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INDUSTRIAL DEVELOPMENT

in

SOUTH LEEDS.

1790 - 1914

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PAGE

NUMBERING

AS ORIGINAL

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CONTAINS PULLOUTS

SUMMARY

The industrial development of South Leeds in the nineteenth century was mainly due to the introduction of factory-based production. From villages dominated by clothiers producing woollen cloth under the 'domestic system', Hunslet and Holbeck grew into suburbs of the City of Leeds, distinguished by the dominance of factories of all kinds intermixed with acres of "working men's cottages" - back-to-back housing mainly.

New industries replaced older established trades and new methods were constantly introduced which fostered the further development of industry and a concomitant growth in the work force and its supporting services.

At the end of the eighteenth century there were already several recently opened cotton mills south of the river, but it was as a centre of flax-spinning that the area developed during the first half of the nineteenth century. As flax-spinning passed its peak the engineering industry was expanding until by 1914 it was the major employer of male labour in the district, with an international market for its products. There were other important trades which developed during the century, chemicals, glass bottle making, chromo-lithographic printing and brewing, but the area had become peripheral as far as cloth-finishing, dyeing and textile manufacture were concerned. The pottery industry was dead and the expansion of tanning, with its

associated boot and shoe-making, was chiefly to the north of the river.

Industrial development was primarily based on the steam engine. In this respect Hunslet and Holbeck were most favourably located, with ample supplies of cheap coal and boiler water, as well as engineering works producing steam engines and boilers. These positive factors were further reinforced by the availability of transport facilities of all kinds and extensive areas of flat land which were essential for the development of heavy engineering works.

There was a significant relationship between the different trades which encouraged complementary development. Initially the access to supplies of raw materials and coal, as well as to markets both near and far, was important in attracting industry to the area. Within the area there were few specific factors affecting location except the paths of the water courses and access to the existing transport network. Industrial development in the out-townships did not follow that of Leeds itself in detail, both Hunslet and Holbeck had a character of their own derived from their evolution as manufacturing areas with associated housing.

By means of a gazetteer of industrial sites, outlining their history and development during the period under review, the impact of the individual entrepreneur is recognised and the varying fortunes of the different businesses is charted as they moved from one site to another according to their prosperity.

CONTENTS

Page

List of Tables

List of Maps

GAZETTEER   Key map of sites

Map	Sites	Map	Sites
Map A	1 - 13	K	131 - 146
B	14 - 24	L/M	147 - 173
C	25 - 49	N	174 - 177
D	50 - 65	O	178 - 180
E	66 - 75	P	181 - 196
F	76 - 103	Q	197 - 210
G	104	R	211 - 214
H	105 - 110	S	215 - 218
I	111 - 125	T	219 - 222
J	126 - 130		

LOCATION OF ALL SITES LISTED IN THE GAZETTEER.

Overall view of sites mentioned.
For exact location see Gazetteer

CHAPTER 1

INTRODUCTION

This survey is an attempt to trace the development of industry in "Transpontine Leeds"; i.e. the South Ward of Leeds and the out-townships of Hunslet and Holbeck. For this purpose industry has been defined as:

> Manufacture and production based on power or needing specialised building.

These seemingly arbitrary distinctions deliberately exclude the Woollen Merchant, so well described by R.G. Wilson,[1] with a staff of croppers, glossers and burlers, finishing cloth in his workshops. Merchants only came within the terms of reference when they operated fulling or scribbling mills. Common brewers and maltsters are included since they required special buildings but did not initially use power.

There has been a parallel study to this, of Leeds north of the River Aire, by Michael Ward,[2] and in the <u>History of Nidderdale</u>[3] all the industry of the dale has been investigated but on an industry rather than site basis. Peter Mathias has carried out a study of the brewing industry on a national scale[4] and Eric Sigsworth carried out a survey

1. R.G. Wilson, <u>Gentleman Merchants, 1700-1830</u>. (1971)
2. M. Ward, unpub. Ph.D. thesis, Leeds 1973
3. B.Jennings, ed. <u>History of Nidderdale</u>.(1968)(Huddersfield)
4. P.Mathias,<u>The Brewing Industry in England,1700-1820</u>.(1959)

of brewing in Yorkshire.[1] W.G. Rimmer produced a detailed study of one firm in the flax industry[2] but there seem to be no other surveys of the development of industry in toto in a given area over a span of time.

The emphasis on the individual site has proved to be the major problem of this study. There is plenty of material available on Leeds industry in the nineteenth century but to attribute statistics to a particular spot in Hunslet or Holbeck is less easy. It is one thing to list the number of flax spinners in Leeds in 1830 from the directory but much more difficult to locate the exact site of each mill. Unfortunately, it is still common for writers from outside Yorkshire to regard any business "near Leeds" as being actually in the town.[3]

For these reasons much evidence has been omitted except where it related to general developments in the area and the exact location was not important.

The major sources consulted are fully listed in the Bibliography but an outline of the methodology used to identify sites may be appropriate.

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1. E.M.Sigsworth, The Brewing Trade During the Industrial Revolution (1967) (York)
2. W.G.Rimmer, Marshall's of Leeds, Flax Spinners, 1788-1886 (1960)
3. A recent magazine article on Marsala wine referred to the Ingham family "of Leeds" when in fact they were from Ossett.

The first step was to list all industrial sites shown on the 60 inch to the mile O.S. of 1847, which covered the South Ward, Holbeck, and Hunslet as far south as Chapel Street. These sites were identified with users listed in Williams Directory of Leeds (1845). The scale of the survey is such that minute details are shown so that it was possible to pick out the individual Lead Chambers and associated furnaces in Bower's Chemical Works on Jack Lane, which were used for the production of Sulphuric Acid. Progress was next made from 1847 towards 1790 by reference to directories, Fowler's surveys of 1841 and 1831 and, perhaps most important at this stage, for Hunslet, the ratebooks and maps for 1791 and 1823-7.[1] These yielded not only exact sites, owners, occupiers and rateable value but summaries of the buildings including steam engines, water wheels and wind mills. There are earlier rating lists for Hunslet, rate books for the South Ward and a map for Holbeck, but lists of properties without a key map are of less value, particularly in areas like Simpson's Fold which had a mixture of properties occupied by numerous merchants and craftsmen living in a very small part of the South Ward. The early directories of Leeds treated Hunslet and Holbeck as out-townships and merely gave lists of names and trades without any location. It may well have been that in 1816 a stranger in Holbeck enquiring for Fisher and Nixon's mill would have its bulk pointed out. The 'Western Panoramic View of Leeds'

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1. Leeds City Archives, LO/HU/4(1791) and LO/HU/5(1823-27)

published by Charles Fowler in 1832 shows Wellington Bridge in the foreground, Whitehall and Gelderd Roads passing through open fields and in Holbeck Marshall's Mills and the Round Foundry tower above the houses. In these circumstances details of locations were superfluous, but the absence of such detail has caused difficulty in establishing the movements of firms within the area. These movements are of some importance since they tend to reflect expansion and a move to larger premises. Most students of directories will be well aware of their general shortcomings, complete omission, muddled cross-references between alphabetical, trade and street indices and spelling variations which, for example, transform "Croysdale" to "Croisdale".

The strongrooms at the Leeds Civic Hall hold the deeds to all property bought by the Corporation, in numerical sequence. To find the correct index number requires the study of the base maps, which are the 1889-90 series of the O.S. 25", to locate the site. Many early industrial sites have been completely obliterated by later housing development and are difficult to identify even when the houses have been bought by the corporation for demolition. The value of these deeds varies considerably. Some give an abstract of title from the early eighteenth century,[1] whilst others show a minimum of detail.[2] The legal essentials of a document of title

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1. LCD 21332 Union Foundry. 1724, Manor of Leeds to J.H.Busk ... 1903. Union Mills, mortgage by H.Rawson, 8 tenants named.
2. LCD 5248 Sweet St.Foundry. 1907. W.G.Bywater to W.Bywater Ltd. ... then to Leeds Corporation with Bywaters as tenants in 1938.

are few, they relate to ownership and location of the site in terms of contemporary boundaries. Most deeds provide more than the minimum, plans are often included and lists of mortgages provide information on capital investment.[1] The reference to a 'newly-built' mill usually means that it has been built since the last conveyance and no more.[2] Many sites of industrial importance are still in private hands and the deeds are not accessible.

