed again in 1901. William Edwards was listed in 1900 and from 1902 to 1907.
In 1894, St Peters' common bricks typically weighed 8lbs of 9lbs 1-1/4ozs and measured 4-1/4x4-1/4x3 inches. St Peters' "brown bricks" were used in the residence of F.S. Willis at Lane Cove road, North Sydney.

SALADINE, Joseph
1885: Denison road, Petersham

SAMPSON and EAGLE
1864: Marrickville

SAMS, Samuel
1798-1828: In 1828, at the age of 70, he was employed by Robert Browne at South Head road.

SANDS - see Cottle
SANANS, James
1822-1828: He was employed at George Innes of Bathurst by 1828.

SARNEVAY, William
1887: Caldwell street, Gladesville

SAUNDERS, John
1886-1891: 1886-1890, Isabella street, Parramatta; 1890 and 1891, Gladstone street, Parramatta; 1890, Sarrell street, Parramatta

SAUNDERS and EYLES - see Ayles; and Eyles
1884 and 1885: 1884, off Kissing Point road, Parramatta; 1884, Gladstone street, Parramatta

SAVAGE, Carmichael
1863: Jenkins street

SAVAGE, George
1882-1895: 1882, Balmain road, Leichhardt; 1888 and 1889, Brixton road, Rookwood; 1895, Kerrs road, Rookwood

SAYWELL, John
1880-1884: 1880, Capel street, Marrickville; 1883 and 1884, New Canterbury road, Petersham.
Saywell was born in Nottingham, England in 1837 and arrived in Sydney in 1848. He was involved in the tobacco business from 1863 and founded the Eagle Brick Company and the Standard Brick Company.

SCHOFIELD, David J.
Manager and secretary of the Croydon Steam Brick Co. Ltd. from 1902 to 1909 (as listed).

SCONCE, William
1818-1828: Employed by William Cox at Windsor by 1828.

SCUTTS, John
1880: Marion street, Leichhardt

SCUTTS, Joseph
1884-1886: 1884, Foster street, Leichhardt; 1886, Davies street, Leichhardt

SEAWARD and HOPKINS
1875 and 1876: Underwood street, Ashfield

SELDON, Richard Carlotta
1880: Lane Cove road, North Willoughby

SENIOR, Henry E.
1883: Cooks River road, St Peters

SEWELL, James
1828: Employed by David Hayes, George street.

SHANNON, W.R. - see Shannon's Brick, Tile and Pottery Co. Ltd.

SHANNON'S BRICK, TILE and POTTERY COMPANY LIMITED
1925-1965: 1925, 1a Percival road, Stanmore (office), and Wentworthville (works); 1926-1932, 258 Parramatta road, Petersham (office), Wentworthville (works); 1933-1965, Wentworthville
W.R. Shannon's and W.H. Bagnall's residences were quoted during 1929 and 1930.

SHERWOOD BRICK and TILE WORKS - see Great Western Steam Brick Company Junction Brickworks, Parramatta
The Works were founded by Arthur Todd, or "Judge", Holroyd. During the 1860s, he acquired a good deal of land (located about a mile from Parramatta). Holroyd recognized the good clays and needed to drain the area. He persuaded a doctor from the Parramatta Lunatic Asylum to share the costs of buying and importing a Whitehead drainpipe making machine from England. (Holroyd was a "Master in Equity and Luncay"). The doctor was unfortunately murdered by a patient and so Holroyd began to manufacture drainpipes himself. At the time there was only one other manufacturer making drainpipes, an Italian farmer and macaroni maker. The other pipe
makers' pipes were expensive and tended to crumble. Holroyd's pipes received a lot of attention. Mr Walter Lamb and others made "urgent representations" regarding the manufacture of red bricks and tiles, hoping that a perfect product might be produced. Experiments were done on the clay, involving thousands of pounds of money. Shale clays were not useful, being too hard to use in carving or "higher purposes of brickwork", but the iron rich red clays of this area were perfect. By 1891, a few of the houses, sheds and outbuildings near the works were roofed with the red Sherwood tiles, which though, "plain and unprepossessing", presented a contrast to houses built a little further out.

By 1891, there was an estimated amount of clay to last a century and a damned creek was capable of holding 250,000 gallons of water. The clay was transported by trollies up an inclined tramway and was tipped into a grinding and pugging mill. The mill was soon to be replaced by a "Chilian" grinding pan. The kilns were on the improved down draught principle with a tall extracting flue. The Sherwood Brick and Tile Works did not produce common stock bricks as the red clay was too valuable. It specialized in double pressed red facing bricks, flooring tiles (said to be better in colour than the French plain, ornamental and corrugated roofing tiles and compared well with the Marseilles goods. Bricks were made especially for carving and rubbing. As well as red facing bricks, moulded bricks and garden tiles were manufactured. Ornamental articles were also made of the various kinds of terracotta. Red bricks were used in the residence of Mr Bruce Smith at Burradoo. Garden edging tiles could be seen at Mr Du Faur's new house at Hornsby. Ornamental roofing tiles were supplied for the turret of Messrs Paling and Company's new premises in George street. The larger range of roofing tiles with ridge cresting and terracotta finials, designed by H.M. Robinson, were used for the new tramway waiting rooms on the corner of Elizabeth and Liverpool streets. At the time (1891), the company was prepared to make all kinds of moulded bricks to any architect's design. They were also prepared to stock up any designs architects or builders regularly used. Red bricks and tiles were used for Norman Self's residence at Ashfield in 1888. The red roofing tiles of the 1881 part of the Granville Public School, came from these works.

The Junction Brickworks and the Great Western Steam Brick Company appear to have been different names used for this establishment at different times. Data under those names have been listed under their appropriate headings in case they are separate establishments.

By 1906, Brosley pattern tiles were manufactured by the Sherwood Tile Company for the refreshment kiosk at Hyde Park "recently erected". The tiles were burned to a "special gauge for the circular roofs and towers".

SHIRLEY BRICKWORKS - see William Mainor
SHOLEA, Stephen T.
1887: Wentworth street, St Peters
SHORTUS, Charles
1886: Gould street, Canterbury
SHORTUS, Henry
1877-1883: 1877-1880, Sydenham road, Marrickville; 1883, Bramshot, Canterbury
SHORTUS, Matthew H.
1886 and 1887: Robert street, Canterbury
SHORTUS, William
1868-1876: 1868, New Cooks River road, Norwood; 1870, Norwood, Petersham; 1871, Sydenham road, Marrickville; 1875 and 1876, New Cooks River road, Marrickville
SHORTUS, Mrs (William?)
1889: New Cooks River road, Marrickville
SIMPLEX HOLLOW WALL BRICK and TILE COMPANY
1899: 114a Pitt street (office)
SIMPSON - see Hines
SIMPSON, J.
1877: Enmore road, Marrickville
SIMS, E. James
1928: Lidcombe
SIMS, James
1886-1937: 1886, Brixton road off Joseph street; 1887-1914, Brixton road, Rookwood; 1915-1929, Brixton road, Lidcombe; 1930-1937, Lidcombe
SIVYER, Frederick J.
1880: Croydon road, Ashfield
SMITH, Alfred
1884-1901: 1884, Cabarita Point road; 1887, Mortlake road, Concord; 1888 and 1889, Short street, Concord
SMITH, C.A.
1932-1937: Old Guildford
SMITH, Charles
1818-1828: Employed at Robert Taylor's South Head road
SMITH, Edward  
1888: Liverpool road, Ashfield

SMITH, George  
1885: Prospect road, Ashfield

SMITH, Jack  
He was known as "Protestant Jack" and worked in the brickyards on the Waterloo Flats at Alexandria, 1870s-1880s.176

SMITH, James  
1817-1828: Working at Parramatta by 1828.

SMITH, John  
1889: Vaughan street, Rookwood

SMITH, Samuel  
1825-1828: By 1828, was assigned to R.A. Rodd, Harrowby, Patrick Plains.

SMITH, Samuel  
1882: Junior street, leichhardt.

SMITH, William  
1875-1891: 1875 and 1876, Canterbury road, Ashfield; 1888-1891, Oxford street, Rookwood

SMITH, Uriah  
1820-1828: Employed by Charles Dricer at Petersham by 1828.

SOUDAN BRICKWORKS  
1888: Croydon road, Kogarah  
Proprietor (?), James Cavey.

SOUTH ASHFIELD BRICKWORKS  
1913-1932: 1913-1923, Goodlet street, Canterbury; 1924-1925, Trevenar street, Canterbury; 1926-1932, Trevenar street, Ashbury

SPEAR - see Speare

SPEAR'S BRICK, TILE AND PIPE WORKS LIMITED  
1925-1937: 1925-1927, 632 King street, St Peters; 1928-1937, King street, St Peters  
Products: "Bricks, Tiles and Drain Pipes and Fittings" (1928-1931).

SPEECHLEY, John  
1882: Homebush

SPEECHLEY, Joseph  
1887: Sutherland street, St Peters

SPEECHLEY, Philip  
1892 and 1893: Alfred street, St Peters

SPEECHLEY, William  
1880-1886: 1880, Bank's Meadow, Botany; 1886, Botany road, Botany

SPEECHLEY, William (junior)  
1887: George street, Concord

SPIERS, Peter - see Peter Speare

SPIERS, William  
1867: Waterloo

SPITSTEAD, William  
1889: Albert street, St Peters

SPITSTEAD, William  
1867: Waterloo

SQUIRES, James - see St Peters Steam Brickworks

SQUIRES, William  
1873: Cooks River road

SPRINGWOOD BRICK and TILE COMPANY  
1914 and 1915: 129 Pitt street, (registered office)
STANDARD STEAM BRICK and POTTERY WORKS
1885-1891: New Canterbury road, Petersham. - see Hart and Gallagher; D. Anderson and Thomas Saywell. These Works were formed by Thomas Saywell. In 1887, Hart and Gallagher were named as the proprietors. The Works were listed under "potteries" in 1890 and 1891.

STANDSURE BRICK COMPANY
1886-1932: 1886-1899, Sydenham road, Marrickville; 1900, Stanmore road, Marrickville: offices, 1888 and 1889, 70 Pitt street; 1890, Union Chambers, Pitt street; 1891-1897, 177 King street; 1902-1907, Stanmore road, Marrickville; 1908-1924, Sydenham road, Marrickville.
The Standsure Brickworks, owned by Thomas Daley, was "re-opened" on the 25th of August 1886, after new machinery was installed on the dry press process. The grinding pan and the 30hp engine were made by Platt Brothers at Oldham, England and could produce 20,000 bricks per day. The pulverizer or grinding pan was said to be the largest in the Colonies, measuring 9 feet 6 inches (2.899 m) in diameter. It weighed 20 tons (20.40 tonnes) and could reduce stone, shale and clay to powder. The pulverized material was taken from the pan by elevators and buckets of a "Dreyer" principle carried the material to the loft and deposited it in a large chute which carried it to the Platt machine. The bricks were then conveyed directly into the kiln.

The account of Thomas Daley's Works in the Centennial History of New South Wales 1888, varies only in minor details but mentioned that the company was formed into a limited liability company in 1887, consisting of Messrs D. Anderson, James Briery and Edward Lee. The company was floated on the August 18, 1887. The registered office was at 70 Pitt street. Daley ceased to be owner but became managing director. Bricks made by the company were said to have formed the superstructure of "many of our finest architectural piles".

The first annual meeting of shareholders took place during July 1888. Mr Edward Lee retired as director. The company was doing well, despite the depression in the building trade. Unallotted shares were offered to the public to defray the cost of erecting a patent kiln.

The kiln was completed by July 1891 and a ceremony was arranged in order to light the Centennial kiln. It was stated that the kiln was built along the lines of the patent held by the Centennial Brick Kiln Company. The investors were Button, Peters and Goodsell. The kiln was built on the continuous principle and railway trucks or drays could be backed into the chambers of which there were 14 with a capacity of holding 250,000 bricks. Previously, the Company used "old fashioned" kilns, probably of the Scotch variety, which cost between 8/- and 9/6 per 1,000 bricks. The new kiln reduced the cost by 2/6. The kiln was built by G.W. Brewer and the consulting engineer was J.J. Stone. It was the third of its type to be constructed.

T. Daley continued to be listed as proprietor until 1910. T. Stanley Daley was listed from 1916 to 1924. Products: "for good Brick, cheap Brick, common and "O.K."", (1916).

STATE BRICKWORKS
The establishing of a Government brickworks was rejected in the Legislative Assembly in 1911 but was accepted in 1912. It was desired that cheap bricks could be had for Government projects. They also sold to the general public at 30/- per 1,000 against the "Combine's" charge of 45/- (at the kiln). In 1922, the State Brickworks sold at 55/-against the private 68/- per 1,000. In 1935, the Steven's Government condemned the Works as a non-profitable concern and tenders for its private sale were under consideration.

There were several areas where the State Brickworks operated - 1912-1935: 1912 and 1913, 28 Elizabeth street (office), works at Rookwood; 1914, Rookwood; 1915-1935, Glebe and Lidcombe (Glebe was sometimes styled as Pyrmont or Bridge road); Pyrmont (1919-1921), and Homebush were also listed (1920-1924 and in 1952). The latter years post-1935, have not been researched.

STATE LIME and SANDLIME BRICKWORKS
Botany
This company was formed by 1915. The brickworks used a formula of two parts of sand to one of lime with a later addition of 70 per cent sand (found nearby). Ball and tube mills were used to reduce the sand and lime to a fine powder. The formula was lightly sprayed before entering the brick pressers and submitted to 200 tons of pressure per square inch. One brick machine could turn out 1,600 bricks per hour. The bricks were later submitted to steam pressure of 125 pounds per square inch in a 70 feet long cylinder, six feet in diameter for about 8 hours which hardened the brick. The bricks were said to be less absorbent than ordinary clay and shale bricks and be able to withstand 2,454 pounds of pressure per square inch (as quoted).

STAUNTON, Thomas
1877: Victoria road, Marrickville

STEPHENS, Alex
1828: Employed by Thomas Street, Sussex street.

STEPHENS, William
1884: Elizabeth street, North Willoughby

STOKES, Sarah
1817-1828: By 1828, she was working in Parramatta.

STONE, N. - see Morris
STONESTREET, G.R.
1885: Constitution road, Petersham
STONESTREET, J.
1887: Middle street, Marrickville
STONESTREET and MOORE
1888: Windsor road, Petersham
STRATHFIELD and ENFIELD STEAM BRICK COMPANY
1892-1900: 1894-1900, Water street, Enfield. The office was listed in 1892 as being at No.4 Imperial arcade, Pitt street.
Lewis F. Garnett was listed as manager in 1892 and John Gardiner in 1894. In 1893, this Company was one of the guarantors for the Sydney Brick Company. The word 'steam' was again adopted for 1909 and 1910.
STRATHFIELD and ENFIELD BRICKWORKS
1901-1905: Water street, Enfield
This name with the word 'Ltd.' was adopted in Sands' for the years 1919 and 1920.
STRATHFIELD and ENFIELD BRICK and TERRACOTTA WORKS
1906-1920: Water street, Enfield
Products: "Common and Open Kiln Facing Bricks of Best Quality, Double Pressed Plain and Fancy. Moulded bricks in Stock and to Order, Terracotta Air Bricks". (1906)
The various names for this company overlap chronologically, suggesting that no great emphasis should be placed on the exact title.
STRATHFIELD and ENFIELD BRICK and TILE COMPANY
1921-1941: Water street, Enfield
STRATHFIELD and ENFIELD STEAM BRICK and TILE COMPANY
1943-1950: Enfield
STRATHFIELD and ENFIELD STEAM BRICKS and TERRACOTTA WORKS
1920-1928: Enfield
STRATHFIELD and ENFIELD STEAM BRICKWORKS
1909, 1910 and 1919: Water street, Enfield
STUBBINGS, Samuel, Benjamin
1877-1880: Cooks River road, St Peters
STUNTZ, William - see Johnston Brothers
1888-1891: Fitzroy street, Marrickville
Stuntz arrived from Germany in 1858 and managed Johnston Brothers from about 1877 to 1888. He became a partner around 1886 when A. Johnston died. The machinery was based on his patent.
STURT, H.P.
Manager of the Railway Brickyards, as listed in 1886.
STYLES and YATES
1844 and 1845: Stanmore, Newtown
SUBURBAN LAND and INVESTMENT COMPANY LIMITED
1920-1937: Ashfield
They bought the National Brickworks at Thornleigh in 1935 and eventually expanded to Eastwood, Burwood and South Ashfield.
SUN BRICK and TILE PTY. LIMITED
1956: Merrylands
SUTCLIFFE, J.B.
1930-1956: Belmore
SUTHERLAND BRICK COMPANY LIMITED
1919-1936: Sutherland
SUTHERLAND BRICK PIPE and POTTERY WORKS
1928-1965: Princes Highway, Sutherland
SYBIER, Frederick
1888: Parramatta street, Granville
SYDNEY BRICK COMPANY LIMITED
1893 and 1894: Post Office Chambers, 114a Pitt street
This company was registered early in January of 1893. The Company was formed so as to standardize the quality of bricks and to regulate the trade generally. It was not an amalgamation but was intended to protect individual businesses, according to a contemporary source. The list of guarantors who registered in January 1893 were: Warne Brothers and Company; A. Harper; Carrington Brick Company; Hurstville Brick Company Limited; Morris Brothers; Strathfield and Enfield Brickworks; Josiah Gentle; Hart and Gallagher; and E. Vickery and Sons. (The inclusion of the office address of 114a Pitt street in listings suggests membership).
SYDNEY BRICKWORKS
1903-1945: 1903-1919, Unwins Bridge road, Marrickville; 1920-1926, Unwins Bridge road, Sydenham (in 1920 St Peters and "Sydney"); 1927-1932, Unwins Bridge road, St Peters
SYDNEY, MELBOURNE, and WALLERAWANG COAL COMPANY
1879: Sydney
This Company entered fire clay which "looked well" at the Sydney International Exhibition in 1879.187

SYMONDS
Symonds was "superintendent" of Bakewell Brothers by 1894.

SYMPS
One of the elected founding directors of the Eight Hours Co-operative Brick, Tile and Pottery Co. Ltd. in 1886.

SYMONS, O.G.
Symons was listed as manager of Goodlet and Smith's Junction Brickworks at Prospect during 1893 and 1894.

SYMONS BROTHERS PTY. LIMITED
1952: Fairfield

TABRETT, DRAPER and COMPANY
1887-1889: Brickfields, Alexandria and at King street, Newtown; 1888, King street south, Newtown and at Alexandria; 1889, Brickfields, Alexandria and King street, Newtown and St Peters
The company was originally formed in 1876 by J.F. Tabrett and brickmaking was but a sideline, Tabrett and Draper being chiefly "Manufacturers, contractors, timber merchants etc.". Before 1888, they purchased Mr Edwards interest in a sandstock brickyard situated close to Tabrett and Draper's in King street, Newtown. An adjoining property was purchased and added to the Edwards property. A steam brickmaking plant of the semi dry process was established. Up to 1888, the bricks were burned in open Scotch kilns but plans were underway to erect kilns where gas and steam could be incorporated based on a recently patented invention.188

TAILARICO - see Andina
TANNER - see Chidgey and Tanner
TATTERSALL, Joseph
1864 and 1865: Newtown
TAVERS, G.S. (junior)
Secretary and manager of the Liverpool Steam Brickworks Co. Ltd.
TAYLOR, E.A.
Listed from 1915 to 1925 as secretary to the Federal Brick Co. Ltd.
TAYLOR, James
1822-1828: Employed at Jabez Henley at Parramatta by 1828.
TAYLOR, John
1888 and 1889: Mitchell street, Enfield.
TAYLOR, Robert
1821-1828: A leading brickmaker, with many in his employ, at South Head road.

TEMPE BRICK and TILE WORKS
1920-1924: King street, St Peters
F.L. Speare was listed as proprietor during this time.

TEMPE BRICKWORKS
1914-1937: 1914, King street, St Peters; 1915-1919, King street, St Peters (near Cooks River); 1919, Cooks River road, Tempe; 1920-1934, Tempe; 1937, St Peters
F.L. Speare was listed as proprietor from 1914 to 1919.

THOMAS, C.W.
Listed as the manager of the National Brickworks Co. Ltd. in 1915.

THOMAS, George
1911-1920: Passefield street, Liverpool

THOMPSON, Benjamin
1907-1911: French's Forest, Manly

THOMPSON, Robert
1882: Walter street, Leichhardt

THORNLEIGH BRICKWORKS
Near Pennant Hills road, Thornleigh
This Company was earlier known as the National Brickworks. The Works were announced in the Cumberland Argus on October 4, 1902 to be opened in the area known as "Dartford Park" and work was to begin in October. A John Hardy 16 chamber kiln was completed by May 1903, Scotch kilns were used before that. In 1935, the Works were sold (by which time a second continuous kiln had been built), to the Suburban Land and Investment Company Limited. It was re-sold in 1938 to the Brickworks Limited.
The Brickworks ceased operations in September 1975 and in 1980 the area was acquired by Hornsby Shire Council who leased the pit as a dump. The last traces of buildings were demolished by late 1984.
Large Platt machines were used (made by Foster and Sons of St Peters), for ordinary bricks but a patent interlocking damp-proof brick was also being manufactured.\textsuperscript{189}

**TIGHE** - see Tye

**TODD, L.S.**
1952: Rothschild avenue, Rosebery

**TOMPKINS, James**
1890 and 1891: Mitchell street, Enfield

**TORNING, J.**
1877: Waterloo Estate, Alexandria

**TOWNER, J.**
1877: Waterloo Estate, Alexandria

**TOY, Henry**
1883: Bridge street, Marrickville

**TOYER, George**
1875-1885: 1875 and 1876, Cowper street, Marrickville; 1880-1885, Unwins Bridge road, Marrickville

**TOYER, James**
When a brickmaker, he had a small nursery in his backyard. After the introduction of machinery, he left the trade and became a nurseryman, founding Toyer and Sons.\textsuperscript{190}

**TOYER, John B.**
1890: Roach street, Marrickville

**TOYER, William**
1886-1894: Bridge street, Marrickville

**TOYER BROTHERS**
1885-1897: 1885, Greenbank street, Marrickville; 1886, Sydney street and Greenbank street, Marrickville; 1888, Greenbank street and Terrace road; 1889-1897, Terrace road, Marrickville

**TREE, James**
1817-1828: Employed at David Hays, George street

**TREE, Samuel**
1816-1828: Working at South Head road by 1828.

**TRIP, Charles**
1886: Forest road, Alexandria

**TRY, John** - see Try's Brickworks
1887-1889: 1887, Government road, Prospect and Prospect and Sherwood; 1888 and 1889, Pitt row, Prospect

John Try, builder and contractor, was born in Middlesex, England in 1856. He arrived in Australia in 1879 and commenced work as a builder and contractor. By 1888, the list of buildings erected by him included: The New South Wales Club, Bligh street; the New Zealand Loan Company; the Orient Company's store, Pitt street; St Joseph's Building and Investment offices, Elizabeth street; the Australian Joint Stock Bank; W.H. Palings Buildings between George and Pitt streets, (including the Safe Deposit Company; Beale and Company's Warehouse and the part completion of St Mary's cathedral).

To minimise on price fluctuations etc., Try opened a store quarry at Randwick, a steam joinery works in Castlereagh street and a brickyard in Granville.\textsuperscript{191}

**TRY'S BRICKWORKS**
1890-1897: 1890-1897, Pitt Row, Prospect and Sherwood; 1892-1897, Pitt Row, Prospect

William Grey managed the brickworks from at least 1887 to 1894 and was succeeded by William Coulson in 1895.

**TUCK, Albert Samuel** (or Albert and Samuel)
1880: Campbell street, St Peters

**TUCK, Alfred**
1883: Off Soup road, Alexandria

**TUCK, A. and S.**
1885: Brickfields, Alexandria

Tuck had a kiln near Huntley street and Mitchell road, Alexandria, (as did Turner, Wilkie, Lawler and Edwards).\textsuperscript{192}

**TURNER, Henry**
1892 and 1893: Albert street, St Peters

He was a director or secretary of the Carrington Steam Brick Company in 1893.

**TURNER, John**
1867-1889: 1867, Waterloo; 1873, Mitchell road, South Alexandria; 1877, Waterloo Estate, Alexandria; 1885-1889, King street, Macdonaldtown and Brickfields, Alexandria; 1887, Jesson street, Alexandria and Brickfields, Alexandria

Turner had a kiln in the vicinity of Huntley street and Mitchell road, Alexandria (as did Tuck, Wilkie, Lawler and Edwards).\textsuperscript{193} Turner was the managing director fo the Carrington Steam Brick Company from 1885 to 1890 (as listed).
TYRRELL, William
1828: Employed at Thomas Street's Sussex street.

TYE, Alfred
1864-1867: Waterloo - see Goodsell and Dawes; and Tye and Dawes

TYE, Frederick
1875-1883: 1875 and 1876, Lord street, Newtown; 1877, Waterloo Estate, Alexandria; 1883, May street, St Peters

TYE, Florace
1880: Lord street, Botany

TYE, James
1875 and 1876: Lord street, Newtown

TYLE, John
1883: Wallace street, Ashfield

UNION STEAM BRICK COMPANY
1880: Constitution road, Petersham

UNITED COKE and BRICK COMPANY
1928-1930: 34 Martin Place (office)

VALE of CLWYDD BRICKWORKS
1913 and 1940: Mutual Life Building, Martin Place

VALE of CLWYDD D.M. and BRICK COMPANY LIMITED
1915-1937: 1915, Mutual Life Building, Martin Place; 1916-1932, 14 Martin Place

Robert Patrick was secretary in 1915.

VALE of CLWYDD nad BRICK COMPANY LIMITED
1919-1937: 1919, 14 Martin Place, 1920-1937, Sydney

VAUSE, Dr. - see Hopetown Brickworks

VELMA CONCRETE VIBROPRESS INDUSTRIES PTY. LIMITED
1953-1956: Revesby

VERNON, Donald
Manager of the Excelsior Brickworks in 1891 (as listed)

VICKERY, E. (Vulcan Brickworks)
1899-1901: 78 Pitt street, Sydney (office)

VICKERY, E. (junior) - see Vulcan Brickworks

VICKERY, E. and SONS - see Vulcan Brickworks
1885-1898: 1885-1894, Brickfields, Alexandria 1895 and 1896, Waterloo road, Alexandria; 1897 and 1898, Barwon Park road, Alexandria

Bricks were stamped "E.V. & S." in a large panel.

A boiler explosion occurred at Vickery's "Vulcan Creek Brickworks" as reported on January 3, 1891.194

VIDLER BROTHERS
1919-1941: Blacktown

VINCENT, Anthony
1880: Unwins Bridge road, Marrickville

VINCENT, John
1890: Forest road, Hurstville

VINCENT, Louis
1890: Forest street, Hurstville

VOST, Charles
1890 and 1891: Railway street, Prospect and Sherwood

VULCAN BRICKWORKS
1894-1901: 1894, Alexander street, Alexandria; 1895-1901, Barwon Park road, Alexandria; 1900, 78 Pitt street (office)

By 1888, they were able to produce 30,000 bricks per week and employed about seventy hands. H. Green managed the brickworks.195

E. Vickery and Sons were proprietors from 1885 to about 1898 or 1899. E. Vickery, junior, was listed after 1899.

VULCAN FIRE BRICKS LIMITED
1920: 4 Bridge street (office)

VULCAN REFRACTORIES COMPANY LIMITED
1928-1932: 4 Bridge street (office)
WADDINGTON, H.
1883 and 1884: Alexandria

WALKER, Benjamin
1890 and 1891: Carrington street, Parramatta

WALKER, Henry
1890 and 1891: Carrington street, Parramatta

WALKER, Samuel
1898: Cooks River road, St Peters

WALKER, BENSON LIMITED
1928-1965: Paton street, Merrylands

WALL, Joshua
1885 and 1886: Flood street, Leichhardt

WALTERS, Charles
1870: Off Liverpool road, Enfield

WALTERS, Samuel
1871: Neich's road, Burwood

WARATAH BRICK COMPANY LIMITED
1962-1965: Waratah

WARD, Randolf
1882: Elswick street, Leichhardt

WARNE BROTHERS
1893: One of the guarantors of the Sydney Brick Company (not listed in Sands').

WARREN BRICK COMPANY

This Company was established by F.C. Curlewis who remained as manager from at least 1890 to 1911. The brickworks adjoined the brickyard of Tye Brothers.

Curlewis was thought to be the first brickmaster to introduce the common open kiln (O.K.), bricks, he set the bricks in the usual scotch kiln, setting and burning them to obtain the desired colour on the surface of the brick. O.K. facing bricks were later burned in down draught kilns connected to smoke stacks, or chimneys. Curlewis made a great success in producing bricks of various shades of colour, ranging from light reds to black for facing buildings. The O.K. facing brick was responsible for the decline and replacement of double pressed plastic facing bricks. Warren Company's "burnt open kiln bricks" were used for the elevations of three shops in George street for Fitzwilliam Wentworth of Brickfield Hill in 1893. Mr John Ashe had worked for the Warren Brick Company before 1902 and was later the North Shore representative for the Metropolitan Brick Company. After 1911, the Works were in joint ownership, styled as "Bakewell and Curlewis" (1912-1915).

WARRINGAH BRICK and PIPE WORKS PTY. LIMITED
1952-1965: Pittwater road, Brookvale (office?)

WATERLOO BRICK COMPANY LIMITED
1902-1918: Botany road, Waterloo

This Company began calling for tenders in January 1902 for the erection of kilns, stacks etc. The architect was W. Kenwood and the builder, R. Hitchin. The chief work was the erection of a 16 chambered kiln. The Company applied for a contract for 500,000 machine made bricks for 2s/3d/- per 1,000 in June 1902. James Edwards was listed as manager from 1903 to 1918. The Waterloo Brick Company became famous for its alumina and silica fire bricks. Bricks stamped with "WHA" indicated Waterloo High Alumina; "SIL" indicated pure silica; and "Woodland 8" was used as a special key brick for the kilns.

In 1919, the word "Fire" was added to the Company name.

WATERLOO FIRE BRICK COMPANY LIMITED
1919-1965: Botany road, Waterloo

James Edwards was listed as manager during 1919 and 1920. Products: "Manufacturers of Fire Bricks, Fire Blocks and Fire Clay" (1919-1931).

WAYNTON - see Magney
WAYNTON, H.O. - see H.O. Weynton
WEAVER, George

Supervised the manufacture of white and glazed bricks at Rupert Cook's Works.

WELLS, James
1824-1828: By 1828, he was employed at J.C. Lloyd, Liverpool.

WELLINGTON, Richard
1817-1828: By 1828, he was self employed at Parramatta.

WENTWORTH BRICK and TILE WORKS
1962-1965: Wentworth
WEST, Absolom
1818-1828: By 1828, he was working at Liverpool. This is not the Absolom West of early publishing fame. He was returned to Government service in 1826 for selling spirits without a licence.

WEST, Thomas
ca.1863 1882-1889: 1882, Concord road, Ashfield; 1883, Thomas street, Ashfield and Adelaide street, Burwood; 1884, Dobroyd Estate, Ashfield; 1885, Henry street, Ashfield, The Crescent, Ashfield and Parramatta road, Ashfield; 1886, Croydon road, Ashfield and Iron Cove Creek road, Five Dock; 1888 and 1889, Dean street, Drumm Town.
Thomas West was born in Sydney in 1838. He was first engaged in contracting but around 1863, he began making bricks and employed about 60 men. In 1888, he devoted his attention to road contracting for which he employed 100 men. He came to Five Dock from Canterbury around 1873.

Thomas West also manager Longbottom’s Works at Lucas road, Burwood around 1888. - see Longbottom’s.

WEST’S BRICKYARDS
1889: Walter street, Ashfield

WEST and HOPPING. - see Hopping and West
1880-1882: 1880, Parramatta road, Ashfield; 1882, Walter street, Ashfield

WESTBROOK
1813-1828: By 1828, Westbrook was working at Richmond, New South Wales.

WESTERN SUBURBS BRICK and TILE COMPANY LIMITED
1921-1956: 1921-1927, 129 Dean street, Enfield; 1928-1956, Dean street, Enfield; 1929-1956 George street (office)

WESTWOOD, Samuel
Manager of the Hopetown Brickworks from 1902

WEMYTON, H.O.
Listed as one of the proprietors of the North Sydney Brick and Tile Company from 1894 to 1911

WHEELER, Richard
1889: Parramatta road, Auburn

WHEELER’S, Samuel
1790-1820s
Master brickmaker at Parramatta by early 1790 and had 21 or 22 men assisting him. He was an old man by 1828, living at Evan.

WHEELER, Thomas
1891 and 1892: Parramatta road, Auburn

WHEELER’S GANG. - see Samuel Wheeler

WHITE, D.S.
1887: Dunmore street, Hurstville

WHITE, Edgar
1890: Westminster street, Hurstville

WHITE, George
1893: Allen street, Leichhardt

WHITE, William
1886: Brickfields, Alexandria

WHITEMAN, J.R.
Listed as secretary of the Croydon Steam Brick Co. Ltd. from 1915 to 1920.

WHITED BRICKYARDS
1890: Kingsland street, Bexley

WHITING, G.F. - see J.F. Whiting
1888: Herbert street, Gore Hill, North Willoughby

WHITING, G.R.
1883-1889: 1883, Gore Hill Brickworks, North Willoughby and Bond street Chambers; 1889, Herbert street and Lane Cove road, North Willoughby

WHITING, J.F. - see G.F. Whiting
1889: Victoria parade, North Willoughby

WHITING and HOBSON
1883 and 1884: 1883, Gore Hill, North Willoughby; 1884, North Willoughby

WHITMORE and GARDNER
1922-1924: Quarry road, Ryde

WICKHAM, James
1828: Working at Thomas Street’s at Sussex street.
WILEY, J.
One of the elected founding directors of the Eight Hours Co-operative Brick, Tile and Pottery Co. Ltd., in 1886. He was also secretary of the Punchbowl Brick and Tile Co. in 1915.

WILKIE, W.
1877: Waterloo Estate, Alexandria
Wilkie had a kiln near Huntley street and Mitchell road at Alexandria.204

WILKINSON, Erwin
1867: Parramatta road, Petersham

WILKINSON, George
1864-1884: 1864 and 1865, Waterloo; 1868, Petersham; 1884, off Chapman street, Ashfield

WILKINSON, William

WILLARD, Robert
1885: May street, St Peters

WILLIAMS, Henry W.
1885: Railway road, Prospect and Sherwood

WILLIAMS, John
1892-1894: Jabez street, Marrickville

WILLIAMS, Thomas
Manager of the Ryde Brick Co. 1912-1914, (as listed).

WILLIAMSON, Hugh
1821-1828: By 1828, he worked for Robert Taylor at South Head road.

WILLING, Daniel
1792-1828: By 1828, at the age of 82, he was a brickmaker at Parramatta.

WILLOUGHBY, Bradley
1882: Orchard street, North Willoughby

WILLOUGHBY, William
1882: Orchard street, North Willoughby

WILSON, J.D.
1899-1904: Herbert street, Gore Hill

WILSON BRICK and TILE WORKS
1897-1899: Herbert street, Gore Hill
Wilson’s Brickworks at St Leonards supplied bricks for the Customs House at £2/1/6 per 1,000.205

WILSON’S BRICKWORKS
1905-1930: Herbert street, Gore Hill
He was listed at “Sydney” and “Gore Hill” during 1924-1926.

WINTERBOTTOM, T.
1871: Balmain road, Petersham

WOLLONGONG BRICK COMPANY LIMITED
1884: 12 Bridge street (office)

WOODALL, DUCKHAM (AUSTRALASIA), PTY. LIMITED
1952: Roseville road, French’s Forest

WOODHAMS, William
1886: Little Anthony street, Ashfield

WOODLEY, A. - see Henry Woodley

WOODLEY, Henry
1877-1901: 1877, Waterloo Estate, Alexandria; 1880-1887, Waterloo road, St Peters; 1891 and 1892, Barwon Park street, St Peters; 1897-1901, Barwon Park road, Alexandria
Gore Hill and Woodley’s bricks (2-1/2 million) were used for the Lands Office in 1891.206
Woodley was a manager of St Peters Patent Dry Brick Company until 1899, when he retired after 26 years. He was also a proprietor of the Federal Brickworks which he founded, as well as the Carlton Brickworks.207 His Works near St Peters was commonly referred to as the “Alexander Yard”. He lived opposite the Hurstville railway station.208 He was listed as manager of the St Peters Patent Dry Brick Co. from 1902 to 1907.

WOODLEY, H. and COMPANY
1889-1907: 1889-1893, Barwon Park road, Alexandria; 1900-1907, Mitchell road, Alexandria
The Works were styled as “Steam Brickworks” from 1902 to 1907 as well as the title above.

WOODLEY, EDWARDS and SQUIRE
1885-1894: Brickfields, Alexandria

WOODS, William
1885: Coventry road

WOTTON, John
1887: Parramatta road, Concord

133
WOTTON, William
1887: Parramatta road, Concord

WRIGHT, William
- see Halverson; and Hopkinson and Wright
1887: Jesson street, Alexandria

YOUNG, James
1886: Kogarah

ZAHRA, Henry
1877-1891: 1877, Waterloo, St Peters; 1890 and 1891, Henry street, Ashfield
Notes - Chapter Two

1. A part requirement, BA(Hons), 1976. (Copy held in Ms J.M. Birmingham's office, Department of Prehistoric and Historical Archaeology, University of Sydney).
3. Incomplete runs are kept by the Society of Aust. Genealogists, the General Post Office Sydney and my own library.
4. This study was made by Aedeen Cremin and a copy may be found in Fisher Library, University of Sydney.
5. Though the Sydney Telephone Directory of 1919 does use their name.
6. 1828 Census. This volume had to be searched page by page for brickmakers (which was not possible within my time framework with those not published).
7. Though one, at least has been ascribed to the 1830s.
10. Wentworth Papers, Dip. 114, M.L.
11. ABCN, 12:09:1891, p.201.
18. Echo, 07:08:1890, p.32.
20. BEIANZ, 04:02:1893, p.65.
22. First mentioned under potters and potteries.
23. CPIA, November 1935, p.15.
24. NSWCRP, 03:06:1902, p.87.
25. CPIA, September 1947, p.4.
29. In 1894, it was listed at Alexander street, Alexandria.
33. BEIANZ, 20:01:1894, p.25.
34. Ibid., 08:08:1894, p.71.
36. Wentworth Papers, Dip. 172, M.L.
39. *Catalogue of the Natural and Industrial Products of NSW Exhibited in the Australian Museum by the Paris Exhibition Commissioners*, Sydney, November 1854, p.82. Exhibited by S. Samuel, esq., MLC.
41. *Australasian Ironmonger*, June 1886, p.68.
42. CPIA, November 1935, p.13.
44. NSWCRP, 26:05:1903, p.83.
112. BEJANZ, 14:02:1891, p.119.
113. ABCN, 21:03:1891, p.221.
114. BEJANZ, 14:02:1891, p.55.
117. Ibid., p.129.
120. CPJA, November 1935, p.13.
123. Ibid.
125. NSWCRP, 04:11:1902, p.175.
127. CPJA, November 1935, p.15.
128. ABCN, 04:06:1887, p.56.
131. Australasian Ironmonger, October 1886, p.151.
133. Ibid., 21:07:1894, p.18.
135. Echo, 07:08:1890, p.32.
137. Ibid., p.99.
138. Wentworth Papers, DIP. 160, 164, 168, 172, 175, 199 and 218 M.L.
139. Ibid.
140. Echo, 14:08:1890, p.2.
144. Tench, op.cit., p.317.
145. Sands', 1892 and 1893.
147. Nangle, op.cit.
148. NSWCRP, 04:11:1902, p.175.
149. Ibid., 08:07:1902, p.106.
150. Ibid., 14:11:1902, p.175.
152. Wentworth Papers, DIP. 191 and 195.
153. NSWCRP, 01:09:1893, p.139.
154. ANC, September 1962, p.11.
156. CPJA, November 1935, p.13.
161. Partridge, op.cit., p.3; and Holden, op.cit., unpaginated.
165. Wentworth Papers, DIP 195 and 209.
166. ML, M2 811, 1825/1881/1.
170. Ibid., 11:03:1893, p.93.
172. This information was taken from ABCN, 14:03:1891, pp.198 and 199.
181. Ibid., 30:07:1887, p.189.
184. Ibid., 11:07:1891, p.25.
193. Ibid.
200. Ibid., 03:06:1902, p.87.
208. Holsted, op.cit., unpaginated.
Chapter Three - Nails

Hand Wrought, or Forged Nails

Nail Rods:

The nail rod was the "raw material" needed for the production of hand wrought, and later machine wrought, nails.

The basic method in the manufacture of nail rods was to reduce puddled iron to flat bars, or ribbons, by hammering or rolling. These flat bars were passed hot through a pair of slitting rollers which resulted in several small square sectioned rods, usually between three to six rods. The earliest recorded introduction of the manufacture of prepared nail rods, or "slit" rods, dates back to the latter half of the sixteenth century when a German, by the name of Shutz, introduced slitting mills to England. Slitting mills were set up in iron works around Dudley and Broomsgrove from 1600 onwards which attracted nail makers to the area. A man called Foley is credited with having been the first to set up a mill in this area, which was to remain the focus of hand wrought nail production for more than 300 years. Foley is believed to have borrowed the method from Swedish manufacturers. Improvements were soon made to the basic principles of slitting and to the power used in operating the slitting machines. In 1606, Sir Davis Bulmer, secured a patent, "for a machine for cutting nail-rods by water power". In 1618, Clement Dawbeny obtained a patent improving on Bulmer's patent in the area of wastage. These early patents, if not useful in detail, indicate a demand for nail rod iron, though also for other products such as hoop iron.

Before the late 1750s most of the flat bars, from which the nail rods were split, were reduced to shape by water powered hammers. After this period, massive cylindrical rollers began to be used more commonly. The rolling method was a far cheaper method for producing flat bars etc., because considerably more power was needed to activate the hammers of the earlier process. The cheapest form of iron was used, made in puddling furnaces. The more expensive hammering process was believed to produce a superior product because the rolling process enclosed impurities in the iron, whereas the hammering process expelled them. Nail makers, without question, purchased the cheaper nail rods as soon as they became available.
difference in the quality of the iron used may indicate an earlier or later date but the changeover from hammered to rolled iron may have been fairly complete by 1788.

**Hand Wrought, or Forged, Process**

The hand wrought process depended on a regular supply of nail rods. The work was not done in factories but was rather a cottage industry and as such, men, women and children were involved in all the processes of nail manufacture. Small workshops or sheds sufficed and were generally attached to the dwelling of the nail maker, or nailor, and his family.

The nailors almost invariably worked for employers known as "nail masters", these supplied the nail rods. The nail master paid for the quantity of nails by weight in money or barter and the nails were stored in his storehouse for distribution.

The nailor usually specialized in a particular class of nails which resulted in a superior nail and rapid production; the maker of horseshoe nails or the maker of tacks rarely or never making other varieties such as "rose" or "clasp" nails.

The usual size of the workshop was about 9 feet x 10 feet, rarely larger than 12 feet by 15 feet. These workshops, or forges, typically had one door and a couple of unglazed windows. The workshop contained a pair of bellows, a small anvil mounted on a low block, and a forge, or hearth.

The forge, before the 1820s, was almost invariably similar to those used by blacksmiths. To economize on fuel and space, the forge was used by several nailors concurrently. Wood charcoal was considered the best fuel but was more expensive than coal. The forge was used purely for heating the ends of the nail rods. The bellows were "lightly loaded" so that they needed but a slight activation in order to heat between two to four rods to a red hot heat.

The anvil was unlike that of the blacksmith's anvil; it was a small cube of steel with a surface of "but a few inches in extent" and was set in a massive cast iron block weighing between one to two hundredweight. The block was surrounded by masonry and set in a bed of smithy slag, only the small steel anvil being exposed. A hack-iron, or upright chisel, was fixed on the anvil. A "stop", or "check" was fixed at a distance from the edge of the hack-iron so that by placing the point of the red hot rod at the stop, the nail length could be regulated and the nail cut off at the hack-iron. The main purpose of the anvil was for hammering out a sharp square point; drawing out the nail to an intended length; also for the severing or near severing of the nail from the rod on the chisel edge of the attached hack-iron. Kept beside the anvil was the swage, used for...
heading nails; when not in use, it rested on two brackets which were probably set into the masonry which enclosed the anvil base.

The tools of the nailor's workshop were thus few and specialized; a hammer, a swage and sometimes a pair of tweezers.

The hammer used came in larger and smaller sizes, depending on the size of the nails being produced; the average hammer weighed about two pounds. The common form was as the frustum of a cone, though the narrower end, which was the face of the hammer, had a pronounced slope towards the handle. The hammer was said to resemble a file-cutter's hammer. There was scope for variation in the size and shape of the handle, the weight of the hammer head and degree of slope on the face of the hammer - all according to the inclination of the individual nailor. Nails requiring specially moulded heads (convex heads, ornamental heads etc.), were formed by a mechanical hammer which had a die on the face of the hammer, but this was a later nineteenth century development.

The swage was a "strong" iron or steel tool between 10 inches and 12 inches long. The swage had two square tapering holes which received the red hot nail, point first. The upper parts of the holes were the size of the shank of the nail, excluding the thickest part of the nail which was to be formed into the head. The holes were located in knob-like swells of metal at each end on the upper side of the tool and were countersunk to correspond with the head of the nail. There is some doubt as to how it was countersunk. The hammer was used to give the nail head one, two or four facets. After heading, the nail was removed by turning the swage upsidedown and striking it upon the anvil. Tomlinson mentioned that by using different swages, various forms of heads could be produced.

In the process where the nail was cut off the rod at the hack-iron, a pair of tweezers were used "like sugar tongs" to transport the nail whilst red hot to the swage. The tweezers were also referred to as "plyers". Rees mentions a "tin pan" in the workshop into which the red hot nail fell after the pointing and severing from the rod.

The mode of making a nail was fairly uncomplicated. Several nail rods, usually three or four, were heated to red hot in the forge by means of one to three blasts of the bellows. One rod was taken to the anvil and the blunt end of the rod was converted to a point and the shank drawn out to a taper by a few blows of the hammer on the anvil. After pointing there were two methods of severing the nail: one nail was severed from the rod at the hack-iron by striking the rod with the hammer on the chisel.
The nail fell into a metal receptacle and was then transported to the swage by a pair of tweezers. The other method was to almost sever the nail at the hack-iron (marking the length of the intended nail) and then to transport the rod to the swage, snapping the nail from the rod once in the swage. The nail was inserted point first into the swage and the slightly projecting top was headed by a few skilful strokes of the hammer. Brads required only one blow of the hammer; clasp nails required two blows; and rose headed nails required four blows. The head size was regulated by the size of the bore in the swage, also the degree of taper given to the nail whilst pointing could be used, for example, a thinner overall taper would drop the nail further into the swage, leaving less metal to form into a head. The nail was then removed from the bore and the process could begin all over again. If nails of an ordinary size were being made, often two nails could be made from one heating of the rod.

For the purpose of a demonstration in 1828, it was estimated that the average nail required 25 strokes of the hammer. I can only account for nine strokes for an average rose headed nail (using the available accounts of nail making); two to four strokes for the pointing, one for severing the nail from the rod at the hack-iron and four during the heading of the four facets. The accounts of the 1828 demonstration did mention that extra strokes were sometimes required to weld short pieces of nail rod together. Hebert mentioned that the maximum production of averaged sized nails was about three or four per minute and that 3,000 could be produced per day for "many days in succession". It seems unlikely that a nailor could manage 75-100 strokes per minute, taking into account all the other movements required in the workshop. Nine strokes of the hammer is perhaps a conservative estimate, the pointing and drawing out of a nail probably required more than just "two to four" strokes for a tapering nail.

The number of nails which were produced, on average, per day is difficult to estimate. Hebert's maximum of 3,000 appears to be very unrealistic. Although nailors in England may have had a greater incentive to work faster and worked under better conditions than their colonial equivalents, convicts or hired men working for the Government were tasked according to what was considered to be a "reasonable quantity". Hebert's 3,000 referred to three inch nails. In contrast, the Sydney weekly schedule for three inch nails was 1,800 nails, thus about 300 nails per day. Six hundred shingle and boat nails per day seem to have been the highest expected output. The average expected appears to have been about 300.

The manufacture of hand wrought nails remained substantially unaltered from the eighteenth century and right through the nineteenth century. There were no changes in manufacture which would have altered the appearance of the nail as far as
can be deduced from the available source material. Though it can be argued that the physical properties of the metal did change with the gradual conversion from hammered to rolled plates for nail rod, as mentioned earlier. Improvements made to the production and quality of iron during the nineteenth century may also have had a consequence on the physical properties of the nails produced.

One invention which made an impact on the production of hand wrought nails was a patent nail forge. The forge must have had an impact on the industry as it appeared in Lardner (1831)\textsuperscript{72} and later in Tomlinson (1852).\textsuperscript{73} A patent was obtained by a "Mr Spencer of Belper" in 1824 and it incorporated "Lindle's circular bellows".\textsuperscript{74} It had the advantage of allowing five or six nailers to use the forge at the same time. The forge was circular in shape without the usual back which allowed it to be approached from almost any angle: it had a grating for the fire and could burn pure wood charcoal.\textsuperscript{75} The bellows could be worked from any position because of the encircling bellows level, or "rock staff".\textsuperscript{76}

Period of Decline

Tracing the decline in the manufacture of hand wrought nails is difficult because of incomplete statistics and the nature of the available source material, especially the encyclopaedic sources which tend to lead the reader to overestimate the impact of the machine during the period from 1790 to the 1840s.

The most reliable of the encyclopaedic sources appear to be Rees, Lardner, Hebert and Bevan. Tomlinson (1852) is largely a composite work but on the subject of nails is a good summary of developments up to about 1850 (as, very strangely, it does not include any of the new developments displayed at the Great Exhibition of 1851).\textsuperscript{77}

Most of the reliable sources seem to point to the 1840s as the period of actual change as far as the market place is concerned. Indications are that the tradesmen became willing to adopt machine made nails for ordinary work which means that the end product of the machines had come close to the quality of the wrought product and that the cheaper prices had overcome a lot of prejudice.

The changeover from wrought to machine made nails was very progressive. The simple cut brad became the first practical success but in no way rivalled the wrought nail as it was used for specialist purposes. A hybrid machine cut/wrought nail eventually rivalled the wrought for ordinary purposes. By the time the wire nail became accepted as an alternative to the cut/wrought nail, the hand wrought nail was well and
truly relegated for use for specialist purposes in Great Britain. As we shall see, because of the nature of Colonial timbers and a lesser degree of prejudice, the sequence of market acceptance was different in Australia.

In England, the cut nail made the first practical impression, according to Rees (published in 1819), about 1803/1804 in Birmingham and Sheffield which established "a very extensive trade". These were the most simple of cut brads without heads or with a single spurred, or leafed, head. As will be seen later, these types of nails (and perhaps cast nails) made a minor impact on the Australian settlements just before 1820. No other practical market success was highlighted by Rees except when commenting on the cut nail in the USA. Rees discussed the hand wrought nail as the primary type of nail used at that time. Thus, up to 1819, we can only vouch for the limited introduction to the market of an inferior type of nail known as a cut brad.

Lardner (published in 1831) was clearly under the impression that machine made nails had made little impact on the market. The most significant practical patent which he cites was an improvement on the traditional nailor's forge. Lardner, as all the other writers on nails during the nineteenth century, had an academic interest in nail making machinery. As almost all other similar publications from 1819 to the present, Lardner alludes to Thomas Clifford's two patents of 1790. Lardner puts the 1790 inventions into context by judging them to be "alike practically inefficient."

Hebert, (published 1835/1836) criticised two "contemporary publications", The London Cyclopaedia and The British Cyclopaedia for stating that: ...the forged wrought-iron nails we have been speaking of have been superseded by the introduction of those made by pressure and percussion machines.

Hebert believed that this statement was "extremely incorrect, as every person acquainted with this department of art well knows". Hebert maintained that the manufacture of forged nails had actually increased. However, it is clear that by the mid 1830s, the machine cut nail had become commercially viable and had found a secure niche in the spectrum of nails in specialist areas. There was "a very great demand" for cut nails on account of their uniformity, square points and cheapness. Hebert explored the details of the machine cutting process in its most modern form (without naming a patentee) but also presented the specifications of an 1826 patent which cut and headed the nail in one operation. Not mentioning whether this patent in particular had been successfully employed, Hebert did mention that there were several manufactories where machines cut and headed the nail in a single operation.
Holtzapfel, (published in 1847), wrote mainly on machinery. He gave almost exclusive attention to the cut nail process. He mentioned the Clifford patents of 1790 and concluded:

Subsequently to this period not less than thirty or forty patents have been granted for making brads and nails, and some three or four of them have been successfully worked.

Tomlinson is largely a composite work: the "state of the art" would be basically 1840s rather than ca.1852 as he does not use any of the nail material shown at the Great Exhibition of 1851, though he features aspects of the Exhibition in many other sections of his publication. Tomlinson presents the method of forging nails in detail, though the information is substantially borrowed from the earlier works, which suggests that hand forging nails was still quite a viable industry. As for machinery Tomlinson only seems to rate nail cutting machinery to be of any importance, noting that some machines could head cut nails and brads in the one operation, forming a "flat head". The decline in hand wrought nails must have been evident to Tomlinson, because he wrote:

Before the introduction of machine-made nails, it was estimated that [in the neighbourhood of Birmingham alone upwards of 60,000 persons] were occupied in nail-making.

The impact of nail making machinery, which according to the sources were of the cut and head in one machine variety, had made a distinct impact by the late 1840s. The change in the market from a preference from hand wrought to machine made nails was beginning to be felt. A notice in the *Builder* (London) in 1845, under the heading of "Nail Trade in Stirlingshire", stated that the wrought nail trade in that area was in a depressed state, "chiefly arising from the use of machine-made nails."

Ure's editions of 1853 and 1860 are not extremely useful in judging the decline of the hand wrought nail, though he gives an indication of decline in his opening paragraph:

The forging of nails was till late years a handicraft operation, and therefore belonged to a book of trades rather than to a dictionary of the arts.

Ure presents a series of patent machines, the latest date mentioned being for 1832. The information and wording are identical from the 1839 to 1867 editions and no evaluation is offered, nor is an indication given as to whether the machines were put to any practical use.

In 1860 the *Builder* stated that the manufacture of "machine-wrought" nails was often stimulated by the continued strikes by nail makers. It was stated that
Messrs Ewbank's "machine-made" nails were the first to be able to compete with those forged by hand and had become "a regular staple of English commerce" and "British export". As will be presented later, the information regarding Ewbank's can be demonstrated from trade lists and from archaeological contexts.

By the 1870s and 1880s, handmade nails in Great Britain had been reserved for special functions, machine made nails having replaced the forged article for all common building purposes. The main development from this period was the shift from the machine cut/wrought nail to the wire nail. The decline in the hand wrought nail trade can also be traced through the shrinkage of the workforce in this traditional trade. The figures are incomplete and uneven for modern statistical purposes but nevertheless reflect the decline. By 1874 the number of people employed in the hand forged nail industry had been reduced by almost two-thirds since the 1830s. Aitken attributed the decline to the introduction of cut and machine wrought nails, particularly the cut nail, which were "rapidly replacing" the hand made nail. The cheapness of the machine variety made the forged variety seem very expensive and hence led to a natural decline in the market. By 1889, it was reported that 15,000 persons were still engaged in the hand forging trade around Dudley.

The decline in numbers making hand wrought nails can be summarized as follows:

1835 - 60,000
1861 - 26,000
1874 - 23,000
1889 - 15,000

The figures are for the district encircled by Birmingham, Dudley, Wolverhampton and Walsall. This area had been the focus of British hand forged production since the 1600s.