The pioneer work of Stanley Chapman in the use of insurance records to estimate capital formation in early factories[3] suggested that the Sun and Royal Exchange insurance registers in the Guildhall Library might prove a fruitful source of material for the critical period before 1815. These registers are not indexed and it is possible to overlook relevant material and great care is required in the interpretation of these documents. Locations are normally vague, 'Cotton Mill at Hunslet',[4] and there is always the possibility that

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1. LCD 18098 Larchfield Estate. Abstract of title (1836) notes mortgages of £1500 @ 4% to Pym Nevins from his father-in-law, Thomas Jowitt, in 1790 and of £2750 from Abel Smith, the banker, to Nevins and J.Brooke, woollen merchant, in 1795. Mary Goodman sold part of the land to Robert Wood (Indenture 1836) 2467 sq.yds @ 6/6 sq.yd "with right to pipe water from the conduit at Nevins Mill and connected to the River Aire."
2. LCD 15830 Corn Mill,Wortley Lane. 1829. Conveyance from D.Dunderdale to S.Dawson, flour miller, of Nidderdale. The only reference to a mill was in a conveyance of 1890 "all that factory, formerly a corn mill."
3. S.D.Chapman,'Fixed Capital Formation in the British Cotton Industry' Ec.H.R. Vol. XXIII (1970)p.235 et seq.
4. Sun CS 11/649649(1795) Beverley, Cross & Billam, of Leeds, Cotton manufacturers, Cotton mill at Hunslet.

the property was under-insured or that the risk was shared with other, unknown, insurers. The most useful material gleaned from these registers has been where an owner has insured his premises and his tenants have insured the contents in the next policy,[1] or a series of entries can be traced which show the development of a site.[2]

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1. Sun CS 52/741102(1802) Benjamin Thompson & Thomas Naylor, Cotton spinners, Hunslet. Millwrights gears £25, Clockmakers Gears £275, Stock £200.
   Sun CS 52/748542 (1803) E. Armytage, cotton house, Hunslet Moor. tenant T. Naylor. 4 storeys high, 806 sq.yds. £700.
2. Sun CS 10/646372(1795) Ard Walker, Cotton spinner, Hunslet. Steam engine, used to raise water only, £100. Total value £1400.
   Sun CS 19/671055(1797) ... total value £1400.
   Sun CS 364/562205(1789) ... total value £1000 fire engine £100.
   Sun CS 40/719547(1801) ... total insured value £2500 engine £500.

Two months later a new mill was being built ...

Sun CS 48/746731(1802) ... cotton mill, four storeys high, 1071 sq.yds. Value £1000, engine £600, total value £5000 and half this amount with the Royal Exchange Insurance also.
Sun CS 88/833883(1809) ... cotton mill five storeys high, 1500 sq.yds. Value £500, engine £300, total value £2500.

The accounts for the building show that Walker paid out £1626 in 1802 for the mill and £2375 for all the machinery including £1318 for the engine and boiler. By 1805 the total outlay was £6200 but the insurance covered stocks in hand over and above the figures for the fabric and machinery.

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A close study of 'clockmakers' gears' permits inferences to be made regarding technological development, omissions being as important as the details listed. There is no evidence from these records to suggest that power spinning of wool was carried on before 1810, but cotton spinners were using slubbers, billies, willeys and breaking engines (carders). The details of steam (fire) engines show that these were much more widely used than had been assumed previously. By inference of values under £100, and by direct references as already quoted for Ard Walker's mill, the use of Savery (fire) engines, which only pumped water back for a wheel and did not supply power directly, has been recorded. These coincide with Stanley Chapman's Type B1 mills[1] and may conveniently be called 'throw-back' engines.[2]

The use of steam power is critical in this study of industrial development and major sources relevant to this area include a letter from Fenton, Murray, Wood & Co. to Henry Teal (Denison & Wilkinson's agent in Leeds) of 1809 listing the prices of their steam engines from ten to sixty horse power.[3] William Lindley's list of steam engines in use in 1824[4] gives the power, makers and users by trades. Other sources include the evidence given to the Factories Enquiry in 1834 and to the Royal Commission on the Pollution of Rivers of 1867. In

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1. S. D. Chapman, op. cit. p.239
2. J. Tann, 'Industrial Archaeology and the Business Historian' Business Archives, (1969) 31.
3. Nottingham University Library. Denison Mss De H 50 (1809)
4. Leeds University Library, Brotherton Ms 18 (1824)

addition to power used this report also gives many details regarding the state of the woollen, dyeing and tanning industries and indicates the concentration of industry along the becks and the main river bank.

Mention has already been made of Ard Walker's accounts for the building of his cotton mill.[1] In addition to giving costs of labour and materials, names are recorded of suppliers also. Whereas the Round Foundry quoted engine prices 'including one best iron boiler' in 1809, when Ard Walker bought his Murray engine he had to buy iron plates from Shaw and send them to Benjamin Pullan to be made into a boiler. The insurance records never mention capital investment in mill dams but the Walker accounts include items for cleaning out the dams and other digging work.

Newspapers have provided much information for the early years. Sale notices have been useful, but frequently have lacked site locations.[2] Special reference must be made to the Leeds Express series for 1883-4 of 'Peeps into Leeds Industries' which are as good a business history as any in the Century's Progress (1893) or Industries of Yorkshire, Part I (1888). Sale notices have appeared and there is sometimes no record of the premises changing hands, so not all sales actually materialised.

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1. Leeds City Archives DB23 (1801)
2. e.g. LM 4.6.1804 Holbeck Mills: "All that water mill ... Also all that newly erected building, four storeys high ... together with a new patent steam engine of eighteen horse-power"

As might be expected the Leeds Archives have provided much information and whereas insurance records have provided details of mills and their machinery for the period round about 1800, the Hepper Valuation Books provide similar material for the end of the nineteenth century.[1]

There are relatively few documents which furnish a total picture of industrial buildings. Even the large scale plans show only ground plans of buildings, yet many round chimneys are built on square bases for example. A few sale notices give dimensions and the height in storeys but actual illustrations of industrial buildings are comparatively rare. There are prints of the Round Foundry in 1806 and many illustrations of Marshall's Temple Mill of 1843; from 1863 directories contained illustrated advertisements showing buildings and at the end of the period the Leeds Commercial Year Books (1910, 1913, 1920) are well illustrated with engravings of 'our mill' and 'our tannery'. It may be noted that 'our mill' was often shared with several others and they claimed ownership in their advertisement on a later page with the mill shown from a different viewpoint. The Glover collection[2] of billheads includes some engravings of industrial premises, processes or products. These billheads have revealed extensions to Arminsteads Mustard Mill between 1811 and 1842 and for Bower's Glassworks they show

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1. Leeds City Archives, Hepper Valuation Book 234(1891) p. 101 et seq. Report on the Holbeck Mills Estate. Values are given in code.
2. Leeds City Archives, A33 Glover Collection.

glass blowing (1820), bottles and an exterior (1829) with alembics stacked in the yard. For buildings before 1850, the Glover collection has yielded the most illustrations. The 1847 O.S. survey shows large areas of open land between Hunslet, Holbeck and the South Ward, an area developed extensively in the 1860s. For reference use an engraving 'A Bird's Eye View of Leeds' c.1874, which looks down on the town from the south with the Leeds Pottery windmill in the foreground, has proved valuable. Whilst the scale omits great detail the number of windows in a building is shown and the style of the chimneys can be seen.[1] Where buildings have not changed markedly the 1874 view is clearly recognisable and so buildings shown, but since demolished, can reasonably be assumed correctly drawn also.

The prime consideration of this study has been the development of individual sites so fieldwork was essential to carry out a record of surviving buildings. The photographic record was completed with the aid of a Kodak Award. Many sites had already been cleared and others were in the process of demolition, which sometimes allowed interior details to be recorded. On some sites, outside development areas, the firm concerned had re-developed the site completely, and no pre-war buildings remained.[2] It was apparent that photographic

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1. There have been suggestions that chimney styles might be used to date factory buildings but all that can safely be said in the Leeds context is that early mills had short, round stacks, in about 1840 square, taller stacks were introduced and from 1860 onwards very tall, round stacks with ornamental tops came in.
2. Hunslet Moor Foundry, rebuit in 1890 and again in 1948.

records, allied to earlier engravings, could be vital in assessing the development of a site. The survival of a firm frequently depended on the ability of management to introduce new technology in order to continue to meet changing market demands. To this end new plant would be installed requiring new or altered buildings. These changes rarely show on title deeds but fieldwork can identify filled-in doorways and windows, added floors and dated keystones, gateposts and fenders. The problem of conflicting documentary evidence on the rebuilding of Alf Cooke's Crown Point Printing Works in 1894 was resolved by a visit to the site where the extension, in the original style,could be seen. In the course of fieldwork many otherwise unrecorded items have been noted and much oral evidence has been obtained from employees, past and present, and management, including descendants of mid-Victorian entrepreneurs who have produced family papers and related anecdotes of the 'old days' which have clothed the skeleton of statistics. Since much of the physical change in the buildings has been a reflection of technological change, visits have been made to a large number of textile mills, dyeworks and engineers outside the area, as well as within it, in order to better understand the different technologies involved.

In so many cases references have been made to Leeds in general and the problem has been to obtain evidence related to a given site. This difficulty has emphasised the importance of fieldwork and illustrative records of buildings in determining the location of a business at a given point in time. This problem may be illustrated by reference to Beverley, Cross & Billam's cotton mill in Hunslet. There are several references in the Boulton & Watt Mss in the Birmingham Reference Library which show that the mill was 75 feet long, 30 feet wide and four storeys high, with a capacity for 3200 spindles but there were only 1800 installed when it was burnt down in 1796. The engine was a 22 h.p. sun and planet gear type and a Savery type engine had been considered.[1] This is possibly above average information for a cotton mill built before 1800, but nowhere is the location given. The only possible clue seems to be 'Cotton Mill Row' which was situated by the Balm Beck, upstream from the Balm Beck Mill and close to the Middleton Railway line. This site seems to fit and it is the only site with no other record of industrial use.

Where buildings have survived fieldwork has given a clear picture of the relative size of a business. The imposing sounding "Quebec Brass Foundry" on Shand Terrace turned out to be a shed at the end of a block of back-to-back cottages, built on the site of the old Meadow Lane Pottery.

In 1967 Professor Beresford wrote:

> "The antecedent ... of the bricks and mortar of Victorian housing was the multiplication of other buildings, the

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1. Birmingham Reference Library. Boulton & Watt Mss.
   a) Catalogue of old engines, p.8 entry 4.
   b) Box 261, Lawson Memoranda of Leeds engines (1797) 9.
   c) Letter to Boulton from John Cross, 23.6.1792.
   Guildhall Mss. Sun Mss 119/32 Vol.XV 15.2.1896 Sun Insurance paid out £2460 jointly with Royal Exchange InsuranceCo

"workplaces: the mills, foundries, engineering workshops, tanneries ... of Victorian Leeds ... there are more examples of this type of building still standing (and in use) than there are houses contemporary with them. In particular, Water Lane, Meadow Lane and Hunslet Lane are still a largely unexplored paradise for the industrial archaeologist. A full survey of these relics of pioneer industrialisation is still awaited"[1]

It is hoped that the fieldwork which forms the core of this study has explored that 'paradise'. Since 1967 much more has been demolished and replaced by ring-roads, urban motorways, light industry and municipal housing schemes.

Any errors and omissions are due entirely to the writer but this survey could not have been completed without the help and encouragement given by Professor Beresford and Dr. M. Ward of Leeds University, my very good friend John Goodchild, of the Cusworth Hall Museum, Dr. Stanley Chapman of Nottingham University and Dr. Jennifer Tann of Aston University. Mr. J.M. Collinson, the Leeds City Archivist, also gave much help in the collection of material from the City Archives in his care.

Throughout the study a number in parenthesis after the name of a factory or mill indicates its reference number in the

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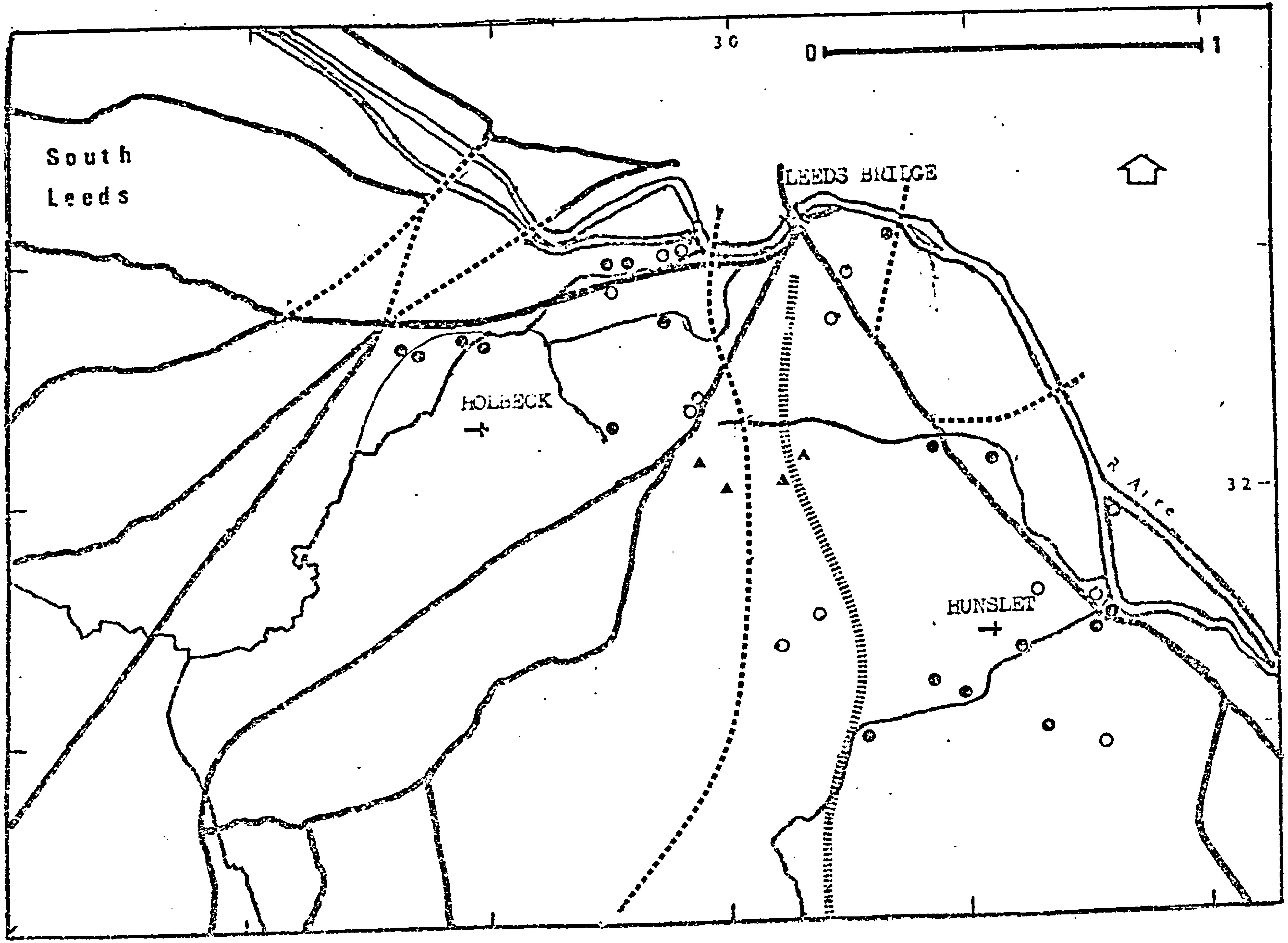
1. M.W.Beresford, "Prosperity Street and Others", Leeds and its Region (1967) pp.195-6.