Considering the rise in population and the increase in overseas trade and colonial expansion, the decrease in numbers is much more spectacular than one would first realize. There is also a strong indication that a large percentage of the later production was confined to horseshoe nails (for which at that stage the hand forged method had not been improved upon by machine).

Machine Made Nails

The previous section on hand wrought, or forged, nails illustrates how machine made nails made little impact on the market until the 1840s. By inference from the available sources, the real rivalry between the two methods of production in Great Britain occurred during the 1850s, the machine made nail having the upper hand.
In the available sources, none of the patent machines listed can be linked with the successes of such manufacturers as Messrs Ewbank. The only exception is a general form of the primitive nail known as a cut brad. These were first produced in the United States of America and many assert that these nails were produced there in bulk from the 1790s onwards. In Great Britain the technique was borrowed soon after 1800 and had an increasing impact on the market over the following decades.

The Machine Cut Nail

This was entirely a "cold" process unless further modifications were desired to the head, shank or point. Apart from the production of simple brads, the most successful of later patents of this process employed heat, "hammering" and dies to modify the head, shank and point. These latter nails were referred to as cut/wrought ("hybrid") or simply as "wrought", often making no distinction with the class of nails which were wrought from heated iron rods.

The "raw material" from which cut nails were manufactured were ribbon shaped plates of rolled iron. These strips were cut from large sheets "by strong shears" according to the length of the nail desired. The sheets were the thickness of the intended nail. These sheets were readily available in Great Britain by the time of Clifford's patents of 1790.

The sheets were sheared against the fibre in the iron so that the resultant strips would have the fibre running perpendicular to the length: this was done so that the fibre of the iron would run lengthways through the nails produced. The main purpose of this was to create a stronger nail or if the nail was clenched, the clenched half of the nail would not fly off. At what stage this was realized in Great Britain is difficult to say. The first reference to it was found in Holtzapffel (published in 1847) but this information was not presented as a new improvement. On the other hand Rees mentioned that if machine made nails (meaning the cut variety) are used for clenching they must be annealed. This indicates that the fibre of the iron had not yet been taken into account by machine nail makers. Lardner and Hebert throw no light on the problem. Out of the other writers only the American Knight mentioned the correct method of preparing the strips. It appears then that in Great Britain no account was taken of the fibre in shearing the iron strips until somewhere between 1819 and 1847. According to L.H. Nelson, in the USA, the period for the proper

122-123. Cut strips, sparrow bills and brads (Bevan, p.41).
The orientation of the iron fibres occurred during the 1830s to 1840s. The period may well be the same for Great Britain. Not a lot can be made of this however because cut nails before that period could have had the fibres running crosswise or lengthwise to the shank depending on which side the original sheet was sheared for the strips. In Australia, cut nails have been identified from contexts dating to the 1790s-1811 period onwards.

Once the strip of iron, the thickness and width of the intended dimensions of the nail, was sheared, the strip was manually fed, end first horizontally along a slide against a regulated stop. A cutter, fixed to a manual level or to the lower end of a fly press, came down onto the end of the strip and stamped off a brad, or nail blank. The wedge shaped nail blank, or brad, was continuously cut from the strip without wastage by overturning the strip after each stroke of the cutter. Nails with a half head, or single spur, could be cut in the same manner but with a change in the shape of the cutter. Hebert, later in the century, mentioned that spur-headed nails were also made by another method (also mentioned by Rees). This other method of achieving the same end was by alternately reversing the cutter after each stroke without overturning the strip. This method was put to practical use in Birmingham and Sheffield forming an "extensive trade" by about 1803/1804. According to Rees' account both methods were in use in Britain by the late 1810s but the reversing cutter method was the first to be put to practical use for production. A third method may have been exclusively American in use; it involved wiggling the iron plate to and fro horizontally, without overturning the plate thus producing a simple wedge-shaped nail blank, or brad.

In Britain, Clifford patented an awkward method of punching nails from a prepared plate already shaped to the taper of a nail in 1790 but the invention had no effect on the development of the cut nail. About 1803/1804 cut nails of the headless and one spur variety were successfully manufactured using the alternatively reversing cutter method. This method was further improved during the late 1810s. According to Bevan, this American principle was introduced by Joseph Dyer in Birmingham in 1814 and had consequences reaching into the 1870s. The American principle was invariably associated with the "cutting and heading at one operation" often mentioned by British writers. The products of the descendants of the 1814 machines were to become a British export item to its colonies and thus must involve the Ewbank's variety of nails.
learned of this new development through some published US state papers of 1810 but gives no descriptions. Ure undoubtedly relying on Rees’ quotation and introductory comment wrote:

So long since as the year 1810, it appears the Americans possessed a machine which performed the cutting and heading at one operation.

It has to be wondered if Ezekiel Reed’s 1798 machine was not one of the first to produce spurred heads on cut nails by modifying the cutter. Surely this would have been a significant development? and it certainly was produced in a single operation. All later references appear to refer to the die-heading of nail blanks “in one operation”.

Rees, who was not aware of Ezekiel Reed’s machine, was not referring to spurred heads when discussing machines which cut and head in one operation because when writing about the “extensive trade” which began around 1803/1804 in Birmingham and Sheffield in cut brads:

... that kind of nails called brads having no head, or at least only a small projecting leaf on one side, was easily cut by machinery.

Ure believed that cutting and heading machines were developed as of 1810, by a careless reading of Rees’. Rees appears to have meant that the news of such a machine became public in 1810 and readers must conclude that the invention was perfected during the years prior to 1810.

Nelson’s nail chronology does not help greatly because he offers no documentation for his conclusions. However, the following may be deduced:

- brads with separately formed heads - mid 1790s to c.1805
- brads completely machine cut (spurred and pointed) - c.1805 to 1820
- brads with shape arrises - 1810 to present
- common nails with separately formed heads - c.1790 to mid 1820s
- common nails with flat machine heads - 1815s [sic] to late 1830s
- common nails with uniform flat machine heads - late 1830s to present.

We do not know if this system is based on documentary or archaeological evidence or a combination of both. If we assume the latter, it reveals that the British first produced machine brads with spurs (c.1803/1804) and that machine cut and headed nails did not appear until 1815, one year after the machinery was introduced from America to Britain (leaving aside Rees’ 1810 account of cutting and heading machines in America or Ezekiel Reed’s invention of 1798). It seems unlikely that the “common nail” illustrated by Nelson could be as early as c.1790 because it displays every evidence of having been reshaped by heat and pressure after cutting (it is not a purely cut nail but must be a hybrid cut/wrought nail).
By the time of Rees' publication in 1819, the common method of heading nail blanks involved a simple machine with a vice for holding the nail and a suspended hammer with a die in its face. The machinery introduced by Dyer from America in 1814, which in 1874 was hailed to have established the "cut nail trade, as it now exists", and "combined in one the operation accomplished by several machines", had obviously made little impact on the market by 1819. In fact, Rees admitted that he knew little about it:

We are informed that J.C. Dyer, esq., who has had the American machinery communicated to him, to be introduced into this country, has lately taken out patents in Great Britain, with a view of establishing the trade in this country.

This quote was given at the conclusion of his presentation of the 1810 American information which included the method of "cutting and heading at one operation". Bevan more directly linked this information and Dyer's together but seems to have had an independent source, as he names the actual year, 1814.

It appears that the 1814 introduction to Britain did not immediately cause a revolution in the nail trade. Nails which were cut and headed in one machine did not make any impression on the market until the 1840s. The Ewbank patent was the foremost of this type of nail, though the shank also underwent further modification (which will be discussed later).

The position was different in the USA, the presumably one operation machine nails began to appear in bulk from 1815 onwards, according to Nelson.

A system of dating cut nails through burr and shear marks along the length of a nail's shank was presented by Nelson to distinguish pre and post 1830s/1840s nails. Nelson asserts that pre 1830s/1840s nails have burr and shear marks on diagonal edges and after this period on common edges, as illustrated.

The transition period, 1830s/1840s, is a period where the method of cutting nails from the iron strip changed from cutting nails from one side of the strip to reversing the strip after each cut. Accepted that this was the case, one would expect that the pre 1830s/1840s nails would have burr and shear marks on common sides, not on the diagonals and vice versa for the post 1830s/1840s period. Nelson admitted that this would seem correct, but: "Surprisingly enough, nails cut from a common side have 'shear marks' on their opposite sides".

Nelson's figure 6, was offered in explanation of this phenomenon. Admittedly I have no firsthand experience with such machines but I am still at a loss as to how this could be. At stage 2 of the operation, the cutter and stationary bed should have
exactly the same mark on the nail on the first and second strokes. In my view shear marks on opposite, or oblique, corners could only occur if the plate was turned over after each stroke. Nails cut by the horizontal to and fro, or wiggle, method would result in shear and burn marks on the same side, because the plate is not turned after each stroke.

Using shear and burr marks, Nelson sets up a five phase chronology. Unfortunately, Nelson does not mention if the data is based on nails collected from dated buildings or if it is based on a study of documentary material. It is impossible to make any adjustments or conclusions to his chronology, especially in the light of his shear and burr marks data as it is further complicated in that Mercer's theory is contrary to his but Nelson asserting that "Mercer's theory seems correct".

If Nelson's system could be clarified, the system would have very limited application to British or Australian contexts, unless American export is suspected. British cut nails produced in Birmingham and Sheffield from about 1803/1804 were cut without alternately overturning the plate and from about the latter half of the 1810s the overturning plate method was also in use. The previous section on wrought nails would reveal that even by the 1820s and 1830s, cut nails represented only a portion of the nails used in Britain. In Australia, cut nails have been found in dated contexts from the late 1790s. The earliest Australian reference to cut nails appears under one of "M. Hayes" sales in the "Sydney Gazette" in 1809, another refers to the late 1810s.

The Patents

Cut and the Hybrid Cut, Wrought Nails

We learn little of the initial developments of the cut nail from the standard British references of the nineteenth century because these developments occurred in the U.S.A. "Knight's American Mechanical Dictionary," published in 1876, was one of the first of the widespread publications to give such an outline account. Descriptions of early patents from the U.S.A. are vague, as Nelson points out, because a "vast amount of primary source material" was destroyed in a fire at the Patent Office in 1836. Before Knight's publication, few gave credit to the pioneering developments which were made in the U.S.A. Rees, Hebert and Ure do credit the Americans with the invention of machinery which could cut and head the nail in one operation but there is no mention of the initial development of the cut nail in the U.S.A. Bevan mentioned that the cut nail trade of the day (1874) owed its origin to Dyer in 1814 but made no mention that Dyer obtained his plans or machinery in the U.S.A. The British
publications usually refer to Clifford’s 1790 patents to suggest an early beginning in the British Isles but these inventions had no bearing or consequence on the development of the cut nail trade.\(^{155}\)

The first credited with making nails from plates of sheet metal was Jeremiah Wilkinson of Cumberland, Rhode Island, USA, around 1775.\(^{156}\) Though the description refers to cutting tacks, these were small headless nails, commonly called brads. Most of the initial mechanical inventions were applied to the smaller types of nail.\(^{157}\) Wilkinson was described as "afterward" making nails and spikes in the same way and forming the heads in a vice.\(^{158}\) Ezekiel Reed of Bridgewater, Mass., invented a machine for cutting nails in 1786.\(^{159}\)

In 1790, Jacob Perkins invented a machine for cutting nails from a plate. The invention was patented in 1795 and it was claimed that it could produce 200,000 nails per day.\(^{160}\) This machine would have produced a headless brad, or nail blank. Nelson believed that Perkins made one of the most important contributions to the development of the cut nail.\(^{161}\) Curiously, Ure claimed that W.S. Stoker’s machines at the Britannia Nail Works at Birmingham, England, were "apparently of American Parentage, - as it has the same set of features as the old American mechanisms of Perkins".\(^{162}\) Stoker’s invention had nothing to do with Perkins or any other American invention as it clearly did not cut nails but used nail rods which were heated.

Benjamin Cochran was credited with having made a machine on the Perkins principle and a machine on a similar principle was patented by Joshua Person of New York.\(^{163}\) If the latter is the same as J.G. Pierson, Nelson lists him as an important contributor - along with Perkins, Jesse Reed, Mark and Richard Reeve.\(^{164}\)

In 1798, Ezekiel Reed, who had invented a nail cutting machine in 1786, obtained a patent for a machine which could cut and head nails "in one operation".\(^{165}\) This term was used several times in British publications to identify the type of machine principle borrowed from the Americans. As discussed earlier, this term by the late 1810s invariably meant that the nail was cut and die-headed in one machine;\(^{166}\) in this early case it either referred to brads with spurs or cutting and die-heading. If it did refer to cutting and die-heading, the invention lay dormant for a decade or so, which would take us to the couple of years preceding 1810, earlier discussed. Nelson opts for the "1815’s" [sic] as the initial year for machine headed cut nails but "c.1805" for brads with spurs.\(^{167}\)

One of the most valuable sources for general trends up to 1810 is quoted in *Rees’ Cyclopaedia*.\(^{168}\) Letters were published which were written by the "American
secretary to the Treasury' in 1810 which outlined the development of nail machinery in Massachusetts to that time. This area of the U.S.A. was the focus of the above mentioned inventions.

The 1810 publication fleshes in the early period just under discussion. The publication mentioned that around 1790 some men "now unknown" began by cutting slices out of old hoops, and by a common vice, gripping these pieces, headed them with several strokes of the hammer. Slitting mills, for slitting iron into plates, were built and shears and heading tools were perfected. Inventions were made to cut nails and to head nails using water power by Jacob Perkins and Johnathan Ellis. These men and others spent large amounts of money on developing improvements which were taken up by a manufacturer called Odiarne. The nails produced were one-third cheaper than the wrought nails and could be used for three-fourths of all nailing work. It was no longer necessary to bore holes in the timber before nailing. They were not very good for clenching which suggests that it had not yet been recognized that the iron fibres should be made to run along the length of the shank and not at right angles to it. The nail was described as better than the wrought nail because of the "sharp corner", or arris, and "true taper the nail, one way, being of the same breadth or thickness from head to point" which made the nail easier to drive into American hardwoods without mishap or splitting. The description accords with samples of cut nails found in dated contexts of a later period.

So far we have a rough "genealogy" of inventors in the U.S.A, and we also have a fair idea of the type of nail produced, according to the written sources, except for the head. Indications are that by about 1810 most heads were still formed by hand or by a separate machine.

As noted in some detail before from Rees and Bevan’s accounts, Joseph Dyer introduced the American machinery to Birmingham in 1814 which resulted in a prosperous trade. Moreover “a considerable bulk of the cut nails produced are exported to Australia and other British Colonies.” Also, as noted earlier, the introduction did not cause an immediate revolution in the nail trade and had little market impact until the 1840s. By the time of Lardner’s publication in 1831, the American machines seem to have been superseded.

Hebert, in his 1835/36 publication, believed that the manufacture of wrought nails had actually increased but a demand for "cut or pressed" nails continued because of their cheapness, uniformity and square points. Hebert, as did Rees, gave a detailed description of the cut nail process, also without reference to any particular invention. Both methods of cutting nails are given: where the plate is flipped over...
alternately after each cut; and where the position of the cutter is reversed after each
cut but the plate remains stationary. The only real difference from Rees’ account is
that the latter process is represented for the production of brads with spurs, and for the
first time two spurred brads are mentioned. 177 Hebert presents two patents after
discussing the principles of the cut nail process. One was by Ledham and Jones of
Birmingham but this was not strictly a cut process as “rods, or strips of iron” were
used.178 Steel dies were used to shape the head and shank.179 The other invention by
Edward Hancorn was of the machine wrought type but both processes involved
heading and creating the shank in one process.180

Curiously no other patents were published in detail in which machines
obviously cut nails from iron plates,181 yet this was the widespread process (though the
nail then went through a secondary stage where the head and shank underwent
finishing in a wrought process).

The Machine Wrought Nail

This process was intended to imitate the hand wrought nail. Although the
many patents published had very little consequence, the principles involved were very
successfully applied to the cut nail process resulting in such patent nails as Ewbank’s.

The earliest surviving patent descriptions are nearly all of British origin.
Much ingenuity was directed towards the process from the 1820s in Britain, mainly in
the attempt to improve on the brittleness of the cut nail.

The majority of published patents with detailed descriptions date from the
late 1820s to the 1840s. Nearly every patent description published in the cyclopaedias
up to the 1870s dates to before 1850.182 The reason for this appears to be that the
problem of aligning the iron fibres to run along the length of the nail was solved by the
early 1840s. By the hybrid process of heating and reworking the nail blank with
hammers or dies a strong nail was created, negating the need for an imitation wrought
nail,183 (i.e., one which was produced by a machine copying the manual process at every
stage). Also the use of nail rod was more expensive, needing more handling and
involved more wastage of iron.

The machine wrought process was a hot process, nearly always involving nail
rod iron. The nail rod was passed through hammers, dies or presses resulting in a
tapering nail. The heading was also achieved by a die, usually a hammer with the
impression of the nail head on its face.
Two British patents were taken out in 1790. W. Finch in Wimborne [sic], Staffordshire, was granted a patent in which powered hammers simply lifted and dropped. It was up to the nailor to turn the heated nail rods so as to form a nail. This was entirely a traditional method but with automatic hammers. This method was mechanically imitated in the patent of Thomas John Fuller (1830s or 1840s) where vertical and horizontal hammers combined to taper and point nails, "which being made to act alternately, resemble hand work". As with the traditional process, hammering did not injure the fibre of the iron which rolling did. The Fuller patent resulted in tapering nails with square and flat point. Another patent (1830s/1840s) by William Southwood Stocker also tried to imitate the traditional process, "usually performed by the hands of a nail maker with his hammer and anvil". The machine possessed "pressors or hammers" which formed the shanks by flattening out two opposite sides, the other two sides were then similarly treated and the process was repeated several times. The wedge shaped nail was then passed into a vice and severed, the projecting end was transformed into a head by a heading die. As noted by Ure, the invention followed every step made by the nailor; the shaping of the nail from red hot iron rods, severing the desired length and heading the end by compression.

The other 1790 patent was taken out by Thomas Clifford of Bristol on the 17th July. This patent involved feeding heated nail rod iron between two rollers; each roller was imprinted with the shape of half of one nail. This produced a string of nails which had to be separated with shears. Sheets could also be passed through wider rollers with several grooves producing several strings of nails. The problem with this method was in aligning and regulating the two rollers not to mention the time consuming necessity of trimming the springs of nails of their superfluous metal. This patent was put to practical use; both authorities are ambiguous as to whether they were referring to the July (roller method) or the December (cut) patents. Knight, after explaining both patents in one paragraph but explaining the cut method last, wrote: "Machines of this kind were in operation at French's factory, Wineburn e, Staffordshire, England, in 1792".

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In 1792 cut nails were first made by machinery. Two rollers with dies being employed for the purpose; the blanks were fed in at the top and the finished nails dropped out below as the steel rollers revolved.

As there was no suggestion that the production of machine made nails at French's factory was continued beyond 1792 or that these nails were ever successfully marketed, it is unlikely that the production was anything more than experimental. Rees
had no knowledge of it citing rather a real success in the cut nail trade around 1804/1805. Lardner confirmed that the Clifford patents were a practical failure by calling them alike "inefficient".  

Clifford’s roller method of creating machine wrought nails led to several unsuccessful inventions from the late 1820s onwards.

The December 1827 patent of Thomas Tyndale of Birmingham involved hot rods being passed between indented rollers. The resultant nails were "rudely shaped" and like Clifford’s string of nails had to be cut apart. They were pointed and headed or finished by the work of dies placed in a revolving cylinder. This machine was in two parts.

Dr William Church’s patent of February 1832 apparently had its own apparatus for reducing bars and plates of iron into rods. The machine then rolled the hot nail rod with "laminating rollers and compressing dies", (indentations in the rollers), into wedge shaped nails.

Ure believed that Edward Hancorne’s October 1828 patent was similar to Dr Church’s "more elaborate apparatus". However, the descriptions published by Hebert and Ure do not seem to support this. It might be that Ure was referring to another patent by Dr Church or referred to the finished product and production of its own nail rods.

Moses Poole’s 1849 patent was similar to the previous machines. The machine contained rollers to reduce metal into rods of iron. The rods were then passed through a second set of rollers which formed them into a succession of the "rectangular triangles". After pointing between vertical and horizontal matrices, cutters separated them. A punching machine then formed the heads. Patents using the roller method declined and by 1874 this process for producing wrought nails had been "entirely discontinued". Other processes involved forming each nail one at a time, usually under the pressure of dies, in fact a process somewhere between the hammer method and roller method.

Willmore and Tonks obtained a patent in 1808. The process involved several distinct stages. The nail rods were roughly cut and pointed as shown opposite. The cut pieces were annealed and then placed in a clamp, or vice, for heading which was done with dies the shape of the intended head. The nail was then properly pointed in another process but required two operations.
Edward Hancock's October 1828 patent was represented as an improvement on the "American mechanism" and Hebert believed that it originated in America. Nothing can be found to support this. As noted above, Ure thought the mechanism similar to Dr Church's invention, but the only apparent similarity is in the fact that it could slit its own rods and that the nail rod was squeezed into wedge forms (but not with rollers). The head of the nail was formed by a hammer with a die in its face and the point by two "eccentric steel sectors".

Other patents were often mentioned in publications but no date or no descriptions given.

**The Hybrid Process**

The article "The Hybrid Process" written by W.C. Aitken in 1874 revealed that:

...the present method of producing machine-made wrought nails is a hybrid process, between cut and wrought nail making, the shank being cut, and the heading and pointing done, by a die and a roller.

This hybrid process was no doubt the most successful of all the machines produced. Although not mentioned by Aitken, Ewbank appears to have been the first to achieve success by the hybrid process. As an example a series of patents by Coates are given. In an 1841 patent Coates achieved the goal of uniting the functions of several machines into one. Improvements were made on this machine in 1844 and 1850. In 1850 the machine was again repatented but instead of using plain nail rods, "ridge rolled" plates were used. These plates had square ridges running along the plate at distances calculated for the length of the intended nail. There were ridges on two sides of the plate for rose and clasp etc., headed nails but for brads, only on one side. These plates were sliced into nail rods, the protuberances forming the metal for the head.

The pre-1850 processes of Coates and Ewbank's nail production were probably very similar: plates were cut into nail rod. The heated nail rod was gripped by dies and then tapered by the pressure of rolling dies, the surplus at the end being stamped by a die head whilst held in a grip.

This survey is not carried beyond the 1870s, as by that period the major mechanical improvements had been accomplished. Although machine cut/wrought nails continued to be favoured by the British for building purposes, in New South Wales etc.
Wales, at least, the wire nail had superseded all previous forms of nails for common purposes.

Factories and Trade Names (British Trade)

We know very little about the factories which produced machine made nails and very few trade names emerge. Hand wrought nails were made in the sheds and workshops attached to the domiciles of nailors, it was a cottage industry. "Nail masters" provided the raw materials to the nailors who in turn sold the finished product to the nail masters. The nails would be stored in their warehouses and were distributed from there to builders or agencies selling hardware. Where the early machines were set up is not clear; they may have been set up in iron works, the warehouses of nail masters and certainly in later times in factory buildings of their own.

References to factories, trade names or even distributors appear scattered throughout the source material available, mostly without any further elaboration. The following is a list of such appearances in chronological order:

French's Factory: In 1792 one of Clifford's 1790 patents was put to practical application. There is no indication that the nails produced were a market success and nothing more is heard of French's factory. This should not be confused with the beginning of the cut nail trade in Birmingham and Sheffield around 1803/1804 which was a market success.

Prince's: Nails listed as "Prince's metal nails" were offered for sale as part of a "British investment" at Mr Hayes' in Sydney in 1804 and 1805. The nails may simply have been cut brads as Hayes offered these for sale in 1809. If so, it would be tempting to link them with the Birmingham and Sheffield production. "Prince's" as a corruption of "French's" was considered but in the light of the source material on French's factory, it seems unlikely.

Dyer: Joseph C. Dyer introduced American machinery to Birmingham in 1814 which led to the later great trade. Although he took out patents, it is not known if he was actually a manufacturer but this is inferred.

Ewbank: Ewbank produced a hybrid cut/wrought nail known as "Ewbank's nails" from at least the early 1840s but possibly from the late 1830s. An English authority asserted that Ewbank's were the first to supply the market with machine-made nails capable of competing with wrought nails: "these nails have now become a regular staple of English commerce punctually quoted in colonial price-lists".

The earliest direct Australian reference found so far dates to 1844 and suggests that these nails were known to customers: "Nails, every sort including Ewbanks", Ewbank's nails appear in the 1859, 1862 and 1877 Mayes' Contractors' and Builders' Price Books. In 1859 they appear to be amalgamated with American and English "cut nails" hence; "Ewbanks patent American and English cut nails".

133. These plates were sliced into strips and then sheared at the ridges and formed into nails. Coates' 1850 improvement.
1862 and 1877 edition of Mayes' they are described as "Ewbanks patent nails" and a list of prices for one to six inch are provided. American "cut and finish nails" are listed separately.

Ewbanks' nails were fully accepted by builders by the early 1850s in both New South Wales and Victoria. An American merchant, G.F. Train, who made an assessment of Australian markets between 1853 and 1855, wrote:

Our American cut nails are not suitable for the wood of this country, or it is of so close a grain they break in being driven. Britain supplies a much better article. Ewbanks' patent pressed nail is much used and well liked.

The archaeological evidence suggests that the above is very true but by the late 1860s the wire nail became to be used in preference and Ewbanks' are uncommon in buildings after about 1870.

It appears that Messrs Ewbanks were taken over by the late 1860s. Some companies were producing a nail almost indistinguishable from the Ewbanks' variety (as the original patent had expired). This caused the adoption of a star shaped trademark to be placed on the heads of Ewbanks' nails. By this time J.J. Cordes and Co.'s had taken over the concern. An advertisement was placed in a well read journal in 1869 which stated: "Patent Wrought Nails, J.J. Cordes & Co. (Ewbanks nails - commonly called). Make it known adopted a star or cross for their T.M. on their heads".

References may be found concerning the nails in later periods. In Britain J.J. Cordes & Co. name may be found as a company.

In Australia Ewbanks' nails were used for specialist purposes after the successful introduction of the wire nail. They are listed as "Ew-banks" (in one size only) in the 1908 and 1914 Mayes' price books but no longer after those dates.

The nails are remembered as being spikes around the World War II period.

Coates: As Coates improved his 1841 patent in 1844, 1850 and 1859 and it is clear from Bevan that his patents were put to practical use, he must have been a fairly successful manufacturer. Coates' ridge rolled iron plates: were considered in 1874 as the "most recent method". Coates' nails, as were Ewbanks by the hybrid process of cut/wrought manufacture.
Britannia Nail Works, Birmingham: This manufactory was established by the 1840s. Little is known about it, except that it used the patent of William Southwood Stocker.239

British and Foreign Patent Nail Co: This company was reported as about to commence their works in 1848. The nail was made in one operation and were represented as being cheaper than "the common cut nails".230

Halkett and Bates, Manchester: This manufactory supplied the London market through their agents Richards & Co. They must have purchased a patent process as the Builder wrote "... patent process... now in the hands of Halkett and Bates". Their machines produced the head and shank in the same operation. They were presented as having been inspired by Ewbank's.231

There would have been many more manufacturers in Britain at the time but the lack of primary source material restricts this survey. One thing which emerges is that the manufacturers in nearly every case purchased the patent rights from inventors and it is rare for a patentee and a manufacturer to be linked together in the available source material.

The Wire Nail

The wire nail is the universal nail used for all common purposes today. As its name suggests, this nail is formed of wire and its development and adoption is closely linked with the cheap and bulk production of good quality iron wire and later, steel wire. The machine developed for the wire nail was generally small, uncomplicated and required little power to operate.232

As the early development of the wire nail was linked with the improvements made in wire production, a little should be said of the development of drawn and rolled iron wire production.