Gazetteer of Sites, e.g. Balm Beck Mill (214) indicates that details of Balm Beck Mill are noted under Site 214.



INDUSTRY :: circa 1800

- Using steam power
- Without steam power
- Potteries

See Map sheet number 2,p.41, for key to transport features.

CHAPTER 2

THE GENERAL DEVELOPMENT OF INDUSTRY BEFORE 1800

The area covered by this study is approximately a triangle with its apex at Leeds Bridge and the base a line joining the parish churches of Hunslet and Holbeck. It lies in a great sweep of the River Aire where the general flow to the east swings to a more southerly course and the land rises gently from the river, only 25 feet per mile towards Beeston and Woodhouse Hill.

On the Holbeck side the streams which make up the Holbeck approach the River Aire from the south-west to power Holbeck water-mill (3) at Millgreen, The old township clustered round the church on a knoll to the east of this. Beyond lay Holbeck Moor eastwards, joining on to Hunslet Moor. Hunslet developed round its church and westwards to the River Aire. Where the old Wakefield road, running to the south-east, left the township, it crossed Balm Beck, a shorter stream than the Holbeck but equally valuable for water-power. The Hunslet 'soke' corn mill (207) was on the river itself, with a weir to channel the water to the mill and a curved tail-race returning it to the main stream again.

From the nature of the soil, and its flatness, most of this low-lying land was ill-drained pasture. The name Hunslet Carr denotes that it was land suitable for summer grazing but tending to be water-logged in winter. The base line between the churches approximates to the line of outcrop of the coal measures. Coal, of a sort, was easily obtainable, and the Wortley clay beds supported potteries, brickworks and clay-pipe makers. To the west of the area the Farnley ironworks were prominent and a few miles further away were the famous Low Moor and Bowling foundries, at Bradford.

Relatively speaking Holbeck was off the beaten track; an engraving of 1715 shows Water Lane 'truly rural', whilst by contrast Hunslet was on the main route from Leeds to Pontefract and Wakefield. Hunslet Lane is an early example of "ribbon development" with merchants' houses and gardens on both sides. Between Hunslet Lane and Water Lane, Meadow Lane was similarly developed to the main township boundary and formed the starting point for turnpikes leading to Elland and later to Dewsbury. Thus there were initially three areas of settlement south of the river, the transpontine fragment of the main township, and the two villages.

The main south bank industries before 1800 were woollens, malting and brewing, corn milling, iron founding, potteries and some cotton spinning in Hunslet.

The Woollen Industry

According to Morris' Directory (1798) 'transpontine Leeds' had over 30 merchants, 16 clothdressers, 8 woolstaplers, 2 dyers and a cassimere printer. This reflects the development of the woollen trade and the importance of the Leeds market. The White Cloth Hall built in Kirkgate in 1711 had been replaced by a larger hall south of the river, in Meadow Lane, in 1755. This in turn was replaced by an even larger hall on the Tenter Ground in The Calls in 1775. The existence of the cloth halls relieved the pressure on the open market held in Briggate, which was left for coloured cloths. The Leeds Improvement Act[1] permitted the widening of roads, including Briggate, and this was followed by the building of the Coloured Cloth Hall on the edge of the Wilson estate, the Park, at the western end of Boar Lane, now a site largely occupied by the Head Post Office. By 1797 the strict rules of the cloth markets had been relaxed in that only a five-year apprenticeship needed to be served before a clothier could use the markets. There were many who were not so qualified and these 'Irregulars' sold their pieces opposite the White Cloth Hall in Meadow Lane from 1755 until about 1790 when they took over the Music Room in Albion Street.

The existence of a second major market led to the settlement of many merchants in Meadow Lane, Bowman Lane and Simpson's Fold. Whilst these men called themselves "merchants", many were also manufacturers: they had fulling and scribbling mills in the district, or operated finishing works

1. 28 Geo. II c.41(1755).

(press shops, glossing shops, cropping shops, burling and dry houses) as well as their warehouses and packing shops.

There was a fulling mill recorded at Temple Newsam in 1185 and many corn mills had fulling stocks as well as grind-stones. The fulling of woollen cloth was the first of the finishing processes, and a weaver would have his piece fulled before taking it to market to be sold 'in balk' (unfinished). With a growing demand for cloth the prepara-tory processes were mechanised. Water-powered scribbling mills, with carding engines to card the wool, and then slubbing billies to make rovings (a loose twist of fibres) which could be used for a weft or be spun by hand-powered jennies for warp thread, were introduced. The same mills also beat out the raw wool to remove straw etc. in the "willey". There were many scribbling millers who called themselves merchants. By 1800 only one is recorded as spinning also in the area. Robert Cookson, master clothier of Holbeck, advertised for a mule spinner for 288 spindles, water-powered,[1] but the Factory Commission report of 1834 referred only to 'fulling and scribbling mills' and the final stages of yarn preparation were done by hand-operated jennies, either in the mill or in the home. The jenny needed little adaptation for spinning wool, but carding wool was more difficult than cotton and required two stages, carding and scribbling. From the scribbler the web of fibres could be rolled by children into a loose rope which

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1. LM 31.5.1800

could be drawn out 8 or 9 times by a slubbing billy. At this period only a few mills carried out slubbing (e.g. Balm Mill (214) and Lower Escholt Mill near Bradford). Before 1800 only Fisher and Nixon of Holbeck (15) were described as owning a scribbling, carding and spinning mill and there was no indication as to the type of machinery used for spinning; jennies, or, as at Cookson's, mules.

Developments in Hunslet

Before 1800 development in Hunslet was slow. The evidence of ratebooks dating from 1763 and 1788[1] show that at Hunslet Soke Mill the Garnetts had added a scribbling mill to their corn and fulling mill, the addition being assessed at £7.10.0. Burrow Copley was a cloth maker in Hunslet in 1786[2] and his scribbling mill was rated at £20 in 1788 (210). At this time he was insured with the Phoenix for a

> "brick and slate scribbling mill: £200, engine £200."[3]

His son, William, was rated at £28 for the same premises in 1791[4] and he probably also occupied another mill across the road (209) rated at £24 and rented from the Couplands.

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1. John Goodchild, Mss, Cusworth Hall Museum.
2. Evidence of Robt. Cookson S.C. State of the Woollen Manufacture (1806) p.11.
3. Goodchild Mss.
4. Leeds City Archives, Hunslet Rate Book 1791.

In 1790 Pym Nevins bought the Larchfield estate from Obadiah Dawson with a loan from T. Jowett.[1] This included a house, warehouse and land at least[2] (152). Business must have developed since the valuation rose in three years to £72, when it included a dyehouse, and in 1795, in partnership with John Brooke, woollen merchant, he borrowed £2750 from Abel Smith, the London banker.[3] A scribbling and fulling mill was built with a 16 h.p. Boulton & Watt engine for power. In 1796-7 the output was 209 pieces of broadcloth and this side of the enterprise was so new that the salary of the searcher had not been fixed.[4] For the next thirty years the Larchfield Mills traded as Nevins & Gatliffe (Gatliffe was another woolstapler). More details of this time have survived for a smaller mill on Balm Beck (214), described as a 'scribbling mill and foundry' assessed at £30 in 1791 and advertised for sale in 1793[5] with:

> "5 machines and billy worked by a fire engine and 2 billeys, scribbler, and carder worked by water-power."

This mill was insured by the tenants, Hinchcliffe, Rainforth and Hodgson, for £500, comprising a:

> "water scribbling, carding and slugging (slubbing) mill"

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1. T.Jowett, woolstapler, Hunslet Lane (Morris 1798) and LCD 18098.
2. Hunslet Rate Book 1791 R.V. £36.
3. LCD 18098.
4. Bradford Sessions returns 1796-7.
5. LI 28.10.1793.

and under the same roof was Hodgson's forge. It was expressly stated that there was no fire engine at this time.[1]

The John Brooke already noted as financially involved with Pym Nevins, was one of two sons of John Brooke, Mayor of Leeds in 1736, who had a family house on Hunslet Lane, on the corner of what is now South Brooke Street. The brothers went into business as merchants in 1791[2] and their prosperity can be gauged by the increase in the value of their house and shop from £40 to £52 in three years.[3] Other merchants included the Inghams and the Claphams (who added a dye house to their 'house and shop' and raised the rateable value from £80 to £91). Like the Brookes these merchants put their money into the finishing trade and built glossing and cropping shops, press shops, burling houses, dry houses and warehouses.

Developments in Holbeck

Over in Holbeck there were as many clothiers and merchants who went into manufacturing, but before 1800 it seems that only two were millowners. Fisher & Nixon, merchants, Meadow Lane, were generally described as 'of Holbeck' by Robt. Cookson and others. Wilson's 1807 Directory listed them at

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1. (Sun, County Series) Sun CS11/649650.
2. Evidence of Robt. Cookson, S.C.State of the Woollen Manufacture (1806) p.11.
3. Hunslet Rate Books 1791 and 1788.

Mill Green, the prime water-mill site, but Peter Willans, of Obadiah Willans, Holbeck Mills (15)[1] stated that the mill was built in 1793 and Cookson said that Fisher and Nixon began in 1792 so it seems more likely that they were on Holbeck Lane and not at Mill Green. This is supported by an insurance record for John Grimshaw, scribbling and carding miller, for a steam-powered mill at Mill Green.[2] Fisher and Nixon insured their mill for £1650 which included £700 for buildings, £100 for the steam engine and no machinery, suggesting a newly built mill.[3] Many of the cloth finishing merchants, like the Claphams, had added dyehouses but there were a few specialist dyers, the chief ones being the Chadwicks, by the river on Bowman Lane, and John Sayner who set up business in 1792.[4] The range of dyes was limited: the main ones included logwood, indigo, copperas and cudbear.

Sources of Capital

At the same time as these capitalists were developing their enterprises there were still yeoman clothiers weaving their pieces and doing a little farming as described by Daniel Defoe in 1772. With the growing demand for Yorkshire cloth, the handloom weavers could use all the yarn spun, so there

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1. Factories Enquiries Commission (1834) Vol. II c.1.
2. Sun CS12/648553 (1796) Steam engine £50.
3. Sun CS12/651631(1796) "N.B. No millwrights Working Gears, Clockmakers Work, Carding or Breaking Engines or any moveable Utensils or Stock included".
4. Hunslet Rate Book 1791. Factories Inquiry(1834) Vol.II C1.

was no opposition to mechanisation in this direction but a raising mill, owned by Johnson of Holbeck, out at Cross Flatts, Beeston, was destroyed by irate shearmen and croppers,[1] in 1799.

The sources of capital in the woollen industry were varied. Some merchants were concerned with finishing, others became involved in fulling and scribbling. The Brookes were in the first category and Nevins was in the second. He was helped by his father-in-law, Jowett, a woolstapler of considerable wealth. Thomas Hainsworth, owner of Balm Mill, was in partnership with Tunstall of Holbeck. His warehouse, counting house, packing shop and press shop were insured for £400.[2] The forge at this mill was worked by Hodgson, but Mason & Co., who were tenants of the scribbling mill in 1791, were replaced by Hinchcliffe and Rainforth in the insurance record already noted, in 1795. In 1791 Rainforth had a small house and dyehouse in the close next to the mill and was mentioned in the advertisement of 1793. This is an example of a small clothier moving up the ladder to become a manufacturer. Jonathan Clapham was probably the most prosperous merchant in Hunslet at this time with his extensive premises, but the Garnetts' Hunslet Soke Mills were more highly rated, at £300, than either the Leeds Pottery (£200) or the two breweries (£100 each). In 1796-7 they fulled over 4000 pieces of broadcloth, more than Benjamin Gott at Bean Ing.[3]

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1. LM 25.11.1799.
3. Bradford Sessions returns, 1796-7.
2. Sun CS11/649657, also there was 'weaving apparatus' valued at £50.

Cotton Spinning

By 1800 Hunslet was a thriving cotton spinning centre. There were at least three mills, Coupland and Wilkinson had two (209)[1], Beverley, Cross and Billiam[2] had another, and Ard Walker was rebuilding his mill. Couplands seem to have been the more successful, since by the time they were declared bankrupt in 1821 they had three mills on Low Road, one was the scribbling mill let to Copley by 1788, which continued to be used for wool, a second mill was demolished in 1824 and the largest mill was still spinning cotton as late as 1827.[3] The main mill was four-storey, with a 40 h.p. engine (RV £80). Beverley, Cross and Billiam's mill was burnt out and never rebuilt, so the exact site is doubtful. The mill was worked from 1792 until 1796,[4] at which time it had 1800 spindles. More is known of the Waterloo Mill (199), on Balm Beck. It was built in 1786/7 by John Storey, as a water-powered oil and cotton mill, with two reservoirs behind the mill to ensure an adequate water supply. Storey died and the mill was insured by his executors.[5] Ard Walker, the tenant,

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1. Hunslet Rate Book 1791. "Copley's" Scribbling Mill was insured for £300(1788) RE13/102199.
2. Sun CS11/649649 1795.Cotton mill(1st Class)£600,engine £800.
3. The situation is not clear since the scribbling mill, with an 18 h.p. engine, was described as a cotton mill in the bankruptcy sale notices, but was rated as a scribbling mill in 1824 (RV £38).
4. B & W Mss(B'ham)Box 261,Lawson Memo,engine started August 1793
5. Sun Mss 119/32 Vol.XV,15.2.1796,£2460 paid out jointly with Sun CS 343/530724(1787). R.E.
Ard Walker, oil & cotton merchant, Richard Greaves,merchant, both of Leeds,and Wm.Davy,gent.of Kildwick,near Skipton, for £1000.

insured his goods for £600.[1] The 1788 Rate Book[2] assessed the mill at £30 and described it as 'new'. By 1791 Ard Walker leased and operated the mill (RV £56).[3] In 1787 the mill was 'brick and slate' but in 1795 it was 'stone and slate' with a steam engine 'used to raise water only'[4] and by 1797 the value of the engine had been doubled,[5] so it would appear that a new engine had been installed to power the mill and not merely pump water from the tail race back up to the reservoir. By 1803 plans had been lodged for a 5 storey mill of 1500 sq. yds.[6] By 1823 Walker had let the mill to the Ingham family as a scribbling and fulling mill, with dam, water wheel and a 36 h.p. engine.[7] There was one other cotton mill in the area, Musgrave's cotton mill, in Simpson's Fold, near Leeds Bridge, burnt out in 1806.[8] The cotton industry in south Leeds was of short duration but one point must be noted, the insurance records list under 'clockmaker's gears', 'carding and