Wire Production (the raw material)

Drawn iron wire was said to be first manufactured in the fourteenth century, the method reached England during the sixteenth century and the first wire mill was erected in Mortlake, England in 1663.233 Rees believed that it was set up by a Dutchman in 1663 at "Sheen, near Richmond".234 Before the drawing of iron wire, workers made wire by beating iron into metal plates: the plates were cut into thin rods, or strips, which were hammered and filed until they took the form of wire.235
Wire drawing required a drawplate, which was a piece of especially prepared hard metal bored with a succession of conically shaped holes ranging from large to small.\textsuperscript{236} Heated iron rods with tapered ends were pulled through the series of holes until the wire assumed the diameter required.\textsuperscript{237} Diderot illustrated a method of wire drawing in his Encyclopaedia of the mid eighteenth century.\textsuperscript{238}

The iron used for wire had to be of a good quality but not too soft. During the process of wire drawing the iron had to be continually reheated, as a form of annealing, otherwise the iron would become too hard and brittle.\textsuperscript{239} By the late 1810s there were two common methods for producing the rods: for superior wire, round sectioned rods between five or six feet in length were drawn out by the workmen under a tilt mill, a sort of hammering process. (These rods, in preparation for wire drawing, had to be hammer straightened, or if available, passed through grooved rollers for the same purpose.) For common wire, the rods could be entirely rolled but the hammering, or tilting, process produced iron of a more tenacious quality.\textsuperscript{240} For steel wire, the wire had to be pulled through more slowly and required to be passed through about 44 "numbers", or holes, in the plate. Steel wire required to be annealed every second time it passed through a number.\textsuperscript{241}

A common size for wire was known as No.6, or No.6 gauge, or "knitting needle thickness".\textsuperscript{242} For telegraphic purposes in the 1870s, this gauge was used for heavily timbered country, whilst the smaller sectioned gauge 8 was used for lightly timbered country.\textsuperscript{243} A much finer wire was also produced, known as "cording wire", being gauge 24 but wire could be reduced so that it could be threaded through wool, hemp and even silk.\textsuperscript{244}

The method of reducing wire with "grooved rollers" was invented and patented by Henry Cort in 1783.\textsuperscript{245} This method produced iron in round or square section, depending on the grooves in the rollers.\textsuperscript{246} It was not until about 1830 that this method was well established in Britain. Coils of 10-15 pound weight, measuring 5/16 to 9/32 of an inch in diameter were readily available.\textsuperscript{247} The basic principle behind the roller system was that the wire passed through rollers with successively shorter distances between them.

Cossions illustrates the improvements made to Cort's patent from the late eighteenth century: the "three-high" mill was introduced in Staffordshire before 1820 but was not a common method until the 1860s. The "three high" mill allowed the wire to be worked on its return to the initial winding panel.\textsuperscript{248} In 1862 George Bedson of Manchester, developed and patented a continuous rolling-train on the "two high" principle where the rollers could be reversed (and presumably shorter distanced) when
the wire returned to the winding banel. The first of these machines was installed at Johnson Brothers at Manchester. This invention produced the first quality production of steel wire.\textsuperscript{249} By the 1880s William Garrett introduced further improvements\textsuperscript{250} reducing the cost of steel wire considerably in conjunction with the availability of the Bessemer steel process. As is widely recognized, the stimulation of producing cheap, quality and quantity wire was the result of the development of the telegraph system throughout the world (including submerged cables).\textsuperscript{251} The development of the wire nail was an unexpected outcome of the demand for wire for telegraphic purposes.

The principles used in wire nail machines are very old. In Diderot’s time pins were made by the same process but manually. The wire was first drawn and cut into suitable lengths, then the point was sharpened and the head was flattened into a button shape by annealing and pounding on a small specialized anvil. Brass was used, as steel wire was prohibitively expensive and iron wire was poorly ductile.\textsuperscript{252} In England, the French steel wire was imported for making nail-like objects such as knitting needles, shoemakers needles and needles in general.\textsuperscript{253} By the early 1830s in Britain an alternative to casting copper nails was found. This involved square sectioned drawn copper wire, which was cut into appropriate lengths and then turned into a nail by the traditional wrought methods (but working the metal cold).\textsuperscript{254} By 1824 the first "solid headed" pin-making machine was patented in England.\textsuperscript{255}

Because of the prejudice of the British against wire nails, none of the major publications on the "mechanical arts" until the 1870s even mentioned them. Knight (1876) did not give wire nail machinery a mention when discussing nail machinery. What this really indicates is that wire nails had made virtually no impact on either Britain or America until the 1870s and 1880s. Curiously, by the 1870s, the use of the wire nail throughout the eastern colonies of Australia, at least, had superseded all other types of nails. The building trades in Australia were less prejudiced perhaps, having readily adopted the Ewbank’s and other patent nails a generation before. The new nail was lighter and as such were more easily transportable overseas and inland. They were also cheaper. The early acceptance of these nails was a European trend which Britain and the U.S.A. were slow to follow.\textsuperscript{256}

Because of the general disinterest in wire nails in the English speaking world until late in the nineteenth century, little reliable information may be found on the origin of the wire nail.\textsuperscript{257}

Sickels believed that the first wire nail machine was a French invention dating to about 1834. This type of machine produced nails without heads but it was suggested that the machine was improved by the 1840s so as to produce headed nails.\textsuperscript{258}
A prior claim was made in 1869 by Heintzmann and Rochussen who asserted: "The wire nail is, like most good things in the application of wire, a German invention".259

At the conclusion of their promotion of nail machines, Heintzmann and Rochussen claimed that "hundreds" had been in use "during the last 40 years".260 Taken on face value, this appears to be a claim for a German invention around 1829/1830. The earliest encyclopaedist to claim a French origin was Aitken in 1874,261 though Sickels was the only writer to offer any substance to the claim, a date. Writers often inferred that it was a French invention because of the alternative names, "French nail" and "Points de Paris". Nelson wrote of its introduction in New York during the 1850s, "following an earlier development in England, France and Germany".262 Aitken's brief account and the silence of British writers of the nineteenth century should rule out Britain. Until further primary evidence emerges, France and Germany should be given joint credit, especially since most of the important developments in nail making machinery emanated from those countries throughout the latter half of the nineteenth century. Belgium should not be excluded either because it was one of the chief producers of nail products during the nineteenth century.

The Great Exhibition of 1851 attracted a number of wire nail and wire nail machinery exhibits, none of which received any attention in English language publications.263

Of the Belgian exhibitors of wire nails; a "prize medal" was given to V. Lefebre and Co;264 L. Sieron received an "honourable mention" for his nails, termed, "clous de Paris".265 Three machines were exhibited, "for making the nails called 'points de Paris'". The machines were described as "ingenious". One machine was made by a Mr Frey and the other two by a Mr Stoltz.266

American Developments

Wire nails were imported to the U.S.A. during the late 1840s267 and several manufactories were set up in New York.268 There have been several claims as to the first machines produced in the U.S.A. Adolph Felix Browne of New York was credited in making a wire nail machine.269 However, Sickel claimed that the first to make such a machine (in 1851) was Morton and Bremmer of New York. This machine was designed by their foreman, William Hassell. The new machine was at first called a "pin machine" as it was mainly employed in making escutcheon pins but headed nails of brass and iron wire were also made on it. The machine was purchased by William Hassell and it
was used for production until 1903.²⁷⁰ In 1884, William's son, John, designed a new machine which was able to take advantage of the new steel wire produced by the Bessemer process to make steel wire nails. The machine became known as the Brooklyn Machine and was patented in 1885. The machine was built by M.M. Smith of Brooklyn. Machines based on the Brooklyn principle were in operation in the U.S.A. as late as the early 1970s. By 1888 steel wire nails exceeded cut nails in production and popularity.²⁷¹ Nelson quotes an article regarding this "newer" type of nail made of steel wire which, "have been in use for a number of years in America and for a longer period in Europe". Nelson believed that the nail did not become the dominant type until the 1890s (in the U.S.A.).²⁷²

It should be stressed that the wire nail machines of the 1850s to 1870s mainly made the smaller sizes of nails not for construction work but for making boxes, frames, etc.²⁷³ The wire nail does not appear to have been taken seriously in the U.S.A. and Britain until the machinery was developed to work steel wire as the raw material. As will be seen later, some of these steel wire nails were exported to Australia.

**British Developments**

As noted above, the British writers remained silent on the topic of wire nails with a few minor exceptions, beginning during the mid to late 1870s.²⁷⁴ The account in Bevan sums up the status of the wire nail in the Britain of the 1870s. The chief points made are that the wire nail, made from one to four inches in length:

...are well suited for, and principally used in, making packing cases of Continental soft woods: "The quantity of wire nails made is not great, for they are but little used in England, and only a few are manufactured for export purposes."²⁷⁵

The two earlier writers Heintzmann and Rochussen (1869) wrote:

In England the wire nail is practically little known, except at bonded wharves, where foreign packing cases are opened for Customs examination; the only people who use them are a few shippers of bottled wines in cases.²⁷⁶

Although builders and joiners of the time considered them "cheap" and "devils to hold", one of the chief reasons for their rejection was prejudice. The builders and joiners of Britain were represented as concluding, "but then they are French nails, and our men won't use them".²⁷⁷ The nomenclature may well have been the chief problem. In the Great Exhibition of 1851 they were termed variously as: "points de Paris", "clous de Paris" and "wire nails".²⁷⁸ Other authorities used, "point de Paris",
"French nails" and "drahtstift", but the most common terms used were "wire nails" or "French nails".

The use of wire nails by builders and joiners even up to the mid 1870s in Britain was clearly almost non existent. Axon, comparing the French and English nails, had to rely on "a writer" for his information which indicates that he knew nothing about the French, or wire, nail. The common use of cut and wrought nails was to continue for a few more decades in Britain. Even as late as 1910 the debate regarding the superiority of cut over the wire was considered relevant and from an illustration of nails commonly used, the cut and wrought varieties outnumbered the wire nails. As in the U.S.A, wire nails were more seriously regarded once they were made from steel during the 1880s, but the conversion to the common use of wire nails was a much slower process in Britain.

By the late 1860s Canada, Australia, New Zealand and many other British colonies were represented as consuming "wire nails largely", in contrast to the British. Aitken in 1874 wrote that wire nails were made in Britain, "a variety of French origin", in lengths from one to four inches. The production was "not great" and "only a few are manufactured for export purposes". There is some evidence that the bulk of wire nails exported to Australia during the 1870s and 1880s did originate from Britain.

Wire Nail Machinery

The earliest available descriptions of wire nail machinery appear in the Engineer and Aitken's account. Although the accounts are brief, they are enough to make us realize that the machine has not changed in its basic principles since the late 1860s. An examination of wire nails dating from the 1860s to the present all show similar machine marks, though refinements may be distinguished and trends in the form of the head varied in time. The two early accounts show that the machine, or "nail-making bench", made the nails in one operation. The wire was gripped and "advancing dies", one for the head and one for the point, would cut the point and create the head. The iron wire at that stage was made of pig iron which was considered better than the metal for cut or wrought nails.

In 1891 two illustrations were published of wire nail making machines, one was an English model constructed by Messrs T.E. Bond of Birmingham and the other a German model by Malmedie and Co. of Dusseldorf. The Bond machine straightened
the wire from the coil, dies gripped the wire whilst a pair of nippers cut the nail and the heading and pointing were effected by dies. The machine operated by the use of a spring bolt mechanism worked by a cam on the main shaft, this was only activated when the wire had been advanced to form a nail. As with the latest cut and wrought machines of the time, the cutting and pointing was performed in one operation. A 'flat spring' worked the heading bolt, after which the nail was ejected from the machine. Depending on the length and size of the nail, the machine could produce 300 nails per minute.

The Malmedie machine worked on much the same line but instead of the heading die striking the nail intermittently, the heads were formed by steady pressure. The steady pressure system was represented as "avoiding injurious percussion". The result of the "injurious percussion" may have caused some of the nail heads to shift off center to the shank, as noted by Nelson in early American wire nails (but this could also be due to some misalignment between the gripper and heading dies).

There are very few descriptions of wire nail making machinery. Few changes seem to have been necessary after the late nineteenth century.

The sizes of the machines tended between five by two feet to thirteen by five feet. The machine took such little space they could be installed in any pre-existing factory without major alteration. The Continental European trend was for wire manufacturers to install them in their factories as a profitable sideline. The same trend was then followed in Australia.

In Continental Europe of the late 1860s, nails from a quarter of an inch to six inches in length were commonly manufactured, though larger nails could be made up to sixteen inches as the limit (five-eighths of an inch in diameter). In Britain by 1874 the standard production sizes was from one to four inches in length.

From Iron to Steel

The shift from the use of iron to steel wire in the manufacturing of nails led eventually to the acceptance of wire nails, first in the U.S.A. and much later in Britain. Australia, or at least the eastern colonies, had already been converted to using wire nails and would have continued using them whether they were of iron or steel. In any case, the conversion from iron to steel is a useful dating factor.
The Bessemer converter was introduced in 1856 but it was not until about 1870 that it began to be used for a wide range of purposes (railway rails, boiler plate, shipbuilding etc.). Even so, the problem of removing phosphorous accumulations in pig iron was not solved until 1879 and this resulted in lower prices. Advances made in producing cheap mild steel and advances made in the production of cheaper wire must have coincided by the mid 1880s. We get an indication that this was the case in Australia, though at that time it relied entirely on imports.

The first steel nails were imported to Australia about 1875 but there was little demand for them "initially" because of the high price. By 1885, in the U.S.A. at least, steel nails were cheaper than iron nails by 10 cents per bag, but the price had certainly fallen in Australia. These nails were said to be stronger and lighter than the iron product.

In June 1886 the Australasian Ironmonger reported that an "American paper" had predicted that, "in the course of the next five years" the iron nail would be replaced by the steel nail. Machinery and plant necessary to manufacture steel nails were, "being set up in every nail centre and at nearly every nail foundry."

Nails taken from dated contexts in Sydney indicate that the transition was fairly complete by the early 1890s. The sources of imports and the beginning of Australian nail manufacturing will be discussed under a separate heading.

**Cast Nails**

Cast nails are not an important class of nails and were rarely applied to the building trade, except in the rare instance when they were used for lath and plaster work and perhaps for decorative purposes. The casting of nails was not a machine process.

Not much is known of their early development. Nelson mentioned that cast iron nails appeared in eighteenth century "hardware catalogues" and set a "tentative availability" period of c.1770-c.1820s. Lenik in his study of cast iron nails cites 1769 as the earliest known reference to cast nails in British patent records, though these were for coffin nails and tacks. Their main functions during the first half of the nineteenth century were for garden walls (training fruit trees to grow against walls), as lathing and for coarse shoes and boots. It is suggested that the former two functions continued into the second half of the nineteenth century.
There were two basic methods of producing cast nails: the earlier method involved moulds formed of sand, the pattern of the head was impressed and the shank was created by picking a model in the sand; the other method involved a two part mould, or casting-flask, the head was set in one half of the mould, die shank in the other. Pig iron was used for the nail types mentioned above but brass, copper and alloys thereof were used for shipping and boating nails.

There are almost no illustrations of cast nails but they were described as having tapering shanks with a square or triangular section. Lenik isolated the following characteristics of cast nails excavated from two sites in the USA: the shanks were square in cross-section and tapered on all four sides to a sharp point; the heads were the shape of a four-sided pyramid about "square, the apex of the head had a small knob, evidence of the casting process; the surfaces of the nails were smooth and arrises lacked the sharpness as found on wrought or cut nails; the lengths of these nails ranged between 1-1/8 to 1¼ (28.6mm to 31.8mm) of an inch. The nails found were associated with mortar and plaster which suggested a function as lathing nails.

Hebert believed that there were three distinct qualities of cast nails: untreated nails were extremely brittle and were only use for shoes (nails called "sparrow bills"); those for plasterers and garden walls and were annealed to prevent them from disintegrating when hammered; and the best type were called "malleable cast iron" nails, these nails were subjected to a long continued process of annealing. Tacks were one of the most successful products of this process. Some cast nails were coated with tin or pewter during the early period and from about 1837 could be galvanized.

In Australia, few non-shipping or boating cast nails have been known to have been imported, one reference was found dating to the late 1810s. None have been recognized from archaeological sites but Lenik proposes that this category of artefacts may exist but have not been recognized by archaeologists. Up to 1977 a few cast nails had been uncovered at the following excavations in the USA: Sackets Harbor, New York (1812); Fort Montgommery, New York (1776/1777); and the Log Dwelling site in Newfoundland (ca.1780-1810). Lenik believed these nails to have originated from England in "limited numbers and had a highly specialized function". It is likely then that such nails reached Australia, certainly in limited numbers but it is doubted that they had a highly specialist function in the early Australian colonies. The ones which were recorded in Sydney of the late 1810s were described as "totally useless" and the writer concluded "There are many of the nails I have now described lying in the
Commissariat Store that are perfectly useless. Nails such as these would have eventually been used as a make-do, as there was always a shortage of nails.

A category of nails which do appear for specialized work are brass nails. Although they were mainly used in ship and boat building, they were also used for securing copper sheathing on roofs (especially churches and public buildings) and copper sheathing on doors such as those on powder magazines. During the early years of the nineteenth century these nails were cast from an alloy of tin and copper. By the late 1820s and early 1830s pure copper was used by some patents but the use of pure copper was very expensive. Flat headed countersunk nails with rounded shafts were the most commonly made but rose and clench headed were also manufactured. By the early 1830s a method was employed using square sectioned drawn wire, the traditional wrought method was used but the wire was worked cold.

Nails and Nail Production in an Australian Context

It was thought best to group this topic under a separate subheading for the sake of clarity. It is vital to understand the development of nail production in Britain, the United States of America and even Europe, as at various times nails were imported into Australia from these areas. It is now important to understand the extent of importation and the development of the Industry in an Australian context.

1788-1803

The most detailed information about building materials are usually found in the official and journal accounts of establishing a new colony. As a general rule, once the initial building problems had been ironed out, there was little further mention of such matters. Though this thesis concerns Sydney and its environs, some of the accounts of the founding of its daughter colonies, such as Norfolk Island, Risdon Cove, Hobart etc., have had to be used to elucidate the situation in Sydney.

The first nails to be used in building construction in Australia came out from England with the First Fleet in 1788. The account books of the Admiralty record that a total of 747,000 nails were sent out in the ships comprising the First Fleet.

Included in the requisites of Sir George Young’s Plan for the proposed colony of New South Wales, dated 1785, were, "Spikes and nails". Lord Sydney’s "enclosure" of 1786 was more specific:
Nails of different sizes, at 2 shillings and 9 pence per 1,000, about 10 barrels - 100.

Spikes, 2,000, at 1 and 10 shillings per 100 - 30.316

Nails were also sent out specifically for barter; the Sirius carried "nails and gimlets" for such a purpose.317 Arthur Bowes Smyth (July 1788) commented that a spike nail and hoop iron were exchanged with the natives for fish318 and that small nails were thrown into the water for the natives to dive for.319 Later during his journey in the Pacific small nails were bartered for coconuts.320

The initial nail consumption must have been enormous, as upon landing a penal township had to be built with every facility including sheds and enclosures for plants and animals. To further drain the store of nails, the Supply left Port Jackson for Norfolk Island on the 15th February 1788 with six months provisions, including "tools and utensils of all kinds".321 The Supply brought extra provisions to the Island late in July.322 As at Port Jackson, building began immediately and the momentum increased dramatically. By 1800 the Island housed a population in excess of 950 people.323 The great amount of building would have created a continual demand at the expense of the supplies in Sydney. The early accounts of the Island's progress (King and Clark, 1788-1791) reveal no shortage of nails though urgent requests were made in 1795 and 1799.324

Evidently, no shingle nails had been sent out with the First Fleet and it seems that ordinary nails were too precious to be used for shingling. It had not been anticipated in England that shingles would form the principal form of roofing; several dispatches mention the use of shingles almost with surprise.325 Collins described how, by the end of May 1788, the hospital roof had been shingled using wooden pegs prepared by the women to secure them.326 Wooden pegs had also been used around 1798/1799 at Parramatta.327 This would indicate a shortage of nails but more specifically of shingle nails because on Norfolk Island in November of 1788 the women were also preparing pegs for shingling.328

A shortage of nails was foreseen by early July 1788. Major Ross included "nails" as part of the "necessaries" for the Colony.329 Governor Phillip prepared an enclosure "of Articles most wanted in the Settlement":

Nails mostly of 18, 20, and 24 penny
Nails "spike", brads
Copper nails for repairing boats.330
A list of "Goods" sent by the ill-fated Guardian, dated 1st June 1789 included the following sizes of nails: "20 casks - 8 penny, 10 penny, 12 penny, 18 penny and 24 penny nails".330

Commissary Palmer prepared a list of complaints regarding the supplier of goods intended for the Colony on 23rd November 1791. Apart from indicating a shortage this list illustrates that nails were sold by the pound in weight and using the penny system to indicate length:

672lb. of 24 penny nails, called in the invoice 900lb., and charged for as such.

Some of the casks of nails marked different from what they are expressed in the invoice, that is 4 penny marked 10 penny, and always a higher mark than what they ought to be.331

The supplier of these nails was a Mr Alexander Davison of "Harpur Street" and supplied material up to at least June 1793.332 He would have purchased his nails from a nail master's warehouse.

The laying out of a regular plan for Parramatta beginning in July 1790333 led to a great deal of building activity. If there had been a shortage of nails, there was no practical sign of it and building proceeded without interruption. A witness wrote on 29th October 1791: "I wish we could fill our granaries as readily as we can build houses".334

There are few references to nails between 1792 and 1800. It is assumed that requests were made by the Commissary and that these requests were generally satisfied335 (after the Commissary's initial wants were made known to the authorities in England). The problem of the lack of shingle nails was probably solved during the 1790s. The failure of the roofs of two prominent buildings which were shingled encouraged the Government to concentrate on terracotta tiles, though from Collins' accounts it is obvious that the wooden pegs, used to secure the shingles, were chiefly responsible for the roofs' failure within a year or two of construction.336 The shingle and tile roofs still required nails and few complaints are heard about roofing failures after the initial years of the 1790s. There was no specific request for shingle nails but 4 penny or 6 penny nails would have served perfectly instead.337

By 1791 the following nail sizes and types were specifically mentioned: 4, 8, 10, 12, 18, 20 and 24 penny nails. The majority would have been hand forged, rose headed nails with tapering shanks to a sharp points; forged spikes; forged brads with or without spurred heads; and copper boat nails. By 1799 scupper nails and horseshoe nails were accounted for.338 The most popular sizes for building purposes were the 18,
20 and 24 penny sizes which with the 10 penny size would have coincided with the English preference. The absence of particular nail types or sizes does not mean that they were not present in the colony for example, the presence of glaziers nails or tacks is implied by the large amounts of window glass that were sent out.

A shortage of nails and iron began to be felt from about 1797. It was reported that the iron bars from buildings on Norfolk Island were being removed so that tools and implements could be made and nails were being made from hoop iron. By September 1800 the commissariat store at Sydney ran dangerously low in its supply of nails, sizes from 1 to 4 inches in length had run out completely. It was also reported that there was very little iron left to make them with and would retard building and repair work. The scarcity of iron continued into 1801 and the Commissary was obliged to purchase iron from the American ship Missouri to alleviate the "great scarcity of iron".

The nails commonly stocked by the Commissariat by 1800 were the following sizes: 4, 8, 10, 12, 18, 20, 30 and 40 penny. There were also copper spikes. The following were ordered for 1801 in casks; 7 of 4 penny, 10 of 8 penny, 5 of 10 and 20 penny and 2 of 12 and 18 penny. Nail samples were sent out to New South Wales "for Examination" in 1800. The nails ranging from 3 to 40 penny were described as "Very indifferent" and the spikes "Are not good". It was expressed that nails of the 3 to 12 penny variety "Are most wanted" which is the first reference to indicate that smaller nails were required.

His Majesty's Store, or the Commissariat, in Sydney supplied nails for both Government work and to the public by sale.

There are few references to local nail production. As seen earlier, a nailor's workshop was not radically different from that of the blacksmith's. The blacksmith's workshop could, with a few modifications, be made usable for making nails. All that was really needed was a bore for the heading of a nail and the raw material, nail rod iron. If the local blacksmith was skilled, the nails produced would be in no way different from those imported. However, few at first were skilled in nail making and the bore was probably improvised, resulting in a fairly crude product.

The first nails to be made in Australasia were made on the 17th November 1788 by a blacksmith on Norfolk Island. For the raw material he used "Iron Hoops", or hoop iron, apparently of a thick gauge in order to make shingle nails. The use of hoop iron is most interesting because the invention of the cut nail was claimed by Rees' 1810 American source to have started when some men, "began by cutting slices out of
old hoops, and by a common vice, gripping these pieces, headed them with several strokes of the hammer.349 This was supposed to have occurred around 1790, though Knight believed that Jeremiah Wilkinson was the first to cut nails around 1775 and some sort of nail cutting machine was invented by 1786.350 In any case, the nails cut, or sheared, from hoop iron on Norfolk Island in 1788 must be regarded as one of the earliest accounts of such a process and is certainly the most reliably documented. Nails were again cut from hoop iron on Norfolk Island around 1797/1798 when there was a shortage of nails and iron.351 A later case was recorded at Newcastle around 1820 where the nailors made “650 shingle or lath nails out of hoops per day”.352

Most of the evidence regarding nail making is found in documents dating to the late 1790s, though the implications are that nails were made only if there was a general shortage of nails or if there was a shortage of a particular type of nail. In February 1797 arrangements were being made in England to send out agricultural implements and also two tons of nail rod iron.353 This indicates, as it appears that they were specifically requested by Hunter, that there were people (by 1796) who were able to make nails from nail rod iron. In December 1798 blacksmiths were recorded as making “streaks and nails for carts and timber carriages” these were special nails most likely of the clout headed dog variety.354 The "Statement of Work" on the 31st December 1799 mentioned that three nailors at Sydney were making screws, rivets, "and such nails as were not in the store".355

Although the first nails were made in the latter part of 1788, we do not hear of "nailors" until the very end of the 1790s. Nailors were of course specialists at making nails, while blacksmiths made a great range of metal objects and in some cases could also make nails. A brief look at the role of the blacksmith might be in order to determine the hidden extent of nail making.

The importance of the blacksmith was indicated by the priority given to the unloading of his tools of trade. On the 27th February 1788, a forge, a pair of bellows and "one bundle of smiths’ tools" were unloaded from the *Scarborough*. On the following day a bundle of smiths’ vices were unloaded and a few days later, three more forges and two anvils, though one was lost overboard.356

During the first year of Settlement the blacksmiths at Sydney were in such constant demand that they could not even do any basic maintenance on the firearms. It was reported that two fire locks were in their hands for three months without any work having been done on them.357 All repairs to tools and sundry iron work connected with building were done by the smiths, even making fish hooks.358 As the 1790s progressed, blacksmiths were required to make agricultural tools and even domestic objects which
were normally imported. Among their duties was to make iron hand mills, sickles, hooks, hinges, stonecutting tools, locks, keys, hoes, shovels, spades, picks, axes, kettles, frying pans, chains, thatching knives, hammers, weights, cart axle-trees, iron work for the schooners Francis and Sydney and other vessels, etc. Only in one case, were blacksmiths listed as making nails but of a specialist kind.

Blacksmiths could not be spared for large scale nail making during most of the 1790s. Requests were made to England for convicts who were blacksmiths because there were never enough to satisfy the needs of the Colony.

Another factor which almost certainly indicated nail making activities was the presence of rod iron, or nail rod iron. It was not originally planned to send rod iron, though flat and square bar iron were proposed, the latter two were not suitable for making nails.

The first bulk importation of rod iron come with the Resolution in September 1794. This shipment contained 1,266 bundles of "rod and casement iron" as well as 3 bundles of German steel, 107 bundles of rolled iron, a bundles of plate iron, 560 bars of bolt iron, 473 of Russian iron, 107 slabs of Swedish iron and one sheet of lead. Earlier that year in March, 40 bundles of rod iron arrived with the William, as well as 37 bundles of sheet iron, five bundles of steel, 90 bars of flat iron, 6 vices and anvils and four pairs of bellows. The next recorded shipment was of 2 tons of rod iron "for nails" in 1797 but unfortunately the ship was seized and became lost as a Spanish prize. Other shipments probably arrived, but by September 1800 it was reported that very little iron was left in the Government Store to make nails with.