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1. Sun CS 343/530/530723 (1787).
   Storey's daughter married Ard Walker in 1774, LM 11.1.1774
2. John Goodchild Collection.
3. Hunslet Rate Book 1791.
4. Sun CS10/646372 (1795).
5. Sun CS19/671055 (1797).
6. Sun CS88/833882 (1810).
   This relates to the new mill details of which are noted in Leeds Archives DB 23.
7. Hunslet Rate Book 1823.
8. A. Mayhall Annals of Yorkshire (1876) 1806

breaking engines and moveable utensils' ... unless hand powered jennies were included in 'moveable utensils' there is no direct evidence as to the actual method of spinning in use, but J. Cross wrote to Boulton and Watt in 1792:

> "I am concerned with some friends in building a cotton mill. It is 75 yards in length and ten in breadth within the walls, four storeys and capable of containing 30-40 spinning frames with 84 spindles each in a circular form after the plan of Mr. Peels". (23.6.1792)

Linen and Flax Dressing

There was a widely dispersed domestic linen industry in Yorkshire which was stimulated in the early eighteenth century by the substitution of an export bounty for the former export duty.[1] West Riding linen, like the woollen cloths of the period, was rather coarse, and sold to what is known as the "fast moving end of the trade". There were coarse linens, harden (hemp) and various mixtures of the two. Hemp was used for the warp of 'linsey-woollsey' and the use of a strong linen warp with the weaker cotton weft was an important stage in the development of the cotton industry at a time when cotton fustian was the only legal cotton cloth. During the eighteenth century local flax was supplanted by supplies from the Baltic, imported through Hull. One of the leading Leeds linen merchants was

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1. J. Horner, The Linen Trade of Europe (1920) pp 219-33

John Wilson of Camp Hall, Holbeck (41). His ledgers have survived[1] and he was described as a buckram manufacturer also.[2] His financial backing came from a fellow Quaker, Arthington, the brewer. Wilson employed hand loom weavers but did not spin yarn. The division of the trade between spinners and weavers arose at this time as the quality of the cloth was being improved. To produce better cloth not only had the woven material to be bleached but the yarn also bleached. This meant that capital was locked up in stocks at two stages of production since bleaching was mainly by 'grassing' - exposing to the sunlight, and was a lengthy process. The initial stages of making yarn differed from cotton or wool since the flax fibres are very long and stiff. The imported dried fibre was scutched - often by water-powered 'beaters' and then heckled by hand, a process similar to combing wool for worsteds. The flax spinning wheel differed in detail from the cotton or woollen wheel but the hand looms were similar. By the late eighteenth century the development of the woollen industry south of the River Wharfe, and the growth of Leeds as the chief commercial centre, had led to a decline of the domestic woollen industry north of Wharfedale and a complementary growth of the linen trade with a strong link between merchants in Leeds and Knaresborough. Flax spinning was very much the poor relation of wool.

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1. Leeds City Archives, W. Records of John Wilson, linen manufacturer, Camp Hall (1754-1833).

2. Wilson, Directory of Leeds (1809).

In 1787 a roller draw-frame and flax spinning machine was patented by Kendrew and Porthouse of Darlington.[1] John Marshall, a young Leeds linen draper, and Ralph Dearlove, a Knaresborough linen maker, set up a business as flax spinners in a small corn mill on the Meanwood Beck at Adel, north of Leeds. The Darlington-designed machines were far from perfect and they were fortunate in securing the services of a good mechanic, Matthew Murray. With Murray's aid, Marshall improved the machinery[2] and moved to a new and better site between the Leeds-Liverpool Canal and Water Lane. Extra capital came from the Fentons and the first purpose-built flax mill was erected in 1791 (27). It used a Savery-type engine to pump water for an overshot water wheel, but in the following year a 28 h.p. Boulton and Watt rotative engine was installed. In 1793 this drove 900 spindles. From Shrewsbury came Thomas Benyon, who replaced Fenton in the partnership with Marshall, and a second mill was built in 1795/6, next to the first. Although a heckling machine had been invented[3] the heckling sheds of Marshall and Benyon were still full of hand workers as depicted by Walker,[4] and the use of machines for heckling was slow to develop. Further developments at the Marshall mills came after 1800 and will be dealt with later. Before 1800 Marshall was the only flax-spinner of note in Leeds. One reason for this seems to have been the relationship between wool and linen in

1. British Patent 1613 of 1787.
2. British Patent 1752 of 1790.
3. Sellers & Standage, British Patent 2034 of 1795.
4. J. Walker, Yorkshire Costumes (1814).

the town. Both needed water power and in Leeds this had been pre-empted by the woollen merchants with their scribbling and fulling mills. All that was left for the flax-spinners was steam power which required a heavy capital investment and running costs for the coal used. In its favour, steam power was independent of the seasonal flow of the river and, unless a waterwheel were on the main stream, elaborate leats and reservoirs were essential to ensure a reliable supply of water (c.f. Waterloo Mill, above). In Nidderdale the decline of the woollen industry left fulling mills idle and these were converted to flax spinning by spinners who had formerly worked on commission for Leeds and Darlington merchants. Probably the only other flax mill in Leeds, apart from Marshall's, before 1800, was built in 1798 by Richard Paley, iron merchant, soap boiler etc. etc., and let to J. & G. Wright.[1] Titley, Tatham and Walker of Water Hall Mills (40) claimed to have been there from 1800 and that it was built as a flax mill in 1788: this is hardly possible, for technical reasons already noted. It is more likely that the claim made by Titley & Co. that they were founded in 1805 is correct since this would agree with the report that Titley's thread mill in Hunslet was burnt out[3] in 1807. The great age of the Leeds flax industry came after 1800.

Other Industries

In terms of capital employed, the next industry in size to

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1. Leeds City Archives, DB 233.
2. Factories Inquiry 1834 Vol.II C1 and Industries of Yorkshire Part I (1888) Historical Publishing Co.
3. Mayhall Annals 1807.

textiles was probably brewing and malting. The large number of small malt kilns in Hunslet and Holbeck reflected the demand for malt and several of the larger houses included a brewhouse. There were many inns and most of these brewed their own ale, their occupiers were in fact "licensed victuallers". As the industrial population increased so did the demand for beer, the staple drink of the working man in an age when the purity of water supplies was doubtful and tea was still an expensive luxury. The type of housing being built for the 'labouring poor' did not allow for home brewing. The common brewer, typified by Sam Whitbread, Barclay etc. had developed in similar circumstances in London early in the eighteenth century but the first common brewery in Leeds, Jaques & Co., was established in Meadow Lane in 1756 (65) with an output of 50 quarters weekly.[1] Using Peter Mathias' conversion tables[2] this equals 200 barrels. By 1763 it was advertised for sale[3] with a stated capacity of 'wetting' 80 quarters each week (= 320 barrels). It was again advertised in 1781[4] but still remained in the hands of Jaques & Co. The freehold was bought by George Jaques from R. Dennison in 1786.[5] Known as the 'Old Brewery' it continued for many years in

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1. ibid.
2. P. Mathias The Brewing Industry in England, 1700-1830 (1959) p. 541.
3. LI 6.12.1763.
4. LM 6.11.1781.
5. LCD 43.

the hands of the Jaques and in time passed to their partners, the Nell family. Almost as old was Thomas Arthington's brewery in Hunslet Lane (81), first assessed for rates in 1763 at £29[1] and at £100 in 1791.[2] Thomas died in 1794 and his son took the brewery over, advertising the succession in December 1794 and again in January 1795. Close to Arthington's brewery and, like Jaques, in Leeds township, was another brewery. This belonged to William Sykes and was probably started in 1786 (c.f. Baines' Directory 1817). An invoice dated 1796 describes the Syke's brewery as being:

"opposite Brandling's coal staithe" ...

which was on Casson Close (76). Sykes let this brewery to an Armley maltster called Joshua Tetley in 1822 and it has been in the family ever since. The only other brewery working before 1800 was at Burton Row on Hunslet Moor (178). It was listed as occupied by Green and Allison in 1788[3] and as Jn. Green in 1791.[4] These breweries used a great deal of coal in malting the barley and boiling water for the mash tun, but none was large enough to need a steam engine to pump the wort such as Whitbread had installed at his Chiswell Street brewery in London.

The route followed by Jack Lane from Hunslet to Holbeck marks an outcrop of good potters clay and there were numerous

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1. John Goodchild Collection: Rate List 1763.
2. Hunslet Rate Book 1791.
3. John Goodchild Collection: Rate List 1788, RV £25.
4. Hunslet Rate Book 1791, owner E. Armitage, RV £100.

potteries as a result. The greatest of these was the 'Leeds Pottery' which was started in the 1750s as Humble, Green & Co. (128) (Richard Humble was Brandling's Middleton estate agent). By 1770 it had extended and on the original site a windmill for grinding flints was built.[1] The pottery was now 'Hartley and Green' and in 1783 the postmaster of Ferrybridge, Thomas Wainwright, and Hanson, joined the partnership, which reflects the links with the Rockingham Pottery at this period. Parts of the site were leased from various landlords but the actual pottery buildings were freehold and rated at £130 in 1788[2] and in 1791 Messrs. Hartley, Green & Co. were assessed at £200 for the pottery, warehouses, workshops, windmill, yard and workmen's houses.[3] According to Mayhall[4] the flint mill crashed down in a thunderstorm because it was worked on a Sunday, but about this time the flint mill was turned over to corn grinding following a change in manufacturing policy. The Leeds Pottery was almost as famous as Wedgwood, following Hartley's innovations. Instead of the local Wortley 'pipe-clay' being used for stoneware he introduced the use of Dorset and Cornish clay and Kentish flint. These came as ballast by sea and the Aire and Calder Navigation. Following a dispute with the Navigation Company over transport dues, the flints were transported up the tariff-free River Ouse and River Wharfe to a watermill at Thorpe Arch.

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1. LM 28.8.1770.
2. John Goodchild Collection: Rate Book 1788.
3. Hunslet Rate Book 1791.
4. Mayhall Annals 1774.

The ground flint was brought by road from Wetherby to Hunslet, avoiding the payment of navigation tolls. By 1800 annual sales were over £30,000 and the 200 workers drew £8,000 in wages. Leeds Creamware rivalled the sales of Wedgwood, especially in the Baltic markets. The success of the pottery at this period was undoubtedly due to the links with the Middleton Railway which ran through the site and enabled coal to be delivered directly from the pits and also provided transport to Casson Close, by Leeds Bridge, and the wharves. Water transport was vital for the safe delivery of pottery. This favourable site was a great help to Hartley as the technical director, with advanced ideas on design and marketing. There were other, smaller, potteries - Petty & Rainforth had one next to the Leeds Pottery on Leathley Lane from 1757 until 1792 (131), when they opened Hunslet Hall Pottery on Holbeck Moor (174). In 1800 Samuel Rainforth was granted a lease by the Ingram estate of a pottery, warehouse and oval (kiln).[1] Pettys exported their wares as far as Brazil. In the same area was another pottery begun by Dennison in 1769 and taken over by Thomas Cartledge about 1800, at a later date this became known as the Victoria Pottery (110).

Coal Mining

Potteries, breweries and maltings were all heavy users of coal, much of which was mined from shallow pits in Hunslet.

1. Leeds City Archives: TN 245 (1800)

These pits lay along Jack Lane, on the rising ground south of the moor towards Beeston and, by 1794 (Smithson Estate Map),[1] across the Wakefield Turnpike north of the township. Most of the coal pits in Hunslet were worked under lease by Fenton and Smith. The Fentons were known in the nineteenth century as the 'Coal Kings' and their interests in mineral workings were extensive in the county and elsewhere. Most of the pits were no more than 'bell' mines with a very short working life but one was deep enough to require an engine for drainage pumping. In the 1788 Rate List, Fenton and Smith held 'Engine Close' from Trinity Church.[2] On the 1791 rate map this was plot 365 and had on it a "fire-engine".[3] It is most probable that this was a Newcomen type beam engine but it could well have been a Savery type engine which drew water from the workings.

South of Hunslet lie Beeston and Middleton, where all the maps of the period show numerous coal and ironstone pits. In Middleton most of these were owned by the Rev. Charles Brandling of Newcastle. Being familiar with the 'coaly Tyne' he was not slow to exploit the good quality coal on his Middleton estate and to do this effectively needed a better system of transport than by wagon along twisting country lanes. Whilst his mining operations are outside the scope of this study, his railway ran across Hunslet Moor,

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1. Leeds City Archives: DB 14. Various Estates in Hunslet.

2. John Goodchild Collection: Hunslet Rate List 1788.

3. Leeds City Archives: LO/HU/4.

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1. Leeds City Archives: DB 14. Various Estates in Hunslet.
2. John Goodchild Collection: Hunslet Rate List 1788.
3. Leeds City Archives: LO/HU/4.

through the Leeds Pottery and terminated at Casson Close near Leeds Bridge. The original 'coal road' from his pits ran practically along the Hunslet boundary to riverside staithes at Stourton. This coal road was a wagon-way of oaken rails with replaceable beech facing strips on the wearing surfaces. The wagons had small diameter wooden wheels fitted with iron discs which acted as a flange and kept them on the 'lines'. Brandling's local agent was Richard Humble and he began to bargain for land and wayleaves in 1749 to obtain access to the riverside. By 1755 coal from the Hunslet staithes went by river to compete with that supplied by the Fentons, from Rothwell, on the Leeds market. To secure better access to this growing market Brandling needed a private Act of Parliament to enable him to take a new wagon way directly to the town. Under the terms of this Act,[1] Brandling's route was secure so long as he supplied a minimum of 24,000 tons of coal each year at 50.3d per ton. The scheme was a success and output from the Middleton pits rose rapidly. A further Act was obtained[2] permitting an increase in price of 8d per ton but Brandling had to supply 12,000 tons in each quarter at this price. The Act also authorised the sale of coal en route to Leeds, a practice noted on Hunslet Moor in 1771 and of vital importance to the industrial development of the area since cheap coal was essential for steam engines, dyehouses, glasshouses,

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1. 31 Geo. II c.22 1758.
2. 19 Geo. III c.9 1779.

south about 1807. At the same time sales appear to have ceased at the riverside staithe at Hunslet.

Mention has already been made of the Hunslet Foundry (211) which began about 1750.[1] It was sold in 1772 by R. Howitt to Titus Salt and Timothy Gotthard. Neither were listed in the rate books until 1791 when Titus Salt was stated to be the owner of a house and forge;[2] Timothy and John Gotthard lived in houses close by. Another small foundry was at Balm Beck mill (214), worked by William Hodgson. Both of these were foundries where iron ore was smelted and castings made. In the district were a number of millwrights, who by 1800 were installing steam engines and making textile machinery. One of the earliest of these was John Jubb who occupied the Soho Foundry (64) about 1792.[3] He was described as 'Millwright and Machine Maker, Meadow Lane' by Morris (1798) and in 1801 erected the steam engine for a mill in Huddersfield. John Sugden was in the same line of business on Dewsbury Road, where he started the Sun Foundry (125). Another machine maker was Joseph Drabble (Morris 1798) of Water Lane, but he does not appear to have had a workshop. Presumably, like Jubb and Sugden, much of his work was carried out 'in situ' when parts were assembled to build engines and machines. This is illustrated later

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1. Leeds University Brotherton Ms. 165/37. E.K. Scott Collection.
2. Hunslet Rate Book 1791 RV £20.
3. <u>LI</u> 29.11.1791 John Jubb married Grace Ponsonby. 2.6.1794 John Jubb, millwright, wants 3 journeymen, makes scribbling, carding and thrashing machines.

in the development of Ard Walker's mill after 1801 (199). Fenton, Murray & Wood were not listed by Morris in 1798. Matthew Murray came from Darlington and worked for John Marshall, successfully developing his flax spinning machinery, before launching out on his own in 1795 at Mill Green, Holbeck. The next year he moved to Camp Field, on the opposite side of Water Lane to Marshall's two mills. Capital was raised by forming a partnership of Fenton, a linen draper, Wood, a machine maker, and Murray, the design engineer, with Lister as a sleeping partner for a short time. They advertised their business in 1796[1] but did not build the famous Round Foundry (34) until 1802. Taylor, Wordsworth & Co., who closed down on amalgamation with Prince, Smith & Stells of Keighley in 1967, began as machine makers in 1793[2] further along Water Lane (23) opposite to the other end of the Marshall site.