In summary, it appears that nails were only made locally if there was a shortage of a particular type, such as shingle nails or dog nails for carts and carriages. There must have been other occasions when it was found necessary to make nails but the raw material, apart from hoop iron, was not recorded as being available until 1794. By the very end of the 1790s, the first professional nail makers are mentioned, "nailors", though they may have been blacksmiths working as nailors. In any case, because the imported nails and those made locally were made of nail rod iron, there would not have been any difference in either product unless the lack of experience and lack of proper facilities was reflected in the local product. Some of the imported nails were described as 'very indifferent', so defects were to be found even in the imported article. By the 1800 nails for common uses ranged between 1½ to 5 inches were available, though smaller sizes were wanted, ranging between an inch or ½ inches to 3 inches which suggests that finer work was being done.
This period has been isolated because it was a time of expansion and of gradual stabilization ending with the arrival of Governor Macquarie. Five attempts were made at establishing settlements during 1803 and 1804, Port Phillip, Risdon Cove, York Town, Hobart and Newcastle and we are given insights into the state of development and the resources of Sydney, unparalleled in detail since the founding of Sydney and the settlement at Norfolk Island. 1803 was also the year when the *Sydney Gazette* was launched providing us with a rich documentary source reflecting all levels of society in a way official records can not.

The Government Store's supply of nails began to improve during 1802 with the arrival of the *Perseus* and the *Coromandel* containing 50 casks of nails ordered in England in May 1801. Another 50 casks arrived in March and April 1803 with the arrival of the *Glatton* and the *Cato* containing nails ordered in England in May 1802. These shipments were probably ordered from Sydney in 1800. The *Glatton* and the *Cato* carried, 3, 8, 12, 20 and 24 penny nails, and the nails carried by the *Coromandel* and *Experiment* (which arrived in June 1803). These amounted to a total of 52 casks of nails specifically intended for Government use. Each cask contained a specific number of nails: 3 penny casks contained 100,000 nails; 8 penny casks contained 32,000 nails; 12 penny casks contained 25,000 nails; 20 penny casks contained 19,000 nails; and 30 penny casks contained 10,500 nails. Nails from the *Glatton*, *Cato*, *Coromandel* and *Experiment* were also set aside for "barter" to private individuals, the following were set aside for this purpose: 300,000 3 penny nails; 200,000 8 and 12 penny nails each; 40,000 18 and 30 penny nails each; and 100,000 20 penny nails.

Nails were offered for barter at the Government Store at Sydney on the 1st May 1803 by announcement in the *Sydney Gazette*; the investment of four "whalers" which had arrived from England over a period stretching from March 1801 to April 1803. The range of nails offered, with the exception of the six penny nail, was basically the same as were listed by 1800. The range was as follows; 3, 4, 6, 8, 10, 12, 18, 24, 30 and 40 penny nails. The prices for the extremes of this range progressed from 3 shillings and 7 pence to 41 shillings and 3 pence per 1,000.

The long delays seen in the above examples between shipment and distribution were not the rule but may have inspired some private enterprise. The *Rolla* arrived on the 13th May 1803. Two days later the ship was reported in the *Sydney Gazette* as containing, among other articles "10 casks of nails" and was undersigned by
Simeon Lord. One week later these nails were offered for sale by "Mr Grossley", "Nails from 6-penny up to 40-penny".

Spikes and iron bolts had also been offered for public sale by Simeon Lord in March 1803, which had been salvaged from the wreck of the schooner *Surprise*. One cask of copper spike nails of 6 inch lengths had been sent by the Commissioners of the Navy early in the year.

The transactions between Sydney and the new settlements in present day Victoria and Tasmania reveal a little about the resources available in Sydney and the scope of its "mechanics".

The list of the stores needed for the Port Phillip settlement was drawn up in England by February 1803, the list included, "30 barrels of Nails of sorts, chiefly 18, 20 and 24 penny; 4,000 Spike Nails; 28lbs Brads". The provisions were sent on the *Calcutta* and the *Ocean* which arrived in Sydney toward the end of 1803. The tradesmen landed at Port Phillip included eight blacksmiths, a tinker, a tinman, a brass founder and a nailor/screwforger. Despite the fact that a nailor was included, no rod iron was specified in the stores list.

For the settlers at Risdon Cove, Tasmania, each were to be allotted two ewes, six bushels of seed wheat, a proportion of tools, nails, clothing and "garden" seeds. This shows the importance of nails to any new settler. As for the convict settlement, they were allotted one blacksmith. Bowen complained to King:

By the Quarterly Employment you will see how few our Artificers are, the Blacksmith having no Idea of making Nails. I am afraid we shall fall short of them, particularly Spike Nails.

King apparently was not willing to spare many nails, though there was no real shortage and another shipment of nails was on the way. King advised Bowen to economize:

As Application may be made to you for Nails to make Paling and Fencing, you will direct Works of that kind to be Constructed with Timber, as the Quantity you will have in Clearing away will sufficiently allow of your enclosing in the American manner, which requires no Nails.

Risdon Cove was abandoned in favour of Hobart. Several frames of "Huts" were removed to Hobart. The Quarterly Return for November 1804 for Hobart shows that things had improved, there being, "8 blacksmiths" as well as an armourer, tinsmith and file cutter. The stores, including nails, were also transferred to Hobart. Few specific references to nails have been found apart from a reference to boat...
building activities when "Sheet copper, Copper bolts, Small and large: Copper Nails for Boats" were requested.\textsuperscript{401} A receipt for tools included "7lb of Pump Nails".\textsuperscript{402}

An account of Stores etc. furnished from His Majesty's Stores in Sydney to Hobart between the 26th November 1803 to the 15th March 1806 seems to suggest Hobart had adequate supplies of nails. £3/13/3 worth, of 10-inch, 10,000 in November nails were sent from Sydney in October of 1804.\textsuperscript{403} By 1806, Hobart had five blacksmiths and Port Dalrymple in the north of Tasmania, had three.\textsuperscript{404}

Not a great deal of detail may be found concerning the early years of Newcastle, though the initial building there was not extensive. King was able to report to Lord Hobart in August 1804 that, "A sufficiency of coals are received to supply the blacksmiths' works" at the various settlements for the use of the Crown as well as for individuals.\textsuperscript{405} This would have saved a lot of effort as far as the charcoal burners were concerned and simplified the fuel requirements of blacksmiths, nailors etc., especially as the coal became to be more efficiently worked. By 1806, Newcastle had three blacksmiths.\textsuperscript{406} As the years progressed less is heard of such matters as hardware, government correspondence focusing on other matters. When new influxes of settlers came, however, the same problems arose. Collins wrote to Castlereagh on 20:04:1808 that "I have lately been obliged to hire some free men who came from Norfolk Island to enable me to furnish the Settlers with Tools and Nails for their Huts".\textsuperscript{407} Even in 1808 it was far less expensive and more expedient to import English nails:

\begin{quote}
\ldots I have also to mention that, through our great demand for Nails for the use of our Norfolk Island Settlers, a large Supply is wanting, and more particularly to some the expense which we are unavoidably put to in making them.\textsuperscript{408}
\end{quote}

In late June 1804 a large shipment of nails etc., arrived in the transport \textit{Experiment}.\textsuperscript{409} The ironmongery had been supplied by Joshua Jowett of "214 High Holborn" London.\textsuperscript{410} The nails arrived in casks; there were six casks containing 600,000 3 penny nails; six containing 192,000 8 penny nails; six containing 150,000 12 penny nails; two containing 38,000 20 penny nails; and eight casks containing 84,000 30 penny nails.\textsuperscript{411} There were also "100 Bundles of Rod Iron, sorted 50".\textsuperscript{412} For barter, one cask contained 40,000 8 penny nails and two casks contained 25,000 18 penny nails.\textsuperscript{413}

A statement of the remains of "Annual Supplies" for barter as of the 31st December 1804,\textsuperscript{414} reveals a moderately well stocked Government Store, except for the 10 penny size. The following sizes were stocked; 3, 4, 6, 8, 10, 12, 18, 20, 24, 30 and 40 penny nails. The \textit{Experiment} had added 40,000 8 penny and 50,000 penny nails to the Store early in June. Settlers, since the 1st July had received 12,037 3 penny nails, and
2403 30 penny nails. The number of nails for Government Works is not stated but can be deduced from the material presented above.

Nails were sporadically offered for sale through the Sydney Gazette by both the Government and private individuals. The sale of Government Stores was advertised from time to time. In July 1804 the sale included "nails". Private sales were more common. M. Hayes advertised "Prince's metal nails" and brass nails as part of a "British Investment" in July 1804 and during the same month in 1805, again offered "Princes metal nails". In October 1809, M. Hayes offered "cut brads".

Hayes' advertisements are the earliest known references to patent and cut nails in Australia: Prince's metal nails must have been a patent type nail and may actually have been machine cut. As seen earlier, Rees pointed out that the cut nail, or brad, industry at Sheffield and Birmingham started as an "extensive trade" around 1803/1804. The first two advertisements by Hayes mention "Prince's metal nails", not specifically "cut nails". No other references have been found of the name and the nails could just as easily have been cast or die headed. In any event, the first clear reference to cut nails in Australia dates to 1809. Another reference in September 1810 refers to a sale of "Nails and cut nails" by Mr Crook.

"Nails of different sizes" were offered for sale in December 1804. This represents a clear reference to foreign nails finding their way into the Colony. The nails were part of the "Prize Goods" taken from the "Batavian Republic" ship, the Swift. The Dutch ship was captured off Sumba and arrived in Sydney on the 17th November 1804 and the goods purchased by Messrs Campbell and Co. The nails sold were most likely from The Netherlands. Spanish goods, including copper suitable for making nails and boats, were available by mid 1806. The Spanish prize, the Santa Anna, taken off St Blas, arrived in Sydney in June 1806. The goods, including, "two boxes and a half of nails" were offered for sale in November of the same year. There is little evidence to support that nails were imported from anywhere apart from Britain. Some trading occurred with American ships but this mostly involved rum. 16,663 lbs of iron were purchased from the Missouri in 1801, as well as "anchors, iron, ironmongery, tools, grindstones, earthenware", etc., during a period of great scarcity of iron. Nails are not specifically mentioned.

From about 1804 nails became increasingly more available from sources outside the Government Store, though there were some advertisements on behalf of the Store. The range of nail sizes remained much the same throughout the decade, though references to sizes below 6 penny are uncommon. Nails available as annual supplies in 1805 to civil and military officers were; 3, 4, 6, 8, 10, 12, 18, 20, 24, 30 and 40
Two more lists were published; one was a requisition for barter, "with the Inhabitants of NSW" for 1807 for 6, 8, 10, 12, 18, 20, 24, 30 and 40 penny; the other was a list dating to 1809 of the investment of the Sinclair at His Majesty’s Stores for, 6, 8, 10, 16, 18 and 20 penny.

During the decade, 1800-1810, names used for nails became more specific, especially toward the latter part of this period. Spike nails are numerously mentioned. Scupper nails had been mentioned since 1799 and 10,000 were for sale in 1808. Horseshoe nails rated but a few mentions but must have been in daily use. Copper nails, spikes and bolts receive sporadic attention, especially in connection with boat building and in one instance "for Boots". Tree nails (wood) of 1½ inch (38.1mm) diameter were mentioned in connection with a call for tenders to build 10 bridges in 1805. The first mention of cut nails may be found during this period and a mention of the enigmatic "Prince’s nails". Flooring brads, tapering nails with a spurred head, are first specifically mentioned in 1809 but must have been available before this date. The full range of penny sized nails, generally used (to 40 penny) are mentioned throughout the decade. In 1809 nail types began to be given their specific names, for example, "Rose nails". During the same year, "Flat Points" from "24 to 40 penny, 6d per lb" are mentioned for the first time.

At this stage it should be emphasised that all the nails mentioned so far, apart from the copper varieties and cut nails, were hand wrought as described under that section of the text. As mentioned earlier, those nails produced in the colonies would have been similar to those produced in Britain unless inexpert workmanship and/or lack of the proper tools gave them a more primitive appearance. Poor quality nails were also imported, as it was well known that merchants in Britain could dispose of unpopular stock by export.

1811 to 1851

This period began with the stabilizing and organizing effect of Governor Macquarie who had a keen interest in building and town planning programmes. Bigge may have had a regulating influence on Government works at least and increasingly, after the 1820s, private enterprise predominated. As far as nails are concerned, little changed in the basic product but a greater variety of nails became available until few products that were generally available in Britain were not also available to the growing township of Sydney. During the 1840s the first major influx of machine made nails occurred. Sydney was declared a city. In 1851 the Gold Rush was to change the city
dramatically. As a result of the goldrush, the early to late 1850s is represented by just about all the latest technical developments which could be transported: Settlers and gold seekers brought with them whatever they thought would be useful. (The same period saw a proliferation of books giving advice to prospective settlers on practical matters.) Merchants sent over to the colonies just about anything saleable in the form of "investments" knowing that there was a shortage in just about everything and most assuredly, building materials.

During the Macquarie period a more regular and orderly approach was reached in most aspects of Colonial life. Details about commonplace articles such as bricks or nails ceased to be the subject of official correspondence and hence the development of such items becomes less clearly defined. The Sydney Gazette, through its advertising columns becomes one of the chief sources of such information. However, as time progressed even advertisements become less detailed as regular outlets became available to the public and the supply of various types of nails came to be taken for granted.

As suggested earlier, the omission of a particular nail type in government lists or commercial advertising etc., does not necessarily indicate that the particular nail had not been imported or had not been made at an earlier date. (In such a case, the documentation of the initial invention and production of a specific type of nail becomes very relevant.) In advertising, the product, if named, may be a very sought after article or it might be that the novelty of it might need advertising in order to have it promoted. A case in point for the latter was the advertising of "Prince's metal nails" at M. Hayes in 1804, most likely one of the first consignments to reach Australia. A typical example of the former case would be Bevan's sale of "a large Quantity of Spikes and Bolts" in 1813; spikes and bolts had been constantly in high demand since 1788.

From the Macquarie period on, nails were rarely given a specific description and if advertised for sale were generally described as "nails of kinds" or "nails of sorts". Nail rod iron was also a frequently mentioned product. "Pailing" [sic] and "Railing" nails were advertised in November 1813. Brass nails and tacks were available at Mr Lord's in April 1819. "European iron nails" were advertised in 1819 and 1820. Cartwheel nails were mentioned in 1823 as well as "shingling and horse nails". Some of the less common types of nails were listed in 1823, "small kegs of batten, shingling, clasp, spike, dog, and hob nails, flooring brads; 5, 6 and 7 inch spike nails; flooring brads; rafter and other nails"; "copper nails, iron nails, of sorts"; "nails, carefully selected, of shingle, chisel pointed, roseheads, flooring brads, rafter, clout, and fine clasp, and various other descriptions".
Local nail production continued to take place in blacksmith's workshops. Druitt recorded in 1819 that he had caused to be built a "Smiths' shop" at the Lumber Yard in George Street including six "fires" for nailors.\textsuperscript{454} A constant request to England was for nail rod iron\textsuperscript{455} though it was also privately imported by the ton.

The accounts of task work, required by the Government reveal that only the most common of wrought nails were forged from nail rod iron. The "nailors" of Hobart Town were required to make, per day, 400 shingle nails, 200 forty penny nails and 350 batten nails.\textsuperscript{456} The weekly Sydney task schedule in 1818 was, 3,600 shingle and boat nails, 3,000 boat and timber nails and paling nails and 1,800, three inch nails,\textsuperscript{457} though the type of nail would vary according to demand. Nail production suffered in some of the new settlements as it was claimed that the iron sent from Sydney was "so very unfit for that purpose".\textsuperscript{458} Another impediment was that the cost of nail rod or iron was prohibitive, resulting in very costly nails.\textsuperscript{459} By 1820, nail rod cost around 8 pence per pound.\textsuperscript{460}

As mentioned earlier, the nailors worked in the blacksmiths' area. Quite often nailors had a skillion shed attached to the blacksmith's shop.\textsuperscript{461} Tools used were rarely mentioned, though one return, dated May 1819, listed, "nail fire tool", "stakes nailors", "tools nailors", "swages, 8", "slicers, 2".\textsuperscript{462}

The identification of some nails present problems; for example, 644 pounds of "steel" nails in 1819.\textsuperscript{463} What were the nails like which were, "sent out formerly, a description of nails that I believe were case and cut . . . totally useless".\textsuperscript{464} Could the latter have been a punched out, or cut, nail suitable only for softwoods as seen during the 1840s to 1860s?\textsuperscript{465}

Wrought nails and nail rod iron continued to be imported during the 1820s to early 1850s. Colonial labour being expensive, wrought nails were cheaper to import than nail rod iron for local production despite that the iron rods had been reduced in cost from 8 pence per pound to one half penny between 1820 and 1834. In 1837, 261,495 pounds of nails iron and coppernails were imported at the cost of £5,308.\textsuperscript{466-468} The range of nail types for general purposes, though mainly "rose headed", had not changed greatly.\textsuperscript{469}
By the early 1840s a revolutionary type of nail reached the Australian colonies, known as Ewbank's nails. The first are believed to have reached Sydney in 1837. One of the earliest references to Ewbank's nails appeared in The Atlas (Sydney) in 1844; sold by Thomas Woolley, "Nails, every sort including Ewbanks". Lists of other sorts of nails do not vary much during the 1840s from the previous period but hurdle nails are often specifically mentioned.

By the early 1850s builders had overcome their prejudice against Ewbank's (and other patent nails). These nails nowadays are often mistaken for "convict" nails but a close examination will reveal the difference: head formed in a automatic swage, die grip marks and shear marks down the edges of the shanks.

G.F. Train between 1853 and 1855 noted that Ewbank's patent nails were much in favour among builders and most suited for Australian hardwoods, whereas the American cut nail was not thought to be suitable. Train noted that Ewbank's "patent pressed nail is much used and well liked". The nail did well in the city and Gold Rush areas until around 1870 when Ewbank's nails were superseded by the wire nail. The Ewbank's patent nail was made in all sizes but retaining the same shape and features no matter how large or small; they were available in sizes suitable for shingling, batten work and for house frames to the size of large spikes. Shortages of Ewbank's nails were sometimes reported in newspapers of the 1850s.

The 1850s saw the most diverse importations which is reflected in the construction of the buildings of the time: quite often handwrought nails and brads were used alongside Ewbank's and other patent nails. Mayes' handbook for 1859 lists both wrought nails (three, four, eight, ten and twenty penny sizes) and "Ewbank's Patent American and English cut nails". Mayes' edition for 1862 lists only "American cut nails", "American finishing nails" and "Ewbank's Patent nails". The former were available in sizes, one to three inches; and Ewbank's in 17 sizes and weights from one to six inches. By 1877 Ewbank's patent nails were still available but wire nails had taken over as the most popular nail. Later editions mention Ewbank's but these were very large spikes which were still in use during World War II.

It seems that not only were hand wrought nails being imported during the early-mid 1850s but they were also being made locally. Ford's Sydney Directory of 1851 lists, "Armstrong and Co. - ironmongers and nail manufacturers, Clarence street south and Market street". The Shipping Gazette and Sydney General Trade List of the early 1850s often lists the importation of nails and rod iron.
The next great revolution in nail types occurred during the 1850s and 1860s and this was the introduction of the wire nail. The first lot arrived in Sydney, probably in December 1853: this was heralded on 1st January 1854 as coming from England. There must have been a prejudice against them as they are rarely listed until the 1860s and 1870s. One of the earliest promotions of the wire nail appears in Sands Directory of 1863 where Richard Reilly advertised, "French wire nails of all sizes". As discussed earlier, Britain produced wire nails mainly for export, so the earliest wire nails came from Britain (94% between 1870 and 1890). By the 1880s wire nails were imported from Britain, Germany, Belgium and the U.S.A. (the latter gaining ground from 1905). By the 1890s, Sydney and Melbourne added to the complex picture by also producing nails. As no illustrations have come to light of the various makes of nails, one must use purely archaeological methods in order to set up a dating system.

During the 1870s a steel wire nail was being produced in the U.S.A. The first of such nails were imported around 1874 but because of the high price, they were not a market success. By 1886, machinery and steel production had become so economical that they were being produced at a slightly cheaper cost than the common iron ones. The finishing and floor brads imported from the U.S.A. were recommended, as they required no boring. By the early 1890s the steel nail had just about superseded the iron nail and could be produced at a lesser gauge than the previous types. It had been predicted in the U.S.A. that the steel nail would completely supersede the iron nail, which statement proved true for the U.S.A. and also the Australian colonies.

Local Production of Wire Nails

There is no doubt that Melbourne led in the nail making industry of Australia from the late 1880s to very recent times. These nails found themselves on the Sydney market as well as elsewhere. Very little is known of the genesis of the Sydney industry of the 1880s and 1890s. At the turn of the century there were two companies in Sydney listed under "Nail and Washer Manufacturers" in Sands Directory. Based on several directories, the following companies produced nails:

- Abbotsford Manufacturing Company, Abbotsford Factory, Five Dock, ca.1910-1932
- Acme Nail Factory, P. Price and Company, early 1920s (See Excelsior Nail Company)
- Austral Nail Company (Newcastle), 1920
- Australian Wire Industries Pty Ltd (Subsidiary of BHP and representing Rylands and Lysaght), 1958-1980
- Australian Wire Mills Pty Ltd, 368 Prince's Highway, St Peters, ca.1936-1952.
Evenden Anchor Nail Pty Ltd, ca.1914.
Excelsior Nail Manufacturing Company (Taylor and Price), 12 Kensington street, Sydney, ca.1914-1919.
Hercules Manufacturing Company, Grafton street, Blackfriars, ca.1912-1919.
McLean Brothers and Rigg Ltd, 512 George street, late 1890s-1902.
Millar, R.H. and Company, May street, ca.1923.
Sidney Cooke Pty Ltd, ca.1952-1965, see United Nail and Wire Netting Company Ltd.
Western Barbed Wire and Nail Ltd, Annandale, ca.1937-1965.

The chief production was taken over by BHP, for example, Rylands was taken over in 1925. Just about the only detailed illustration of Australian nails was published in 1930, otherwise we have little knowledge of the types of nails produced by the above companies. Once again we must rely on a purely archaeological approach, for example, common nails after World War II tend to be jolt headed and before that from about World War I with rhomboidal heads, as illustrated in the 1930 BHP publication.

Nail Forms and Functions

The chief authorities on the names, forms and functions of nails available are Rees, Hebert and Bevan, although in some cases these authorities are not always entirely clear on either form or function, probably because it was assumed as "common knowledge". The diversity of wire nail types is a very late development and only the common pre World War II types are listed, although the later types are illustrated.

Many of the nails included in the list are not strictly building construction nails but as some specialist nails have been found in building construction, the list has been made as comprehensive as possible. Scarcity of nails often resulted in the use of nails for other specialist purposes, for example, ships' nails for metal sheathing in buildings or tacks for lathing nails. In workshops and sheds etc., nails for specialist purposes were often appropriated as hanging pegs or hammered into benches and walls for unknown purposes, for example, horseshoe nails, spikes, tacks etc. With an understanding of basic nail form and function, more may in future be recognized in
above and below ground archaeological contexts and may lead to further archival discoveries.

149. Wrought and wire nails. (P.N. Hasluck, The Handyman's Enquire Within, Cassell and Co. Ltd., 1910, plate 5.)
## Nail Forms and Function

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<td>100</td>
</tr>
</tbody>
</table>

Source:
a Knight, op. cit., p.1501.  
b Stickles, op. cit., p.69. He uses wire nails to illustrate his system. Note error in text, 1/8 inch nail is said to be 4 penny.  
d Knight, op. cit., p.1502.  
e American Encyclopaedia, 1939, p.683.  
f Ibid. According to gauge.  
g See, Hardware Catalogue (USA) 1908. Wire nails, 2, 3, 4, 6, 8, 10, 12, 16, 20, 30 and 40 penny, p.480. Tiernan Nails Co.  
h See, Iron Nails (USA) 1862. Nail sample catalogue (ca.1862).  

150. Cover of Royal Engineers' Recommended Nail List.

151-162. The following illustrations were taken from the Association for Preservation Archaeology Bulletin, Vol.VIII, No.3, 1976, p.9ff. The labels were added to the illustrations for convenient reference. Some faded areas have been enhanced.
Glossary of Nail Types and Terminology

Annealed: These nails had been doused with water when red hot, usually cast or cut nails. Another method was to put the nails with tallow or grease and heated in a fire shovel. The ordinary method was sometimes repeated several times. A later method involved placing the nails in a closed iron box filled with haematite iron ore. Annealing removed the brittleness from nails and was especially needed when used for clenching.

Back: Back nails had flat shanks and were used in timber which might split. These were probably superseded by cut nails which had similar shanks.

Barge: This was a nail similar to the back nail having a broad and flat shank and a chisel point. (Usual range, 2-4 inches in length.)

Bastard: This is an adjectival description indicating thickness as in "Fine, Bastard, Strong". This seems to be a medium to medium thick nail or equivalent to "Best Best" in Bevan's system of "Fine, Best, Best Best, and weighty".

Bellows: This was a large flat rose headed nail used in the leatherwork on blacksmiths' bellows.

Best: a distinguishing quality for a medium sized nail. See Bastard.

Best Best: A distinguishing quality for a nail somewhere between a Best and Weighty, or Strong, nail. See Bastard.

Billed Head: This refers to a type of head on a wrought or cut brad. The bill head is commonly referred to as a "dog head", as in dog headed spike for railway nails, but formerly was known as a lip, leaf or spur. A billed head was also known as a half-head and those with two such projections were known as two-billed.

Black: As in black tack etc. The blacking was achieved by a process where a tack or nail was immersed in black varnish and then dried in a stove.

Blue: A general species of tack one of which was known as a Blue Bell tack, the blue referring to the colour of the tack (which is a common colour in tacks generally). The colour was the result of placing cut tacks in an iron cylinder and subjecting them to the heat of a muffle. When the desired shade was attained they were removed from the cylinder and cooled.

Blue Bell Tacks: This was a popular British tack which appeared by at least 1910. The 'Bell' probably refers to a patent.

Boat: Boat nails were generally of brass or copper and were both square and round shafted but commonly with flat countersunk heads. See Copper, Brass and Ships.

Bothom, or Bottom: See Back.

Bove: See Rove.

Box: These were a clasp headed nail used in constructing boxes. These were probably superseded by cut nails and the early wire nails.

Brad: This was a class of nails without a head or had a billed or spurred head. This was a large class of nails of various thicknesses depending on the strength of the intended work. Lengths generally varied between a quarter of an inch to three inches. The earlier brads were hand wrought but were one of the first types of nails to be machine made, hence cut brads. There were many specialist names, chair brads, flooring brads, fine cabinet brads, joiners brads etc.
Brass: Boat and ship nails were made out of brass or copper but they were also made for nailing sheeting. These were generally cast nails with flat countersunk heads and with round or square sectioned shanks. Bright: This adjective referred to the surface of a nail and was more commonly used in connection with steel wire nails which could also be described as "polished".

Bullein, or Bullen: This was an upholsterer's nail with a round, or cupped, head, a short shank and was tinned and lacquered.

Cast: Cast nails refer to nails for which metal was melted and cast into forms. The metals used were chiefly iron, brass and copper (and copper alloys). Iron nails needed to be annealed to remove brittleness. Iron cast nails were chiefly used for lath and plaster work and horticultural purposes (training fruit trees to grow against garden walls, hence wall nails), and for heavy shoes and boots (sparrow bills). Those made of brass and copper were used for nailing sheeting and in boat and ship building.

Chequered Head: This is seen on some wire nail clout head nails where the upper surface has a raised lozenge pattern.

Chest: These nails were rose headed and generally wrought. The "large" size was considered to be 2-1/8 inches and the "small" 2 inches.

Chisel Point: This describes the point of a nail where the shank tapers to a point on two opposite sides and a flat on the other sides (where the shank does not taper). The most common types of nails with chisel points were cut nails and patent nails such as Ewbank's patent. Before the general introduction of cut nails, chisel points were sometimes made on wrought nails. Chisel points are not synonymous with flat points, though they share similarities.

Clamp: A large type of nail used to fasten clamps in buildings but also used for securing clamps to the ribs of ships.

Clasp: These nails had sloping flattened heads, or spurs, on opposite sides. The head clasped or stuck into timber and allowed a plane to go over it for a smooth surface. The most common sizes used in building were 10 penny, 20 penny and 24 penny. The nail was hand wrought and usually came in three thicknesses, fine, bastard and strong. These nails are often found in fine work such as moulded architraving etc.

Clench: This type of nail was used chiefly in boat building where the end of the nail, the point of which projected out of the wood, was battered down with a hammer. In this way the planks etc. of boats were firmly drawn together. These nails were sometimes used for picket fencing and for packing cases and boxes. Iron nails were mostly hand wrought, or if cut had to be well annealed to stop them from breaking in half when hammered. These nails had rose heads and square points but for fine work had clasp heads. The most common brass or copper variety had a square sectioned shank and a flat countersunk head.

Clout: This type of nail was used for nailing iron work or metal sheeting, leather etc. to timber. Rees describes them 'for nailing on clouts to axle trees'. They were extensively used by smiths and wheelwrights but smaller cut varieties were used in box making and nailing up laths, shinglets, pickets etc. Clout nails had flat circular heads and for some uses were countersunk (smith's work). They generally had sharp points though for some work had chisel points. They are known with both square and round sections and were available in three thicknesses, fine, bastard and strong. The nails were available in numerous sizes, starting at 7/8 of an inch.

Clout Tack: A nail-like tack like in form, larger in the head, longer and thicker in shank, similar to a Flemish tack.

Illustration 151
Coopers' Clout: A specialist nail ranking in size from 1 of an inch to 5 inches. See Clout.

Copper and Copper/Tin Alloy: This was used extensively by shipbuilders and specified by the British navy. See Boat and Ships' Nails.

Countersunk: This applied to a broad range of clout and wire nails. It was a nail with a conical head similar to the head of a common screw. See Clout.

Copper: Referring to a round headed nail.

Cut: A type of nail which was cut, or stamped, from a strip of metal. These nails had shanks of which two opposite sides tapered to a point and two sides which remained parallel along the whole length, hence were chisel pointed. They had rectangular, or "square", sections along the shank. Cut brads generally ended in a square point.

Deck: These were wrought nails with diamond, clasp or neat square die headed heads so that they could be nailed flush with the deck planks. They were used for nailing deck planks on ships. See Boat and Ships' Nails.

Diamond: Referring to the shape of the head of a wrought nail. This nail generally had six facets instead of the four seen in rose headed nails. This type of head was a common form used for dog nails (and was an optional variety of deck nails).

Die: A die-headed nail was a hand wrought nail where the head was formed by a hammer with a die in its face. The term seems to have been dropped with the advent of machine made nails with heads. The most common forms were cupped heads and square bevelled heads. They were in the early nineteenth century used for spikes, dog and deck nails. See Boat and Ships' Nails.

Dog: These served the same function as clout nails in smiths' and wheelwrights' work, mainly for nailing iron to wood where the heads were not required to lie flush with the work. The shanks were square or of round section and generally had spear points which allowed them to pierce well and were often clenched. The heads were often diamond or die headed. Dog nails for special purposes sometimes had a chisel point or a countersunk clout head. They were available in thicknesses known as 'fine, strong and weighty' and lengths varied from 1 to 5 inches.

Doubling: A doubling nail was used in securing sheathing and linings.

Drawing: A nail with a rose head and of hand wrought manufacture. The drawing nail illustrated in the Royal Engineers' Office (REO) List, 1812, was 3 inches long. The function is unclear.

Escutcheon pins: A variety of nails of small size, 3/8 of an inch to 1 inches. These were one of the first wire nail types to be manufactured in the U.S.A.

Essex Hurdle: See Hurdle.

Ewbank's: A patent English cut/wrought nail with a knob-like flat rose head and chisel point. This was one of the most popular machine nail to be exported to Australia during the 1840s to 1860s.

Facet: Refers to the plains, or facets, on a nail head or point.

Fencing: Fencing nails were popularly used in America for use in fastening fence palings. Wrought nails of the 6 penny to 10 penny size were adapted for this purpose by increasing the weight by almost 100 per cent. These nails generally were clout headed.

Filling: Filling nails were very bulky nails with thick flat, or clout, heads and a stumpy tapered point.

Fine: This term is used as a distinguishing indicator as to thickness, as in Fine, Bastard and Strong or Fine, Best, Best, Best, and Weighty. In earlier days a fine nail may have been described as 'fine drawn'. A fine nail was generally a slender long nail used in detail or finishing work.

Flat Head: A term which referred to the head of a nail which was either a clout nail or a countersunk clout. In the U.S.A it might have had a more specialist meaning as Knight describes it as being a small sharp-pointed wrought nail with a flat thin head, rounded body and being larger than a tack.
Flat Point: This was a point resembling a chisel point formed into a spoon bill as seen in some bird species. It is not a synonym for a chisel point. The nail was driven into timber with the edge across the grain to prevent splitting. Rees distinguished two types not mentioned by later writers; a "long" flat point used in shipping where clenching was not necessary but where the firm holding of timbers was required; and "short" flat points which were fortified with points to drive into oak and hardwoods in general.540

Flats: These were squat wrought nails, described with broad or round rose heads and spear points.541

Flemish Tacks: These tacks ranged from 3/4 of an inch and were denominated from 1 to 16 (penny) per thousand. The name is due to the fact that they were "flemished", that is, the heads were not raised to quite the height of a rose nail, nor so flat as a clout head. The tacks would have appeared similar to rose tacks.542 These tacks were later cut.543

Flooring Brad: These nails were originally forged and given a single spurred head. When cut from a sheet they were either headless or cut with a spur. The former type was often headed separately. With the advent of the wire nail, nails with a slightly bulbous countersunk heads (polf head) succeeded as "flooring brads".544

Forged: This term is used synonymously with wrought, or hand wrought. Though by usage "forged" is the most unambiguous form because it is never coupled with "machine" as wrought is (as in "machine wrought"). Forged nails were made entirely by hand, as described in the text, except for the raw material (iron rods). The shanks generally were made to taper on all four sides unless a chisel point was required. The most common types of heads found are rose, spurred and clasp. See text on hand wrought nails.

French: The term French nail is synonymous with wire nail. Other names used for the wire nail were "Point de Paris", "Point de Paris", "Pointes de Paris" and "Chocs de Paris". In Germany they were known as "drahtstift". The term "wire nail" is preferred as it is easily understood and there is some doubt as to whether the wire nail was first developed in France. They were known as "French nails" during the mid to late nineteenth century because the French exported them in considerable numbers. See Wire nail.

Garden Wall: See Wall nail.

Gate: The gate nail was similar to a hurdle or Kent-hurdle nail but were made stouter for the purpose of hanging gates. They were always forged.545

Gimp: This was a small forged nail with a rounded head, used by upholsterers. By at least 1910 they were available in brass in sizes of between 3/8 to 3/4 of an inch long.546

Half Head: See Spur.

Head: This is the swelling on the top and of a nail and come in scores of forms according to function.

Hinge: In America these were available in both cut and wrought for hinges. The English equivalent was the gate nail.547

Hobs: Probably the same as "hobnail", used for the heavy shoe trade (boots etc.).548

Hob Nail: This was a short thick nail with a pointed tang, a large head with pendent claws which pierced the sole.549

Horse Nail: Used in Rees to indicate a cut nail which is given a die head in shape of a rose head. Though may have been wrought in earlier years and appears to have meant "horseshoe" nail. These were sent out to New South Wales arriving on the 16th October 1802 by the Buffalo. Tomlinson and Hebert make it plain that horseshoe nail was meant.550

Horseshoe: Horseshoe nails were a class of nails which defied mechanization throughout the nineteenth century. It was a forged nail of the best quality refined, tough, iron, to later writers; a "long" flat point used in shipping where clenching was not necessary but where the firm holding of timbers was required; and "short" flat points which were fortified with points to drive into oak and hardwoods in general.540

Illustration 153
nearly disused”. Hebert seems to suggest that countersunk heads were a fairly recent departure (ca.1835/1836).5

The U.S.A. shared the penny system, or a variation of it. Knight records a system of sizes/lengths by numbers which may also have been used in Britain:52

<table>
<thead>
<tr>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5</td>
<td>1-1/2 inches</td>
</tr>
<tr>
<td>#6</td>
<td>1-5/8</td>
</tr>
<tr>
<td>#8</td>
<td>2 inches</td>
</tr>
</tbody>
</table>

Hurdle: Hurdle nails were for nailing the oak bars of a hurdle (rectangular framed temporary fence) onto its frame. Hurdle nails, especially the Kent-hurdle, were spear pointed. The heads were broad thin rose heads and the shank was flattish. The iron had to be tough so that the heads would not break off and the points could be clenched. This was a hand forged nail with several minor varieties such as Kent hurdle and Essex hurdle.553

Jobent: This was a nail for fastening hinges to doors. See Dog.

Joiner’s Brad: This was similar to a cut floor brad with a spurred head, only much thinner.554

Kent Hurdle: See Hurdle.

Knee: Knee nails were long slender rose headed nails of spike or near spike lengths (4 to 6 inches).555

Lathing: These were small nails for lath and plaster work. They were hand forged, cast and later made of wire. The nails were generally fine pointed with rose or crudely flattened heads.556

Lead: Lead nails were used to nail lead, leather and canvas to hardwood. These were clout headed nails dipped in lead or solder.557 Knight (1876) described them as round headed (clout), copper alloy nails used for nailing lead sheeting to roofs.558

Leaf: Refers to the single spurred head of a wrought or cut brad. See Billed.

Lip: A synonym for bill, leaf, half head, spur etc.

Mop: A die headed wrought nail with a chisel point. Hebert merely states that the name expresses the type but the function is not clear.559

Nichol’s: The Nichol’s nail was a patent (USA, 1873) nail. It was described as a strong, light nail formed from sheetmetal with or without a head. It was stiffened by longitudinal corrugations along the shank.560

Oval: This describes the shank and head of some types of wire nails. These were manufactured by at least 1910.561

Panel Pins: These were very slender nails used in panel mouldings, small frames etc. The earlier varieties were hand wrought and cut. They were available in wire and had slight heads of the jolt variety.562

Pail: Pail nails are mentioned in Hebert as being a nail where the name expresses the type. No further explanation can be found.563 Probably flat headed nails for securing palings.

Patten Cut Tack: This is a patent cut tack available in lengths between 3/4 of an inch and 1 inches.564

Penny System: The penny system was used by retailers as a system of describing nail lengths. The system was in use by at least the early sixteenth century.565 With variations the system was extensively used in Britain, the U.S.A., Canada, Australia etc. References to the system can be found dating to the foundation of the colony of New South Wales and was extensively used when ordering or selling nails by government departments and the private sector. Nails were also sold by the weight system (See Weight system).
As admitted as early as the mid 1830s the penny system was "very undefined as respects the kind, as well as the precise size, these varying with the locality wherein they are sold. Although scores of references may be found in which the system is used, very few references actually explain the system. Published lists are mostly American in origin but a comparison of lists, none of which are identical in their information, may give some idea of the system as used in Australia. Knight believed that the English system of defining nail sizes was by numbering according to pounds per 1,000 nails, but even in the 1870s both systems were used but the penny system was in decline.

Hanlock believed that the term "penny" was actually a corruption of the word "pound". He believed, for example, that formerly, nails of which 1,000 weighed 6lb would be called '6 pound'. "Penny" was a mere corruption of "pound", and therefore "sixpenny" nails were those of which 1,000 weigh 6lb. A practical application of this to the system described does not seem to support this unless one makes every concession as to the weight of each category of nail.

The greatest variation of sizes in the comparison of the penny system occurs between the Van Cleve and the American sources. Knight's version shows that variation can occur according to weight, depending on weight or gauge (fencing nails are stouter than common nails and also in length) (Note that 3 penny nails can be either 1 or 1 inches).

It should be remembered that Knight's and Van Cleve's lists refer to cut or machine wrought nails and the remaining ones to wire nails. Two sizes, among others, are often quoted between 1800 and the 1820s as common in building, namely 18 and 24 penny, are not mentioned in any of the lists.

Pin: See Spriggs

Point: This is the point of the nail which entered the timber first. There are several basic types of points, see Sharp, Side, Spear, Flat, Chisel.

Pound Nails: These resembled rose headed nails with sharp points but had well defined and solid heads. They were used extensively in Essex, Suffolk and Norfolk for "course, strong work" such as field fencing using oak.

Pressed: The term pressed nails was sometimes used as a synonym for cut nails. It is a little ambiguous as it could refer to nails pressed between rollers with dies.

Ribomboid: A description of a raised rose head on a wire nail.

Rib: Used to explain the rib-like marks on wire nails left by the dies gripping the shank for heading and pointing.

Ribbing: Ribbing nails were used to fasten ribbing, to keep the ribs of ships in place during construction.

Ring Shanked: A term referring to the shank of a wire nail with a continuous series of rings along the shaft to the point, resembling barbs.

Rivet: This is a nail usually used in binding metal together. They generally have clout heads and truncated shanks without points.

Rose: This strictly refers to the shape of the head of a nail which is like a flattened pyramid with only four facets. The facets were formed by a hammer and later a die. Rose nails were once the most common of nails used in building. Rose nails could have chisel, flat and sharp points and could be had in fine, bastard and strong. Rose nails were used for coarse building work including fencing and coopering. A rose-sharp (pointed) was used for the latter two purposes but also for hardwoods such as the European oak and beech. The broad spreading head had the advantage of securely holding the work down. A thinner sort of rose-sharp was used for pine and other soft woods. Large quantities were exported from Britain to Canada by the mid 1830s. A rose-flat (pointed) was used if the timber was liable to split, the flat points were driven with their edges across the grain. Smaller varieties were used for shingling and even tacks (flemish tacks).

Although Rees describes rose headed nails as being "drawn four square in the shank" and they were also manufactured by the cut and machine wrought methods, they were later manufactured...
Royal Engineers

List of Nails and Spikes

1812

Illustration 156
G

N° | Spikes Die-headed | 14 Inches
---|------------------|-------------
100 |                  |             
101 | d°               | 12 Inches   
102 | d°               | 11 Inches   

Illustration 157
<table>
<thead>
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<th>No.</th>
<th>Spikes Die-headed</th>
<th>Length</th>
</tr>
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<tbody>
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<td></td>
<td>10 ½</td>
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<tr>
<td>104</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

Illustration 158
by the wire method and enjoyed a popularity from the 1860s to the 1880s until a rhomboidal head became more popular for general purposes.  

Rose Canada: These nails could be had in 'fine' or 'strong' by the 1870s and were cut nails. The appellation "Canada" is probably due to the popularity of their hand wrought counterparts which were exported to Canada earlier last century.

Rose Tacks: See Flemish tacks.

Rother: Rother nails were used to fasten rother-irons to ships.

Rough: Usually a description of the surface of a nail, usually a cast nail (rough as opposed to smooth or bright).

Round Head: This was a term used for a die headed nail in the shape of a segment. One early variety was tinned.

Rove: A rove is not a nail but sometimes accompanies a clenched nail. It was a lozenge shaped plate with a central hole. The point end of the nail received the rove and the point was clenched over it. Roves are more commonly associated with ship and boat building. A rove was sometimes referred to as a bove.

Sacking: Sacking nails were cut nails in a small variety of between 3/8 to 5/8 of an inch and a larger variety between 3/4 of an inch and 1/4 inches. The nails had a large flat head, and must have been similar to the sacking tack. The smaller variety may have been known as a 'sacking tack'.

Sacking Tack: This was tack-like in form but had a larger head and longer and thicker shank.

Saddlers' Tack: Saddlers tacks were similar if not identical to sacking tacks.

Scarf: Scarf nails appear to have had spear points and proportionally small rose heads. They were available in "fine" and "stout". These nails appear to have been used for securing scarfed joints.

Screw: This refers to the twist like shank seen on some ships' nails and wire nails. Two patents were taken out for square shafted "torsion nails" about 1821.

Scupper: Scupper nails had very broad flattish rose, or perhaps plain flat, heads. The shank tapered to a point. The nail was mainly used for fastening leather and canvas to timber, they were also used for fastening down lead linings. They continued to be hand forged into the 1870s.

Shaft: A synonym to describe the shank of a nail.

Shank: This comprises the main body of a nail apart from the head or point of a nail.

Sharp Point: This name applies to the point of a nail where the nail terminated gradually, tapering to a fine point. See spear point.

Sheathing: Sheathing nails were used to nail sheathing boards to ships. The rule for the length was to have them fully three times as long as the boards were thick. They were stout flat pointed nails with clasp heads.

Shingle: Shingle nails were used to fasten timber shingles to the shingle battens. They took a variety of forms. The earliest were forged with flat or rose heads. Similar nails were produced by the cut method. Wire shingle nails are usually clout headed. Usually 1 to 2 inches.

Ships': These were particularly formed nails for rudders, ribs and various other parts of ships. Brass, copper and copper/tin alloys were used for ships, boats and barges. Cast nails of a copper and tin alloy were used for securing copper sheathing in ships although pure copper nails were also used but they were more expensive. Countersunk clout like nails with short shanks were used for sheathing and improvements were made by patents such as Guppy's patent. The most common copper type of ships' nails were of the rose-clench variety, similar to the regular iron article, only these were made of square sectioned copper and processed in the traditional way. The nails were worked cold. An average length was 2 inches, heading tools could form not only rose heads but
diamond and clout as well. Most of these longer shanked nails had a slight countersink under the head. Most of these nails have changed but slightly over the years. For specialist nails: see Boat, Brass, Copper, Deck, Ribbing, Rother and Rove.

Shoe Tack: These by the 1870s were cut and in varieties of size between 3/8 of an inch and 1 inches.

Slating: Slating nails progressed from being hand forged to cut/wrought and eventually was manufactured from wire. Slating nails always had broad heads of the clout variety to hold down the slate.

Side Pointed: This type of point is similar to the obtuse cut on a quill.

Slice Cut Pointed: See Side Pointed.

Slute Tack: This was nail, tack like in form, with a broad flat head and long and thick shank.

Smooth: The term refers to the surface of a nail as opposed to rough. Smooth surfaces, especially to the head, were important in the sheathing of shipping as rough heads tended to attract marine growth.

Sparrable: These were small wedge shaped cast nails resembling the beak of a sparrow, hence sparrow bill, from which “sparrable” is derived. Because they were cast in the crudest manner, the nails were very brittle. Sparrables were used in the heavy shoe trade (boots etc.), and common forms of shoes. A variety shown in Bevan shows a sort of a pump handle shaped head. See Sprig.

Sparrable: See Sparrable.

Spear Point: a spear point slopes suddenly from the shank of a nail to a point and is flattened on two sides (of a wrought nail). Often the shank sides flare out a little before sloping down to a point, giving a distinct spear blade impression.

Spike: This was an order of large nails, originally hand wrought and generally with flat or chisel heads. The Royal Engineers' List of 1812 show all of the spikes with square bevelled die heads but this may have been the exception rather than the rule for that early period. Spikes generally ranged between 4 and 12 inches in length. Later spike nails were made by the machine processes, including wire.

Sprig: Sprigs were slender wedge shaped cut nails, or brads, and were often classified as "pins". Sprigs served a great variety of purposes, thus there were glaziers' sprigs, sash sprigs, shoemakers' sprigs and even highly specialist types such as "best fine pointed for Canister Shot Case" sprigs.

Spurred Head: This is one of the names referring to a cut nail with a single side projecting head. See Billed Head.

Square Point: This is of a similar shape as a sharp point only the point itself is missing and it ends in a square shape.

Staples: See 'U' nail.

Stereo Pin: Stereo pins are listed in Hasluck (1910) and were thinner than panel pins and ranged between an inch and 2 inches. The function of these wire nails is not clear.

Studs: These are basically round die headed tacks used in studding leather etc. onto timber in furniture, chests etc. These were quite often used ornamentally from the earliest times onwards, most commonly of brass.

Strong: A distinguishing quality of a nail denoting a heavy duty nail rather than a fine or bastard nail, as in "fine, bastard and strong". "Weighty" is an indication of the thickness of a nail.

'T' Head: A synonym for double billed or double spurred. In some very early references it may refer to a clasp head.
Tack: Tacks are one of the smallest orders of nails. The most common variety have flat, or clout, heads and sharp tapering shanks and points. The Royal Engineers Office list of 1812 illustrated several types, though most were clout headed, some are shown as round die headed and with clamp heads. Rees listed the basic sizes, the smallest for fastening paper to wood, "nailing" were used for "wool-cards" and oars; and the larger size for upholstering and pumps. There were many varieties of tacks, see Black tack, Blue Bell tack, Clout tack, Flemish tack, and Tray tack, others were known by their distinctive features such as flat tacks, round tacks, rose tacks, "T" headed tacks, white tacks. Tacks were also sold by a penny system, 2-4 penny.

Tenter Hooks: These were nails with extremely long single spurred heads. They were used by dyers "formerly" (1874) to dry the cloth dyed by them.

Tingle: Tingle nails were described as a small nail of an inch or longer.

Tinned: Some nails required to be tinned to reduce the corrosion, especially when in contact with other metals. Nails were immersed in a liquid solution of tin after a cleaning; of sulphuric acid diluted in water. A nail or tack which has been tinned may also be referred to as "white."

Torsioned Shank: See Screw.

Tray Tack: This tack was described as tack like in form but larger in the head and longer and thicker in the shank.

Tree Nail: This appears to have been a huge spike-like bolt of wood. One was specified as being 1½ inches in diameter.

Trunk: Trunk nails were illustrated in the Royal Engineers Office List. They had a rose head and a flat point.

Two Billed: See Billed.

‘U’ Nails: These are more often referred to as staples in technical literature. The most common form has one sharp point and one "side", or slice, point. Without points, they are known as "dropper" staples. ‘U’ Nails are wire nails, usually galvanized, of comparatively recent origin.

Wall Nail: These were large sized cast nails used in walls in order to train fruit trees to grow against the wall.

Weight System: This system was an alternative system to the penny system of indicating lineal measurement. The length was understood by the number of pounds or ounces per one thousand nails; for example, a 7½ rosne nail was ½ inches long, was rose headed and pointed, and weighed about 7½ per one thousand nails. Nails on a larger scale were also sold by the hundredweight and ton. In the early 1870s, 2½ inch cut nails sold for £23/10/- per ton, wrought nails for 126 and machine wrought for £33/4/.

Nails were also sold per 1,000. The 1,000 was largely fictional. In Rees' time one received about 600 nails when buying "1,000" nails; in Bevan's time it was between 750 and 1,000. This system was really based on the weight system unless the 1,000 was sold "by tale", then one would expect the full, or true, number.

Weighty: Distinguishing quality as to the thickness of a nail, synonymous with the term "strong."

Wheelwrights: These were forged nails made of especially refined metal to produce a "tough" nail. Wheelwrights' nails were used to secure the iron tyres on wheels.

White: See Tinned.

Wire Nails: These were formed out of iron or steel wire. The most common types were rose, clout, rhomboidal and jolt headed. Most of the specialist nail names were discontinued as wire nails were found to suffice for most work. Many specialist wire nails were developed, especially in the U.S.A. Sickels illustrated many of these.

Wrought: See Forged.
2. Ibid., p. Nai (1). By Rees' time, it was done by rolling as this was the cheapest method.
3. Ibid., pp. Rolling-Mill (2-3).
4. Ibid., p. Nai (1).
6. Ibid., p.31.
7. Ibid. Some of Foley's descendants continued in the industry.
9. Ibid.
10. Ibid., pp.1505 and 1508.
11. Rees, op.cit., Rolling-Mill (3). Rolling and slitting mills also for iron hoop tyres, sheet iron and sheet copper, see Nai (2).
12. Ibid., Roll (2).
13. Ibid., Rolling-Mill (5).
14. Ibid., Nai (1). It was a process which converted cast iron into a malleable state to decarbonize it. It then had to be rolled (or hammered) at welding heat to reduce the grainy nature of the metal.
See Rolling-Mill (5).
15. Ibid., Rolling-Mill (2 and 3).
17. Rees, op.cit., Nai (1). As Lardner illustrates, (D. Lardner, Cabinet Cyclopaedia, 1831, pp.192 and 193), women were completely integrated into every aspect of this trade, as well as children (both boys and girls). Accounts of this unusual departure in a trade date back from the reign of Queen Anne.
18. This term was used for the nail maker. It was written as 'nailor' or 'nailer'. The spelling 'nailor' is preferred and used throughout the text. Either spelling was used for those who hammered nails professionally as well.
20. Ibid., p.33.
21. Ibid., p.35.
23. Bevan, op.cit., p.32.
24. These structures were called; workshops, worksheds, shoproom, forges and little smithies.
25. Bevan, op.cit., p.32.
26. Ibid., p.35.
27. Patent forges, which were more economical in fuel and more convenient to use, were being promoted from the 1820s.
30. Ibid., pp.194 and 197.
32. Lardner, op.cit., p.194.
33. The word 'slack' was used.
34. Lardner, op.cit., p.194 and Hebert, op.cit., p.180.
36. It is not really clear if the stop or check was adjustable. See Rees, op.cit., p. Nails (1) and C. Tomlinson, Cyclopaedia of Useful Arts, ca.1852, London, p.309.
37. Rees, op.cit., p. Nails (1) and Hebert, op.cit., p.180. Later descriptions: 'nearly' cut off the nail at this stage and snap it off after placing it in the swage. In actual fact it is not certain if the one technique is earlier than the other. Rees' description has it severed at the hack-iron; Hebert has it 'nearly' cut off. The 'nearly' method saves the use of tweezers, loss of heat and must have been a quicker method.
39. Lardner, op.cit., p.195. The 'drawing out' would have given the nail a taper which must have been taken into account when the rod was at the stop and hack iron.
40. Lardner (p.193) called it a 'bore'; Tomlinson (p.309) called it a 'bore, or strong piece of iron' and (p.305) a 'swage tool'; Rees (p. Nai [1]) referred to it as an 'iron tool' and 'mould'; Hebert (p.180) had 'heading tool'; and Bevan (p.33) called it a 'bolster'. As 'swage' describes what it actually does to the nail, I have adopted it for the text.
41. Lardner, op.cit., p.195.

Notes - Chapter Three

5. Various Belgian nails and tacks (Gesart and Beate, Les Industries a domicile dans Belgique, Belgique, 1900).
Having examined thousands of nineteenth century nails, I have seen no evidence of this countersinking which surely must be evident on the underside of the nail head.

Considering such factors as: the number of hours worked per day; nail types being produced; quality of nail rod, etc.

The nails were found to be useless. See Richie, *Evidence of Druitt*, 02:11:1819, pp.24 and 25.

Lardner, op.cit., pp.193 and 194. The 17:07:1790 roller invention appears to have been put into practice in 1792 according to *Artizan* 01:10:1860, p.282. Knight after discussing the Clifford patents of 1790 adds, after discussing the 04:12:1790 patent "machines of this kind were in operation at French's factory, Winburne, Staffordshire, England, in 1792", suggesting, only by the context of this statement, that the machines were based on his second invention. The important factor is that there is no hint of these machines having any consequence after 1792 (E.H. Knight, *American Mechanical Dictionary*, 1875 [U.S.A.], p.1508).


Ibid., see also p.557, "Value of Labour ".

The article on which this information was based appeared in the *Mechanics Magazine* in 1828. The information was highlighted in Lardner (p.196); Hebert (p.181); Bevan (p.32) etc.

The Ledsam and Jones patent. The 1827 date is approximate for it appeared in an article by Barlow "Treatise on Machinery etc." in the *Encyclopaedia Metropolitana*. 

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89. Ibid., p.187.
91. Ibid., p.949. Holtzapatfel obviously checked the records as he quoted the Clifford patents from the Repertory of Patent Inventions, 1st series, vol.vii, pp.217 and 377. Of interest, he names Clifford as John Clifford, whereas most other authors, including Rees (1819), quote Thomas Clifford. It could be that Rees first made the mistake and the other authorities quoted from him.
92. The prospectus for the publication was issued in March 1850 (introduction). This was a traditional means of attracting subscribers to finance the publication. (See C.C. Gillespie, editor, A Diderot Pictorial Encyclopedia of Trades and Industry. Dover, 1959, vol.I, p.XIV.)
93. Direct reference and even illustrative material can be found originating from Rees, Lardner, Hebert and Holtzapatfel.
94. For example, wire nails and machinery were exhibited. See Exhibition of the Works of Industry of all Nations, 1851, "Reports by the Juries". Lond. 1852, pp.427, 1111 and 1116.
95. Tomlinson, op.cit., p.310. The meaning of "flat head" is uncertain in this context which seems to suggest something new. It could refer to clout headed nails but if so, more information would have been expected. The Ewbank's patent had rose heads but were flattened, this was truly a "new" and successful in one operation' patent. If it refers to brads, the description is anachronistic.
96. Ibid., p.307. The brackets were inserted by myself. The passage in brackets was directly quoted from Hebert, op.cit., p.180, minus a comma after "above". The words preceding the unacknowledged quote belong to Tomlinson and his period.
97. Builder, 17:05:1845, p.239. Adding, " and also from a spirit of competition among employers". Which competition would have stemmed from the same cause.
98. Ure, A. A Dictionary of Arts, Manufactures and Mines, 1853 edition, Lond. p.216. The 1860 and 1867 additions are identical in regard to nails except that information on screw patents etc. were removed from the text after the 1853 edition. Miles Lewis informed me that the account is unchanged from the edition of 1839 (pers.comm.).
99. Ibid., p.218.
100. No doubt referring to the hybrid cut/wrought nail machines of the mid nineteenth century. Often the term 'machine-wrought' was used loosely to refer to any nail made by machines.
102. Bevan, op.cit., p.30 (article by W.C. Aitken, 1874).
103. Ibid.
105. ABCN, 03:03:1889, p.227. Assuming that the hand forged article was by then only made in that area.
106. This figure appeared in Hebert, op.cit., p.180 and is quoted by Tomlinson, op.cit., p.307. For 1830, Bevan, op.cit., p.30, lists 50,000 and this figure is quoted by later authorities. It is not clear where Bevan found this figure which appears for the first time in the nail article (dated 1874).
108. Ibid.
109. ABCN, 09:03:1889, p.227. Assuming that the hand forged article was by then only made in that area.
111. Bevan, op.cit., p.37, after listing the advantages of the hand forged nail, writes, ' And these attributes alone will ensure a demand for hand-wrought nails, especially 'Horse', in preference to machine-wrought'.
112. A tapering nail on both sides of the shank usually with a single spurred head, these days referred to as a "dog head". The half head is also referred to in nineteenth century publications as a "projecting leaf" (Rees, op.cit., p. Nail [1]; Hebert, op.cit., p.184, calls them "bills"; Knight, op.cit., p.354, uses "lip", etc.)
114. Ibid., p. Nails (1).
116. Ibid.
118. Knight, op.cit., p.1505. The sheet, however, was specially prepared for the process.
119. Nelson, L.H. Nail Chronology as an aid to dating old buildings. American Association for State and Local History, Technical Leaflet 48 (1968), p.8. He seems to suggest that the changeover began during the 1830s (p.8) and that by the 1840s this process had been fully established (p.6).
Hebert, op.cit., pp.181 and 184. Terminology is often confusing as there was no standardization during the eighteenth and nineteenth centuries. Hebert wrote, "stamped, or pressed", Tomlinson, op.cit., p.309, wrote "by cutting or punching".


Rees, op.cit., p.184.

Rees, op.cit., p. Nails (1). The industry may have started earlier before the "extensive trade". Rees may also have written the account a year or so before publishing in 1819 which would push back the 1803/1804 date.

Ibid., pp. Nails (1 and 2).

Nelson, op.cit., p.5.

Rees, op.cit., p. Nails (1). A wiggling plate cannot produce nails with spurs but the alternately reversing cutter and plate methods can.

Ibid., Nails (2).

Ibid., p. Nai (2). Bevan omits to mention that Dyer's machines were American inventions but Rees makes this clear.

See Rees, op.cit., p. Nai (2); Hebert, op.cit., p.189; Tomlinson, op.cit., p.309; Ure, op.cit., pp.216 and 218; etc.

Knight, op.cit., p.1508. How this information can be substantiated is unknown, as the U.S.A. Patent Office had a fire in 1836 destroying most of their records on nails (see Nelson, op.cit., p.5).

Rees, op.cit., p. Nai (2).

Ure quotes most of the article and takes a liberty by rewording Rees' introductory comment. He credits the information to 'American Journal'.

Ure, op.cit., p.216. Rees actually wrote "it appears that they have invented machines which perform the cutting and heading at one operation" (Nai [2]).


Nelson, op.cit., pp.6 and 7.

Ibid., p.6.


Bevan, op.cit., p.42. Article by Aitken, 1874.

Rees, op.cit., p. Nai (2).


Ibid., pp. 5, 8 and 9.

This explanation is only implied by Nelson, not stated.

Nelson, op.cit., p.8. Nelson was indebted to Donald Streeter, blacksmith and collector, of Iona, New Jersey, for this information. Was it based on practical experience or on the basis of Streeter's collection?

The stationary die, or bed, was given to make the difference but surely, as long as the plate is not flipped over after each stroke, the impression at each stroke should be the same. It could make a difference if the shear blade cut its second stroke on the way up but such a machine was not recorded and in any case would send the nail flying into space on the upstroke and obliterate the lower burr created by the downstroke. Miles Lewis pointed out that Nelson's Fig.6 is correct, if, as he illustrated (not Nelson or myself), there is a gap between the shear blade and the stationary die (pers.comm.).


Mercer's theory was that early cut nails were sheared from opposite sides and later nails were cut from common sides. Nelson's chronology has the earliest nails cut from common sides but if Nelson is correct about the appearance of the shear and burr marks, they would be in agreement.

Rees, as outlined earlier, revealed that both methods were in use by the time of the writing of his article. The overturning plate method may have been introduced with Dyer's machinery in 1814.

Sydney Gazette, 27:10:1809, p.2 "cut brads". Another mention is made referring to the late 1810s. Druitt "believed" those to be cut and cast nails but they were criticised as being "totally useless".


Ure, op.cit., p.216, for example was unaware of the information which Knight later published and relies on Rees' quote of an 1810 American report.

Nelson, op.cit., pp.4 and 5.


Lardner, op.cit., p.197. See Hebert, op.cit., p.181; and Holtzapfel, op.cit., p.949.

Knight, op.cit., p.1508. The plates could have been hoop iron.

See Rees, op.cit., pp. Nails (1 and 2). This was largely due to the fact that most machines before the 1830s were operated by hand power.

Knight, op.cit., p.150.

Ibid. No details are given apart from the fact that it "cut" nails.
Although in this case it could have concerned the cutting of brads with spurs, there are no extant details of the patent.

Despite these separate operations.

Both Rees and Knight, op.cit., p.1508, refer to him as "Odiarne". On p.665, Knight renders his name as "Odion" but refers to an invention of 1816 which was followed by an invention by a Mr Reed (both men from Massachusetts). The section written on p.665 must have been written by another writer. Ure, op.cit., p.218 adopts "Ordione". I have opted for the spelling in Rees' 1810 account.

I am not sure about earlier editions but Ure's 1853 nail machinery data remains employed from 1853 to later additions.

Except for special purposes such as for horseshoe nails.

Flat points are better described as chisel points. (See Rees, op.cit., p. Nai [1]). The taper would have been the same on all four sides, unlike the cut nail.

Ure thought this invention to be "apparently" of American origin. This cannot be correct as the Americans concentrated on the cut process. It only resembled the American process in that the head and shank were made in the "one process", though even in this case Ure reveals that Stoker's machine was actually two machines in one frame.

For a full account read this and the references in footnote 190.


207. Builder, 10:03:1860, p.156.
208. Bevan, op.cit., p.38. The ridge rolled plate idea was reported in 1859.
209. Ibid., p.39.
210. This has been discussed under the section on the handwright process. See Bevan, op.cit., p.35.
211. Knight, op.cit., p.1508.
212. Rees, op.cit., p. Nails (1) and Sydney Gazette 15:07:1804, p.4 and 28:07:1805, p.4. The nails may have been unsaleable and in 1805 offered again.
213. Ibid., 29:10:1809, p.2.
219. Mayes, The Victorian Contractors' and Builders' Price Book, 1859, p.XII. No authority suggests that Ewbank had established a patent in the U.S.A.
220. Mayes, The Australian Builders' Price Book, 1862, p.107 and 1877, p.119. There was also an edition in 1871.
222. Building News and Engineering Journal, 08:10:1869, p.VIII, see also 07:01:1870, p.VII. Note: Miles Lewis reminds one that patents expired "in fourteen years, or twenty-one years if extended", (pers.comm.). A lesson to me that it should not be assumed that everyone knows that patents were arranged in units of seven years.
224. Australian Builders' and Contractors' Price Book, 1908, p.240 and for 1914, p.163. They are offered in "black" or "galvanized".
225. Smith, J.B. Treatment upon Wire, its Manufacture and Uses, 1891, Lond. p.335.
226. Knight, op.cit., p.2787. Smith, op.cit., p.19, mentioned "about 1350" but does not name the location.
227. Rees, op.cit., p. Wire 5. NB. The given pagination here starts with Wire 1 as of Rees' article entitled "Manufacture of Iron Wire".
228. ABCN, 12:01:1888, p.18.
231. Diderot, op.cit., ill. 184. This was part of a series on the manufacture of pins.
233. Ibid., pp. Wire (1 and 2).
239. Ibid., pp. Wire (1 and 2).
240. Ibid., p. Wire (3).
242. Ibid., p. Wire (5).
247. Ibid., and Singer, op.cit., p.164. Cossons believed that the first reversing mill was established at Crewe Locomotive Works in 1866 (p.169).
248. Singer, op.cit., p.622ff for a detailed discussion on the progress of wire making.
249. Ibid., and Singer, op.cit., p.164. Cossons believed that the first reversing mill was established at Crewe Locomotive Works in 1866 (p.169).
251. Ibid., p.622. Though for submerged cables, copper wire was used soon after the 1850-1858 initial period.
253. Rees, op.cit., p. Wire (4). Of course local steel was also used, especially during the period of the French Revolution and Napoleonic Wars.


255. Encyclopaedia Britannica, 1953, vol.17, p.932. By 1845, the Americans had a machine, operated by one girl, which could make 8,000,000 complete pins per day. See Atlas (Sydney) 16:08:1845, p.451.

256. Engineer 17:12:1869, p.405: "throughout civilised Europe, except England, it has very many years ago replaced the wrought and cut nail".

257. A study of European, especially French, German and Belgian, sources should eventually remedy this.

258. Sickels, E.D. 'Nails and Nailmaking - A Short History'. Wire and Wire Products (U.S.A.), March 1972, p.68.


260. Ibid.

261. Bevan, op.cit., p.44. Article written by Aitken.


263. Apart from publications directly generated by the judging of exhibits. It is extremely curious that Tomlinson's work did not mention the new wire nails.


265. Ibid., p.1116.

266. Ibid., p.427. The former appears to have been French, the latter, German. Only one Englishman exhibited, J. Reynolds, "cut nails" (p.1112).

267. Sickel, op.cit., p.68.


270. Sickel, op.cit., p.68. The 1850s inventions were based on European models, in some cases they were imported machines. See Nelson, op.cit., p.9.

271. Ibid.


273. Ibid.

274. W.E. Axon's The Mechanic's Friend, Lond. 1875, p.26, was the first to publish. Axon wrote a few lines comparing French and English nails, the note was based entirely on a letter written by two Germans to the Engineer, 17:12:1869, p.405. The article in Bevan, op.cit., p.44, covers half a small page and though it was written in 1874, was not published until 1878.

275. Bevan, op.cit., p.44.


277. Ibid.


282. Ibid. See plate 5, opposite p.193. About 16 of the 42 nails illustrated were wire nails. For the common nails, 3/4" to 6" equal status appears to be given to the wire and cut types.

283. Engineer, 17:12:1869, p.405.

284. Bevan, op.cit., p.44.

285. Bevan, op.cit., p.44 and Engineer, 17:12:1869, p.405. In the latter publication the writers expressed that they would be willing to supply a drawing of the machine, "but since hundreds are in use during the last forty years, an illustration would cause continental readers to ridicule your valuable publication".

286. Smith, op.cit., p.335 and see figures 31 and 33. All the material on the Bond and Malmedie machines were taken from this reference.

287. Nelson, op.cit., pp.7 and 11. I have noticed this in some Australian nails of the late 1860s and 1870s, but this could also be due to some mis-alignment between the gripper and heading dies.


289. Engineer, 17:12:1869, p.405. The machines could also work up wire off cuts in these factories which would otherwise have to be discarded.

290. Ibid.

291. Bevan, op.cit., p.44.

292. Cossons, op.cit., p.177. Of course there were many other factors (such as the open hearth furnace) which gradually reduced the cost of steel, see p.175ff. See Singer, op.cit., p.620ff for an account of the improvements made to wire machinery.

293. ABCN, 27:08:1887 p.250.


296. Australasian Ironmonger, June 1886, p.61.


Nelson, op.cit., p.6.

Lenik, op.cit., p.45.

Bevan, op.cit., p.45.

Hebert, op.cit., p.184.

Most authorities have simply followed Hebert and the information when presented later may have been anachronistic.

Bevan, op.cit., p.45. See also Lenik, op.cit., p.45 and 46 for a full description of the process.

Hebert, op.cit., p.187.


Lenik, op.cit., pp.46 and 47. A metal analysis was included in this description.

Hebert, op.cit., p.184.

Lenik, op.cit., p.45.

See footnote 150.


Hebert, op.cit., p.187.

Nails had been used earlier; for example, with the affixing of the Hartog pewter plate in 1616 and the de Vlamingh plate in 1697. See, *The Australian Encyclopedia*, published by the Grolier Society of Australia, Sydney, 1963, vol.LX, p.133.

*HRNSW*, vol.II, p.388.


Ibid., p.17. The abbreviations in the text have been expanded.

Ibid., pp.43 and 54.


Ibid., p.102.

Ibid., p.109.


Ibid., p.98.


*HRNSW*, vol.II, p.323. "nails of all sorts are much wanted"

Ibid., vol.III, p.344 and 644. Nails were made from old hoop iron and 'Articles to be sent' included 20 casks of horseshoe nails, nails and 254 scupper nails.


Ibid., p.117. The structure was about 12 months old in December 1790 but the shingles were falling off the roof. There are no further references to using wooden pegs.

King, op.cit., p.157. The blacksmith was making nails out of iron hoops for shingling.

Ibid., vol.II, p.413.

*HRNSW*, vol.I, part 2, p.156. 18, 20 and 24 penny sizes were approximately, in inches, 3-3/4, 4 and 4. Spikes were mostly about 5 and 6 inches but the range could be from 4 to 6 inches. See *Nail Forms and Functions*.

Ibid., vol.II, p.421. In order, these were approximately 2, 3, 3, 3-3/4 and 4 inches in length. Abbreviations have been expanded.

Ibid., vol.II, pp.458 and 459. A 4 penny nail was one of about 1 inches in length. The word penny has been expanded from "d" in the text.

Ibid., pp.40 and 53.

Collins, op.cit., p.103. Though buildings had been erected there since early November 1788. By 24 March 1791 about 100 huts, 25' x 12' had been built. *HRNSW*, vol.II, p.775.

*HRNSW*, vol.II, p.788.

Ibid., pp.318 and 319 "Regular demands", for tools and supplies were made (Hunter to Partland, 11:09:95).

Collins, op.cit., pp.23, 117 and 146. Terracotta tiles replaced the shingles of the old hospital. The connection between the wooden pegs and the failure of the roofs was probably not immediately obvious to the authorities. For public buildings, shingles fell into temporary disrepute, the returns of the 1796-1799 period suggest that more tiles were being made than shingles. Later references suggest that shingled roofs predominated in private structures and thatch for outbuildings and huts.

See Shingle nails in *Nail Forms and Functions*.

Ibid.

Rees, op.cit., Nai (1) cites 10, 20 and 24 penny as "the most common in building"

For example, note the context of footnote 331.
342. Ibid., vol.III, p.344. Hunter to Portland, 10:01:1798. Periodic shortages did occur on Norfolk Island, there was an urgent request for "nails of all sorts" on 05:10:1795. (HRNSW, vol.II, p.323).
345. HRA, ser.1, vol.2, p.628. There were 8,000 each of 30 and 40 penny and 4,300 copper spikes left in store.
346. Ibid., p.540. The document was signed by John Hunter.
347. Ibid., p.628. See also pp.519/520 for Government Store regulations.
349. Rees, op.cit., Nai (2).
350. Knight, op.cit., p.1508.
354. HRNSW, vol.III, p.524. See also Nail Forms and Functions.
355. Ibid., p.751.
356. Ibid., vol.II, p.403. Originally, it was planned to send iron forges (portable?), anvils, hammers and "smiths' tools". See HRNSW, vol.I, part 2, pp.13 and 15. The list of goods actually sent were: 10 sets of cooper's tools, 5 sets of smiths' tools, 10 smiths' bellows and 10 forges but the anvils were not listed (HRNSW, vol.II, p.388).
357. Ibid., vol.1, part 2, p.218. There were obviously no gun smiths there at the time.
362. Ibid., p.339.
363. Ibid., p.321.
364. Ibid., see pp.524, 751 and 753 for a complete list of works.
367. Cumpston, op.cit., p.29.
369. Cumpston, op.cit., p.29.
372. Details of the cargo of a ship rarely survive. In the cases of the Guardian and the Lady Shore the details do survive because they were kept as a record of what was lost, though in the case of the Guardian most of the metal was recovered. The details concerning the Resolution are rare examples.
373. Cumpston, op.cit., pp.41 and 42. Although 1,616lbs of nails were in the Store in May 1802. (HRA, ser.1, vol.IV, p.27.)
375. Ibid. Compston, op.cit., p.43.
376. HRA, ser.1, vol.IV, p.628. Though only 31 casks were wanted for 1801.
379. Ibid., p.440. 3 penny nails sold at 2 shillings per 1,000; 8 penny for 4/3; 12 penny for 6/3; 20 penny for 8 shillings; and 30 penny for 20 shillings per 1,000.
380. Ibid., p.434.
381. Ibid., p.30. Sent by the Buffalo.
382. Ibid., p.27. Cumpston, op.cit., pp.42 and 43.
383. Sydney Gazette 01:05:1803, p.1. Cumpston, op.cit., pp.38, 42, 43. The Perseus and the Cato were not listed as whalers but the Greenwich and the Britannia were.
385. Cumpston, op.cit., p.43.
390. Ibid., ser.III, vol.1, p.8. The Stores were expected to last for two years, see p.xvii.
393. Ibid., p.8. Though 10 tons of iron bar, flat and square were provided and also smiths' tools and cooper's tools.
394. Ibid., p.194. Memorandum dated, 10:06:1803.
395. Ibid., p.200.
397. Ibid., pp.440 and 443.
398. Ibid., p.205. King advised Bowen to be "very Careful of the Distribution of the several Articles you are possessed of". The "American manner" was probably post and rail or a system of "shear legs" and rails.
399. Ibid., p.209. One armourer appears to have done the duties of a gunsmith etc., which in earlier days at Sydney was done by the blacksmith. Sullivan was informed by Collins that many of the articles were constructed of "bad materials" and that the iron was mostly rolled, not wrought, "as it ought to have been".
400. Ibid., p.259. Dated 03:08:1804.
401. Ibid., p.300. I am not certain what the function of these nails was, though they must have been a heavy duty type similar to dog-nails.
403. Ibid., p.496.
404. Ibid., p.496.
405. HRNSW, vol.5, p.442.
407. Ibid., p.400. The settlers came from Norfolk Island to settle in New Norfolk, Tasmania.
408. Ibid., p.414.
410. Ibid., vol.IV, p.440. The previous supplier had been Alexander Davison of "Harpur Street", see footnote 332.
411. Ibid., vol.IV, p.440. The prices were also included.
412. Ibid., p.441.
413. Ibid., p.443. These were supplied by the "Experiment". See footnote 414. There is a discrepancy of 25,000 18 penny nails.
415. Ibid., p.251. Cumpston, op.cit., p.51. The statement only deals with the period from the 1st July to the 31st December but is a report of the state of Stores for barter (see p.246).
417. Ibid., 15:07:1804, p.4.
418. Ibid., 28:07:1805, p.4.
419. Ibid., 08:10:1809, p.2.
420. See footnotes 123 and 136. If Rees had written the account a year or so before publishing in 1819, the date 1803/1804 should be shifted back. Also the production of cut nails could have started earlier before it developed into an "extensive trade".
421. The term "cut nail" would not have indicated much in 1804 so a factory or patent name may have been used instead. It is also tempting to think that Prince's nails were distrusted and that Hayes had to re-advertise them and eventually sell them as "cut nails". Another possibility exists, that he received regular shipments of them and by 1809, those in the trade knew such nails as "cut nails".
422. Sydney Gazette, 01:09:1810.
423. Ibid., 02:12:1804, p.4.
433. Ibid.
437. Ibid., 14:05:1809, p.2. Flooring brads were excavated at Risdon Cove.
438. Ibid., 29:01:1809, p.1. The rarely mentioned 16 penny is also included in this list.
439. Ibid.
440. Including nails cut or sheared from hoop iron.
446. Ibid., 03:04:1819, p.2.
447. Ibid., 04:12:1819-08:01:1820, p.4.
448. Ibid., 09:01:1823, p.6.
450. Ibid., 30:01:1823, p.8.
451. Ibid., 01:05:1823, p.3.
452. Ibid., 12:06:1823, p.4.
453. Ibid., 06:11:1823, p.7.
455. Ibid., pp.13 and 22.
457. Ibid., p.712.
458. Ibid., p.415.
459. Ibid., p.253.
460. Ibid.
461. Ibid., pp.382 and 716.
462. Ibid., p.718.
463. Ibid., p.615.
465. As noted in many Gold Rush period buildings of the 1850s in Victoria and New South Wales. This type of nail was still being produced in Britain until recent times.
466. Maclehose, op.cit., p.183.
467. NSW Government Gazette for 1834, part 1, p.57.
468. Ibid., pp.58 and 59.
469. Ibid., pp.57-59, 109 (part II), pp.697 and 808:
470. I have not been able to confirm this.
472. Ibid., 04:01:1844, p.72; 08:02:1845, p.132, etc.
476. Mayes, The Victorian Contractor's and Builders' Price Book, 1859, pp.146 and XII. See the 1862 edition, it seems that a distinction should be made between 'Ewbank's patent' and 'American patent'.
478. Ibid., 1877, p.119.
479. Ibid., 1908, 1914, 1927 etc.
481. Ford's Sydney Directory, 1851, p.4 of the alphabetical section.
482. Shipping Gazette and Sydney General Trade List, 01:01:1853, p.2.
483. Ibid., 01:01:1854.
488. Australasian Ironmonger, June 1886, p.61.
489. Ibid.
490. See A.H. Smith's (op.cit.) very thorough analysis
491. Sands Directories; Australasian Manufacturers' Directory; Directory of Manufacturers of Australasia; BHP Revue; Shapes and Sections BHP and Allied Industries, 1930.
492. The dates are approximate only.

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494. *Shapes and Sections, BHP and Allied Industries*, Australia, 1930.
496. Ibid., for more details.
497. The information contained in Rees and Hebert were reused in almost every publication on the subject thereafter.
499. Bevan, op.cit., p.45.
502. Hebert, op.cit., p.181. Tomlinson (p.305) and Knight (p.1505) give the same descriptions.
503. Bevan, op.cit., p.34.
504. *REO List, 1812*, F90.
508. Hasluck, op.cit., plate 5.
509. *REO List, 1812*, E79.
510. Rees, op.cit., pp. Nai (2) and Nails (1). Hebert, op.cit., p.184; Bevan, op.cit., p.33 etc.
513. Knight, op.cit., p.401.
515. *REO List, 1812*, E77 and E78.
519. Hebert, op.cit., p.182; Knight, op.cit., pp.560 and 561; Bevan, op.cit., pp.33 and 40.
520. Rees, op.cit., p. Nai (1) and (2); Hebert, op.cit., pp.183, 187 and 188.
521. Bevan, op.cit., p.34.
522. Knight, op.cit., pp.561 and 1505; Sickel, op.cit., p.70.
525. Bevan, op.cit., p.33.
527. Bevan, op.cit., p.46.
528. Knight, op.cit., p.638; Bevan, op.cit., p.34.
529. Rees, op.cit., p. Nai (1); Hebert, op.cit., pp.181 and 183; Knight, op.cit., p.682.
531. Rees, op.cit., p. Nai (1); *REO List, 1812*, D54, D76, F91-98 and L134-138; Hebert, op.cit., pp.181 and 182. In the USA large dog nails often had a spur on one side and were used by locksmiths and carpenters. See Knight, op.cit., p.716.
532. Knight, op.cit., p.731.
533. *REO List, 1812*, F85.
536. *REO List, 1812*, E84.
537. Tomlinson, op.cit., p.308; Bevan, op.cit., p.34.
539. Knight, op.cit., p.878.
541. *REO List, 1812*, E73-75.
542. Hebert, op.cit., p.183.
544. Hasluck, op.cit., plate 5; Sickel, op.cit., p.70.
546. Knight, op.cit., p.968; Hasluck, op.cit., plate 5.
547. Sickel, op.cit., p.70.
548. Bevan, op.cit., p.34.
552. Knight, op.cit., p.1129.
554. Bevan, op.cit., p.34; Hasluck, op.cit., plate 5.
555. REO List, 1812, M151 and M152.
559. Hebert, op.cit., p.181; Bevan, op.cit., p.34.
560. Knight, op.cit., p.1506.
561. Hasluck, op.cit., plate 5.
562. Hasluck, op.cit., plate 5.
567. Knight, op.cit., p.1505.
570. Rees, op.cit., p. Nai (1). Also note nail sizes listed in Government records. See Australian section.
571. Hebert, op.cit., p.183.
572. Ibid., p.181.
575. Sickel, op.cit., p.70.
576. REO List, 1812, M159-M163.
578. Rees, op.cit., p. Nai (1). The observations on the wire rose nails were deduced from field experience and is supported by late nineteenth century advertisements.
579. Bevan, op.cit., p.40; Hebert, op.cit., p.182.
581. REO List, 1812, F.99.
582. Hebert, op.cit., pp.182 and 183.
584. Ibid., p.33.
585. Ibid.
586. REO List, 1812, F88 and F89.
587. Lardner, op.cit., p.199; Sickel, op.cit., p.70.
588. Rees, op.cit., p. Nai (1); REO List, 1812, D68; Hebert, op.cit., pp.181 and 183; Bevan, op.cit., p.34.
589. Rees, op.cit., p. Nai (1); Hebert, op.cit., p.183.
590. REO List, 1812, B20 and B21 for an early illustration of them.
592. Ibid., pp.187 and 188.
594. REO List, 1812, E70 and E71.
595. Sickel, op.cit., p.70.
596. Bevan, op.cit., p.33.
598. Ibid., p.184; Tomlinson, op.cit., p.309; Bevan, op.cit., p.34.
599. Hebert, op.cit., p.182; REO List, 1812, G100-G102, H103-105 and H106-109. It should be mentioned here that many spike nails salvaged from the Old Military Barrack at Norfolk Island, dating to the late 1820s and early 1830s were all square die headed.
600. Hebert, op.cit., p.184; REO List, 1812, D69, M155 and M156.
602. Hasluck, op.cit., plate 5.
603. Chest dated ca.1793 in author's possession.
604. Tomlinson, op.cit., p.308; Knight, op.cit., p.150; Bevan, op.cit., p.34; Hebert, op.cit., p.181.
606. Bevan, op.cit., p.34.
607. Lardner, op.cit., p.194.
608. Bevan, op.cit., p.42.
609. Ibid., p.33.
611. REO List, 1812, D62-D65.
612. BHP Shapes and Sections, 1930, p.501.
613. See Cast Nails.
614. Rees, op.cit., p. Nai (1); Hebert, op.cit., p.181; Bevan, op.cit., pp.33 and 40. See also Knight, op.cit., pp.1505 and 1506.
615. Hebert, op.cit., p.182; Bevan, op.cit., p.34.
616. Hebert, op.cit., p.181.
617. Sickel, op.cit., p.70.
Chapter Four - Summaries And Assessments

The following represents an overview and assessment of the topics under study. Two categories are presented in detail; nails, because they are to be found on just about every historical site; and bricks because they are one of the most common of archaeological remains, after nails (excluding stone). Both categories have been in continual use since 1788 to the present day and have a high survival rate in most contexts.

There can be little doubt that building materials are potentially of great value in dating structures and archaeological sites but the extent of usefulness depends on a number of factors:

1. Survival rate under and above ground

Obviously thatch, bark, shingles and timber have a very poor survival rate underground but in the right conditions above ground, building timber and shingles may survive very well for centuries. Shingles are often found under galvanized corrugated iron roofs or in attics and under floors. One possible case of carbonized thatch has been noted in an excavation. Bricks, terracotta, mortar plaster and stone are virtually indestructable. Metals can survive quite well depending on the soil type.

2. Documentation

Documentary knowledge is useful where words or illustrations can explain additions or subtractions to the form and composition of an object in a particular area. Where an object is mass produced, it has a greater potential for dating as opposed to one created purely by manual means. There are rich sources for tracing changes in mechanical processes but in cases where there are few or no illustrations of the object produced, other dating techniques must be used involving fieldwork and a scientific archaeological approach: decorative tiles, for example, may be easily dated both broadly and in detail because of the ease in tracing makers and sometimes dates through registered patent numbers. Nails may be broadly dated but not in detail because of the lack of illustrations by the various makers. Bricks dated broadly but only
in detail after the mechanization of the industry with the help of a gazetteer of makers. Mortar and plaster can only be very broadly dated but this depends very heavily on the area in which it is found.

3. The scientific archaeological approach

This depends on a thorough analysis of the form and composition of an object or even as to how it was arranged (building approach). The results should then be compared with the evidence from other clearly stratified deposits. This technique is most useful and accurate if a sequence of absolutely dated sites are discovered and analysed. To achieve this, one must again rely on documentation to date sites and structures before a chronological morphology can be established. Some building materials, such as mortar and plaster may be broadly be dated through a study of dated remains in specifically limited areas.

4. Combinations

By combining broadly datable building materials the dating value of each item may be enhanced. For example, an assemblage of: frogless sandstock brick, 1788-1840s; white gritty shell mortar, 1817- early 1850s; Ewbank's nail, 1840s-1860s; a flooring brad with a hand wrought spur, 1790s-1840s: assemblage date, 1840s (probably late 1840s). If the Ewbank's nail is deleted and replaced with a sandstock brick with a fine broad arrow, the assemblage date would be mid to late 1820s or early 1830s. It is to be expected that broadly dated items such as flooring brads, when dated in this way (and other ways), will lead to the observation of distinguishing chronological features.

5. Chronological position

The more recent an object is, the more easily it is datable because of the profusion of specialist journals, catalogues, advertising and even oral history sources, film and photography.
Outline Summary

Bricks

Generally English regulation size and plain - 1788-1820s
Kings Broad arrow - early 1820s-1840s
Frogs - 1830s-1880s (manual)
Fire bricks (imported) - 1840s onwards
Over use of organic materials - 1850s
Slop moulding (fairly unusual) ... 1860s-1880s
Double pressed (wire cut and pressed) - 1870s-World War I
Double pressed (moulded and pressed) - 1880s-1920s
Wire cut (rare in Sydney) - 1870s-1900
Dry pressed - late 1870s to the present
Polychromatic - mid 1880s-1890s

Refer to Gazetteer, especially for bricks of the 1870s to the present. For the earlier period, bricks could be compared to dated and name-credited bricks from documented sites.

Much of the detail presented in the full accounts on nails and bricks may seem unnecessary, especially in the light of these short summaries, however, the detail will become more relevant when applied to new (or even past) archaeological assemblages and contexts.

Nails

Handwrought nails of the various types mentioned in the text - 1788 early 1850s
Cut nails - 1809-late 1810s
Cut floor brads - 1840s-1860s
Ewbank's patent - 1840s-1860s
Patent machine wrought (other than Ewbank's) - 1840s-1860s
Wire nails (iron) - 1860s-1880s
Wire nails (steel) - late 1880s-onwards
Wire nails rhomboidal - late 1890s-1930s
Wire nails, jolt head - 1940s to present

The outline summaries list the chief dating factors based on documentary evidence. The text provides, in detail, potential dating factors which in many instances are not yet immediately evident because professional fieldwork on building materials is still in its infancy. For example, the expected weight differences in bricks made by different brick machines and processes such as wet, dry and slop moulding; also, for example, the expected shift from vertically and horizontally aligned iron fibres in
relation to the shaft of a nail to fibres uniformly aligned along the length of a nail (1830s). The gazetteer is featured because of its potential use in dating (see example further on).

Closer dating may be possible by combining all that is known of the two categories of building materials here examined. Of course, the greater number of categories combined and the more known about them, the better will be the diagnosis.

Most building material categories have strong and weak dating phases. For example, brick dating factors of 1788 to early 1820s are not rich in detail whereas dating factors between the 1840s to 1870s are very complex, hence both periods could be said to be weak. Nails during the 1840s to 1870s go through a strong phase and hence can be used to clarify brick dates: nails change from being manually produced to machine wrought and then wire cut and machine pressed.

Some building material categories appear to have little value at present as criteria for dating. Although outside the scope of this thesis for detailed examination, the following are used as examples:

*Terracotta Roofing Tiles,* (flat, one or two holed, of a distinctive red clay or red with white whorled clay). These tiles are very well documented but are confined to the 1790s (except for cases where tiles were made later to replace broken tiles). These have little value over a 200 year period but are diagnostic of 1790s activities.

As the tiles were often fired with bricks, there should be a theoretical percentage of bricks with firing "shadows" which do not conform to known brick dimensions.

*Screws.* These came to be pointed by about 1850. Until work is done on machine made screws and their various distinctive threads and gauges, the point or the absence thereof is the only reliable dating factor before 1850.

This is one case of "too broad" a dating factor over a 200 year period.

Despite some building material categories being too broad or too restricted in time span, their combination with other categories may result in unexpectedly fine dating.

For example, sand stock bricks without frogs or markings and of variable dimensions could be dated between 1788 and the early 1820s. If found in context with the above terracotta tiles, the bricks could be said to date to the 1790s. The case might be improved if some were found to have firing shadows relating to the tile dimensions.
If many nails were found in the same context but none were of the cut, or brad, variety, it could suggest an early 1790s date.

Dating by "absence" alone is unreliable and dangerous but should not be ignored as an indicator. The tiles are dating factors in their own right but enhance the potential dating value of other categories of building materials (once they are morphologically analysed and the results applied to sites without tiles). As thatch, shingles and tiles were used for roofing during the 1790s, the absence of tiles does not necessarily rule out a 1790s date.

As another example, Ewbank’s nails broadly dated 1840s to 1860s, may be more finely dated. Documentary and physical evidence reveal that Ewbank’s nails with stars impressed on the heads of the nails may be dated from the late 1860s. Ewbank’s nails of the ordinary type, found in association with heavy gauge iron wire nails, may be dated to the early to mid 1860s (with perhaps some 1850s possibilities). Ewbank’s nails found in association with handwrought nails may be dated to the 1840s and very early 1850s. If found with screws without points, nails should date to the 1840s. Ewbank’s nails in such associations, for example, should be closely examined for signs of differentiation over the thirty years or so of common use.

This thesis has argued for thorough documentation as a foundation for fieldwork. Documentation can provide solid chronological anchors and identification. Once this is established, there is solid ground for detailed morphological analysis which is certain to produce very find dating factors. In the case of wire nails, there is very little documentation of the morphological changes between the 1860s to mid-1880s and from then to the 1930s: however, fieldwork has resulted in much finer chronological distinctions. The fieldwork was the result of obtaining samples from closely dated structures from the 1840s onwards.

As stated earlier, there is no higher authority than the artefact itself. That is why as much must be done to enhance the diagnostic value of the artefact, not only as to date but function as well: hence the need for thorough documentation even if some of the details uncovered may not seem relevant at the time of research. The potential of fieldwork is vast and unknown, especially considering that many building materials are virtually indestructible. Theoretically, every brick, tile, stone, glass, some metals etc., used since 1788 still exist - somewhere.
Manually based technology has very particular problems when correlating
documentation with what is actually found in the field. Bricks and nails are no
exceptions, until they became to be mass produced. It is not the simple matter of being
able to look up a patent or a trade catalogue. Documentation provides a framework
upon which to structure what is found in the field.

In the case of manually produced nails there was not a great degree of
variation between workshops. The workshops used the same nail rods and had the
same basic tools. Changes in time reflect the gradual introduction of mechanization to
the preparation of the raw material (iron, steel, the rods, plates and wire) and the
forming of the nail itself.

Machine made nails began to make an impact on Sydney during the 1840s
and superseded the manually made nail as the 1850s progressed. During this time the
basics of traditional brick production remained the same, though there were
morphological changes to the brick due to the changing requirements of the
brickmaker; those ordering the bricks; and due to technical improvements to hand
moulds, scrapers, kilns etc.

The 1840-1870s period is extremely complicated due to the high level of
diversity, regionalization and individuality within the brick trade in the Sydney region.
This period requires a comprehensive understanding of brickmaking and judicious use
of the gazetteer. Fieldwork in the case of bricks, should be confined within small
geographical units (suburbs, for example), as cartage was expensive and charged by the
mile. Fieldwork techniques combined with the documentation should lead to closer
dating systems.

Details of the following may be found in the previous chapters. Here the
documentation is compared to data compiled from fieldwork. It will be seen that the
results are not always equal to the effort.
Brick Sizes (measurements in inches)

A green brick of 10x5x3 was estimated to reduce to 9x4½x2½ after firing, varying according to the material and intensity of heat. Apart from the uneven heat factor in scotch kilns and clamp firing resulting in bricks of variable sizes, sometimes two or more different brick sizes were deliberately made. The exterior wall of St James', Sydney, required bricks measuring 9x4½x2½ and 8x4½x2½. The constant factors of 4½x2½ show that the variability of 9 and 8 was deliberate. Apart from such examples variability in the majority of cases is due to clay and firing factors. As the length is the most affected and the thickness least so, it may be more rewarding in comparative brick studies to confer greater value on thickness first and then the width. See the St Andrews tomb example below. Ideally, bricks should be examined in terms of volume and mass because most are deformed in some way.

Bricks removed after firing were usually sorted as they were taken from the kiln into three categories: under-burned (large); well fired (desired size and strength); and over-burned bricks (small and glassy-surfaced). Often the large under-burned bricks were used for interior work; such possibilities should be considered in any survey.

An opportunity to study the bricks of an early structure came about when a 1790s-1810s tomb was discovered adjacent to St Andrews Cathedral, Sydney. Two categories of bricks could be defined on the basis of the clay used. Type I was of a fine homogeneous clay, and type II of a turbulent clay mixture with light and dark blotches. The variation of brick size was surprising:

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td>8½x4-3/16x2-1/8</td>
<td>8½x4-1/8x2½</td>
</tr>
<tr>
<td>8-7/8x4-3/8x2½</td>
<td>8½x4-1/8x2½</td>
</tr>
<tr>
<td>9¼x4-3/8x2½</td>
<td>9x4½x2½</td>
</tr>
<tr>
<td>9½x4½x2½</td>
<td></td>
</tr>
</tbody>
</table>
1774 London Building Act brick: 
8-3/4x4x2½

1784 Brick Duty minimum:
8½x4x2½

1788 First Fleet supplies:
10,000 bricks
12 brick moulds

1788 Sydney brickmakers from London:
Samuel Wheeler
John King
James Bloodworth

1790 Parramatta brickmaker from Birmingham, James Becket

1803 Brick Duty (London)
mould size: 10x5x3
(9x4½x2½ after burning)

1821/1833 Bigge Report period.
Complaints of irregularities in brick size and composition

1819-1821, 1822/1823 Bigge Report period.
Complaints of irregular brick sizes and composition

1838 Sydney Government Surveyor recommended the 1774 London brick size.

1839 London Building Act brick becomes:
8-3/4x4-1/8x2½

1843 British publication, "average brick": 9x4½x2½

1788 Sydney Government House brick:
averaged out to 8½x3-3/4x2½
(Selected abnormal brick)

1792 Norfolk Island Government House bricks (fragmented).
8-15/16x3-3/4x2 3/4 (Wheeler?)

1790? and 1799 Parramatta Government House
9½x4½x2-3/4 (Birmingham brick size?)

1800 Peter Smith tomb bricks (Parramatta):
8½x4½x2½, 8-3/4x4½x2½.
(Various intermediates between 8½ and 8-3/4)

1817-20 Hyde Park Barracks:
8½ to 9x4x2½

1819 St James', Sydney: 8 and 9x4½x2½

1819 Hobb's tomb (Parramatta);
9½x4½x2½

1820 . . Supreme Court Building:
8-3/4x4½x2-3/4

Mid 1820s Hyde Park Barracks modification:
9x4x2½

1836 James Elder tomb, Parramatta.
8-3/4x4½x2½

1839 James Elder tomb, Parramatta.
9 to 9½x4½x2½

1844 C.H.W. Pye tomb, Parramatta.

The documentation on brick sizes after this is almost non-existent until the 1890s (as applied to Sydney brickmakers). Access to buildings or archaeological sites of, ca.1788 to 1850 is difficult in the Sydney region: a comprehensive survey is in order.
Broad Arrows 1788-1822

No contemporary account.

None found on any bricks from buildings dating between 1788 to ca.1822. Counter claims due to uncertain provenance and context.

1823-1840s

The Bigge Reports (1822) by implication. Bigge took an interest in bricks. Recommended that all tools be marked with a broad arrow. Apparently extended to bricks as they appear regularly from that time.

Such bricks appear in government buildings of the mid 1820s. Examples: Interior modifications (1820s) in the Hyde Park Barracks. ca.1828 cemetery wall, Parramatta. Buildings at Port Macquarie, including St Thomas' 1824-1828. Buildings at Liverpool, the old Hospital 1825. Examples of 1830s structures are more accessible and have a greater survival rate outside of Sydney.

1840s onwards

No contemporary account.

By then most of the larger public buildings were constructed of stone. The use of the broad arrow seems to have declined with the convict system of public work.

Note: the broad arrow is used by some public authorities to this day.

Frogs 1788-early 1820s

No contemporary account.

None found. A brick from Ultimo House (ca.1806) had a faint margin on the upper face of the brick.

Early 1820-1840s

No contemporary account.

Frogs were uncommon during the 1820s and 1830s, which is disappointing to the collector and are hence under-represented (if represented at all) in most collections.

The most common frog shape is the rectangle and after that diamonds, hearts, circles and ovals in countless varieties. There are also many other shapes and marks. Some of this period had a letter or letters indicating the name or owners name of a property or business.

1850s-1880s

No specific contemporary account. English "mechanics" magazines begin to mention frogs.

Frogs become almost universal except on wire cut bricks.

The adoption of slop moulding techniques resulted in sharper outlines on the bricks, otherwise the basic frog varieties remained diverse.
Gazetteer for Use in Dating

For archaeological purposes, bricks requiring to be dated are extracted from well documented contexts, whether as part of a structure or excavated. As bricks were rarely transported far from the brickyard, identification should be fairly straightforward. The more uncertain the provenance of a brick, the more uncertain the identification.

A collector of bricks may request an identification of a brick impressed for example, "HUGHES" with the provenance given as "Sydney". Lack of exact provenance is an immediate drawback, as there are seven brickmakers listed in the Sydney area between 1868 and 1920 with the surname Hughes, variously at Glebe, Redfern, Petersham, Leichhardt, Marrickville and Manly. To complicate the matter some five "Hughes" (Hughes and Drury) are impressed brick types known from Newcastle. Some of these found their way to Sydney (special bricks made of coal associated clays).

Most surname impressed bricks are straightforward for broad dating purposes. Caution must be used for finer dating. For example, "R. FOWLER" was stamped on paving etc., bricks long after Robert Fowler had died. In the majority of such cases, the continuation of a deceased person's name (as a trademark) is well known. In less well known cases, for example when a widow carries on her husband's business, old mould plates may be used until the supply is exhausted: P. Speare is one such example.

Initialled bricks require extra care. The exact provenance for such bricks must be established and if possible a search made in the area for examples of the same kind of brick. The results of the examination should hopefully coincide with the likely candidate found in the Gazetteer.

There are a few stumbling blocks when deciphering initialled bricks. Two letters can stand for a christian name and surname, two surnames of partners, or the trade name of a large brick manufacturer. Some examples:

| AB | Austral Brickworks |
| GB | Goodsell brothers |
| GT | Goodsell and Tye (also as G & T) |
| WF | William Flemming |

Generally for partnerships there will be an "&" between the letters but not always. There are some individual exceptions which should be watched for:
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV&amp;S</td>
<td>E. Vickery and Sons</td>
</tr>
<tr>
<td>MWL</td>
<td>Magney, Weynton &amp; Lancely. This actually represents the North Sydney Brick and Tile Company</td>
</tr>
<tr>
<td>PBC</td>
<td>Penrith Brick Company</td>
</tr>
<tr>
<td>R + C</td>
<td>The cross between the letters should not be taken as an &quot;and&quot;. Red Cross Brick Company</td>
</tr>
<tr>
<td>8HPCC</td>
<td>Eight Hours Co-operative Brick, Tile and Pottery Company</td>
</tr>
<tr>
<td>GT NEWTOWN</td>
<td>Goodsell and Tye, Newtown</td>
</tr>
<tr>
<td>G NEWTOWN [sic]</td>
<td>Goodsell, Newtown</td>
</tr>
</tbody>
</table>

The Gazetteer is cross indexed and annotated to clarify some of the ownership intricacies.

The following list of impressed bricks have been selected randomly for application to the gazetteer. (Warwick Gemmell Collection). Randomly, in that Mr Gemmel piled these into his car one day and drove to my Sydney address to ask my opinion of them. He kindly permitted me to photograph them.

The bricks are at a disadvantage with a couple of exceptions in that I do not know the exact provenance, hence the broad dates. For example, the George Acott brick (ignoring evidence) would be dated between 1871 and 1904. In this case I know that the brick was found at Rookwood. The gazetteer shows that Acott worked at Petersham and Leichhardt between 1871 and 1883. From 1884 to 1904 he was based at Rookwood. Considering the expense of transport, it would be safe to propose that the brick dates between 1884 and 1904. One could consider doing a local survey of Acott bricks and look for technological and morphological features in order to build up a closer dating system. If the archaeological site was at Rookwood, the large cemetery would be an ideal place to begin a survey, as many of the more elaborate grave monuments incorporate bricks, many of which are sufficiently exposed for study. The monuments are dated. (If the survey is comprehensive, monuments built long after the date of death should stand out on a number of criteria, even apart from the bricks.)

NOTE: In the following examples, the brick impressions are indicated in capitals. The information selected from the gazetteer could have been reduced in most cases if the exact provenance had been provided.
NOTE: Machine made brick found at Rookwood, most likely 1884-1904.

BAKEWELL: Bakewell Brothers' 'Beulah' Brickworks: 1886-1956...
NOTE: Useful for dating as an 1886 marker at best. The long lasting and prolific brick and 
pottery company would make an ideal subject for morphological studies of its products, many of
which were marked or stamped.


B&B: Brittleff and Bell: 1931/1932, Castle Hill
NOTE: A very restricted date is a great joy to archaeologists but such find dating is devalued in
usefulness, the more recent the date.


R COOK: Rupert Cook: 1863-1919-1922. 1880-1905 at Denby street, Marrickville. 1906-1922, corner of
Burwood road and Mitchell street, Enfield. Set up machinery between 1880 and the mid 1880s. A
prolific brickmaker. His white double pressed bricks were in great demand. Three impressed
forms of "R COOK" at least, have dating potential through fieldwork techniques. Four main shifts
of site may be useful through clay or chemical identification.

TD: Thomas Daley was proprietor and director of Standsure Brickworks, 1886-1910. Shifted site from
Sydenham road, Marrickville during 1899/1900 to Stanmore road, Marrickville. Standsure
continued to produce bricks after Daley, up to 1932.
NOTE: Large castellated tower between the letter.

8HpCC*: Eight Hours Co-operative Brick, Tile and Pottery Company Ltd: 1886-1889.
NOTE: Clearly a useful brick for dating purposes - 4 years inclusive.

GARNETT ENFIELD: Lewis F. Garnett of the Strathfield and Enfield Steam Brickworks, Enfield, was
manager from 1892 to 1893/1894.


J GIBSON STEAM BRICKWORKS NORTH WILLOUGHBY: John Gibson: 1885-1892. From 1893 to
1896, 'Gibsons Brick and Tile Works'. Gibson had a partnership with Lamb, 1883/1884.

G NEWTOWN: Goodsell 1840s to 1890 when sold to Peter Speare. The last building to receive their
bricks was the Railway Institute Building, 1890-1891.

GT PATENT: Goodsell and Tye, around 1868 to 1880/1883.

G & T: The first brick machine installed 1869.

G T NEWTON [sic]: NOTE: The Goodsell family and their brickworks have a long and rich history. A
good subject for a morphological brick study.


HAYES OAKES: Oakes Steam Brick Company, 1884-1891. Edward T. Hayes was manager between 1884
and 1888. Robert Grant appears to have succeeded him. The Hayes family seems to have owned
the company.

HEWS: George and William Hewé: 1885/1886, Marrickville.

H & G: Hart and Gallagher: 1886-1912, Petersham.


LEIGH: Henry, John and Thomas Leigh operated at Rookwood between 1885 and 1903. From 1904-1907
styled at Leigh Brothers.

LIVERPOOL BRICKWORKS: Liverpool Steam Brickworks Company Ltd, 1907-1932.
MWL: Magney, Weynton and Lanceley of North Sydney Brick and Tile Company. As listed, 1894-1911. Lanceley appears to have bought out Magney and Weynton after 1911.

NB: National Brick company (Monogram).

NBC: Ditto: 1903 onwards. The monogram probably dates to after 1943.

PB: (On reverse, "Marrickville"). Phoenix Brick Works: Marrickville, 1893-1896. Usually styled, "Phoenix" or "Phoenix Bricks".

R + C°: Red Cross Steam Brick Works: Marrickville, 1886-1888.

SHERWOOD TILE WORKS: Sherwood Brick and Tile Works, 1860s-1886. Taken over by Goodlet and Smith in 1886.


PS: Peter Speare: 1893-1897, Newtown.

TOYER B'S: Toyer Brothers: 1885-1897, Marrickville.


EV&S: E. Vickery and Sons: 1885-1898, Alexandria.

The Final Word

Bricks and nails, as examples of building materials, are rich criteria for dating structures and archaeological sites and may also help in their identification. Chapter Four and sporadically elsewhere in the text, fieldwork examples have been used to elucidate points in the text.

This work is documentary in its approach, for assessing the dating potential of bricks and nails, as an assertion of priority in the process of artefact archaeology.

The next step is systematic fieldwork and detailed morphological analysis for finer dating distinctions, thereby enhancing dating potential.

Stated again, there is no higher authority than the artefact itself. That is why as much must be done to enhance the diagnostic value of the artefact, not only as to date but function as well; hence the need for thorough documentation even if some of the detail uncovered may not seem relevant at the time of research. The potential of fieldwork is vast and unknown, especially since many building materials are virtually indestructible. Theoretically, every brick, tile, stone, glass, some metals etc., used since 1788 still exist - somewhere.
Overview of Building Materials:
Sydney and Environs Research and Fieldwork Potential

Two categories have been used in this study to explore the dating potential of building materials. These were chosen for their great potential regarding both documentation and fieldwork, in addition to their good physical survival rate and maximum time span of use (1788 to the present) in the Sydney area.

To conclude the study, the following is offered as a broad indicator toward future research on the theme of dating potential.

<table>
<thead>
<tr>
<th>Building Material</th>
<th>Documentation</th>
<th>Time Span</th>
<th>Survival Rate</th>
<th>Morphological Study Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws, Bolts etc.</td>
<td>poor</td>
<td>1788-present</td>
<td>good</td>
<td>fair</td>
</tr>
<tr>
<td>Metal Fasteners and Hinges</td>
<td>poor</td>
<td>1788-present</td>
<td>good</td>
<td>fair</td>
</tr>
<tr>
<td>Decorative and Constructional Iron</td>
<td>fair-good</td>
<td>1830s-present</td>
<td>good</td>
<td>fair-good</td>
</tr>
<tr>
<td>Roofing Iron</td>
<td>fair</td>
<td>1840s-present</td>
<td>poor</td>
<td>fair</td>
</tr>
<tr>
<td>Lime</td>
<td>poor</td>
<td>1788-present</td>
<td>very good</td>
<td>fair</td>
</tr>
<tr>
<td>Stone</td>
<td>poor</td>
<td>1788-present</td>
<td>very good</td>
<td>poor</td>
</tr>
<tr>
<td>Slate</td>
<td>fair</td>
<td>... 1840s - 1890s...</td>
<td>very good</td>
<td>poor</td>
</tr>
<tr>
<td>Window Glass</td>
<td>fair</td>
<td>1788-present</td>
<td>good</td>
<td>fair</td>
</tr>
<tr>
<td>Glazed Tiles</td>
<td>very good</td>
<td>1870s-present</td>
<td>very good</td>
<td>very good</td>
</tr>
<tr>
<td>Roofing Tiles</td>
<td>good</td>
<td>1790s and 1890s-present</td>
<td>very good</td>
<td>good</td>
</tr>
<tr>
<td>Paving Tiles</td>
<td>poor</td>
<td>1810s-present</td>
<td>very good</td>
<td>fair</td>
</tr>
<tr>
<td>Terracotta Decorative</td>
<td>fair</td>
<td>1880s-present</td>
<td>very good</td>
<td>good</td>
</tr>
<tr>
<td>Plumbing, General</td>
<td>fair</td>
<td>...1830s-present</td>
<td>very good</td>
<td>fair</td>
</tr>
<tr>
<td>Constructional Timber</td>
<td>poor</td>
<td>1788-present</td>
<td>very poor</td>
<td>very poor</td>
</tr>
<tr>
<td>Architectural Furniture, Timber</td>
<td>poor</td>
<td>1788-present</td>
<td>very poor</td>
<td>good</td>
</tr>
<tr>
<td>Shingles</td>
<td>poor</td>
<td>1788-1870s</td>
<td>very poor</td>
<td>almost nil</td>
</tr>
<tr>
<td>Thatch</td>
<td>poor</td>
<td>1788-1810s</td>
<td>almost nil</td>
<td>nil</td>
</tr>
<tr>
<td>Manufactured Lining Materials</td>
<td>very good</td>
<td>1890s-present</td>
<td>very good</td>
<td>very good</td>
</tr>
<tr>
<td>20th Century Manufactured Materials</td>
<td>very good</td>
<td>-present</td>
<td>very good</td>
<td>very good</td>
</tr>
</tbody>
</table>

The above is intended as an indicator only and based on my own research and fieldwork over many years. Every student of archaeology must feel the need to add or subtract or request greater clarification and definition to it. It is not a definitive guide, it is an indicator which I feel necessary to include.
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