In Hunslet, William Varley set up as a wire-drawer, in Low Road, in 1740 (206). The business passed to his son on his death in 1794.[3] Wire-drawers made the teeth for carding boards, an important ancillary trade before carding engines were widely used. In addition they made sieves for general use and in corn dressing machines. As a side line the Varleys also operated a glue works.

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1. LI 11.7.1796.
2. LI 3.2.1794.
3. Ibid.

Before 1800 there were few other industries of note south of the river. Both townships had their own corn mills, at Mill Green (3) in Holbeck and on the Aire at Hunslet (207). Hunslet Mills were used for fulling and scribbling as well as grinding corn since they had an excellent supply of water for power. In Hunslet there were two 'distil Houses'[1] which developed into chemical works later. Their main product was Sulphuric Acid (vitriol) for use in textile bleaching. The Chamber Process for making Sulphuric Acid was developed about 1740 by Joshua Ward and by 1746 the glass retorts were being replaced by lead lined chambers at the Prestonpans works, in Scotland. In Leeds the scale of manufacturing was relatively small and the use of glass retorts persisted for many years. A billhead for John Bower's Hunslet Glassworks shows that they were still in quantity production in the 1830s.[2]

In terms of transport, the area was well served. The turnpikes to Halifax and Elland were begun in 1740 and the Wakefield road was improved by Turnpike Trustees after 1758. Water transport was of major importance. The Rivers Aire and Calder were improved by a Navigation Company incorporated in 1699 which made Leeds Bridge the head of navigation on the River Aire. This assisted commercial development, since goods for many parts of the West Riding were landed at Leeds for road transport on the turnpikes. There were many carriers living on Meadow Lane and Simpson's Fold

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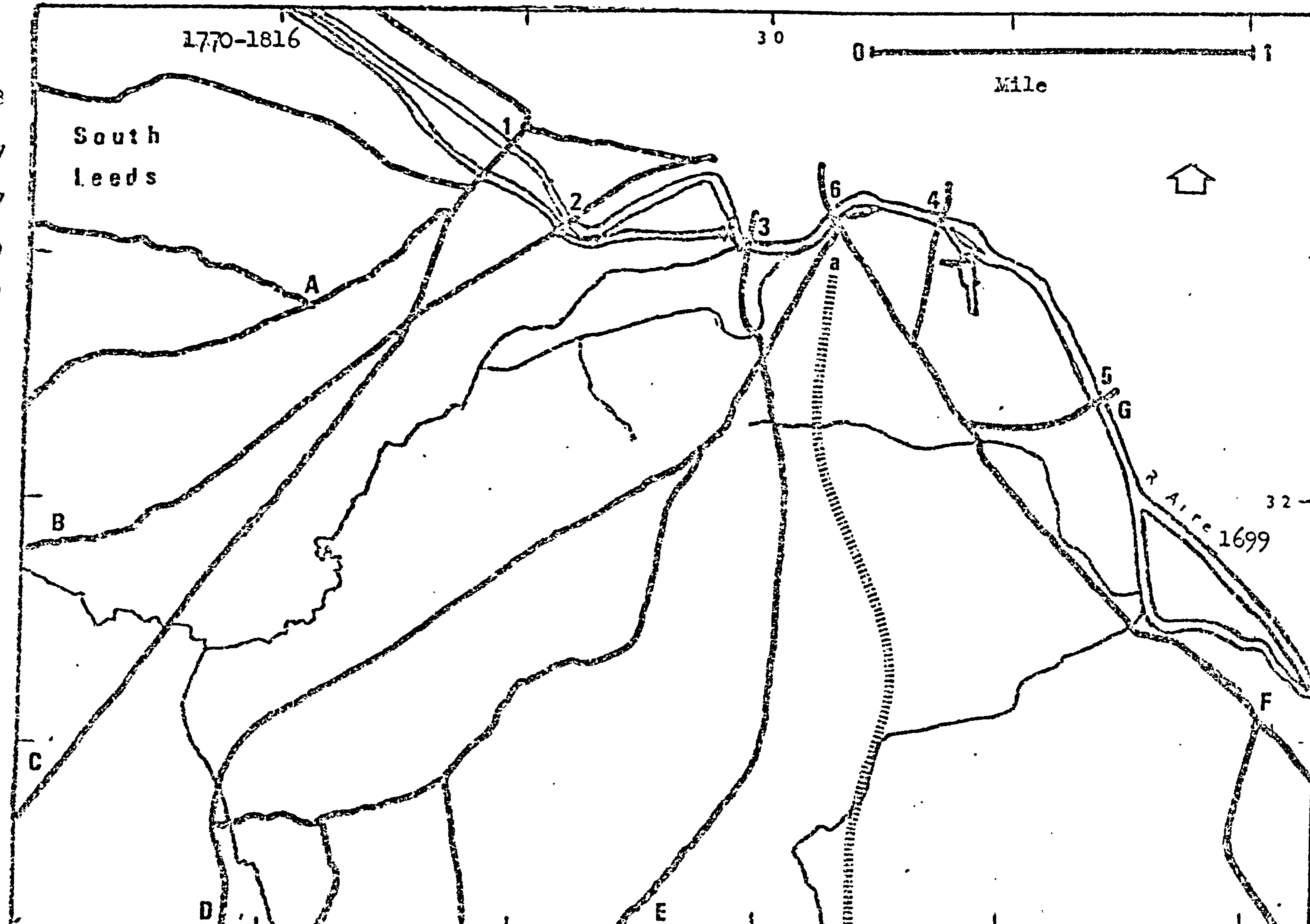
1. Hunslet Rate Book, 1791. Joshua Bower RV £10, Fenton & Co. RV £20

2. Leeds City Archives. Glover Collection, A133a

SHEET NUMBER 2



	BRIDGES		
1	Wellington	1818	
2	Monk	1827	
3	Victoria	1837	
4	Crown Point	1840	
5	Hunslet	1829	
6	Leeds medieval		
	TURNPIKES		
A	Tong	1742	
B	Halifax	1740	
C	Huddersfield		
D	Elland	1740	
E	Dewsbury	1825	
F	Wakefield	1758	
G	Hunslet	1829	
a	Middleton Railway	1758	

ROADS & BRIDGES

as a result. This favourable situation was further enhanced by the start of the Leeds-Liverpool Canal in 1770. Plans were drawn up and approved by the great canal engineer, James Brindley. Work began at both ends and soon the canal stretched from Liverpool to Newborough (28 miles) and from Leeds to beyond Skipton (33 miles), with a branch to Bradford. Until further Acts, in 1790 and 1794, permitted the raising of more capital and variations in the line, there was no more development. Even in its incomplete state the canal opened up Airedale to bulk cargoes at low rates, providing cheap transport for coal, iron, corn and lime in particular. To handle all this trade the company built a large stone warehouse with an enclosed dock, by 1790. There were open wharves with cranes, and between the canal and the river there were stone merchant's yards and a boat building dock. This stimulated development along Water Lane: merchants and carriers at first, then industry. With Leeds Old Bridge forming a traffic bottleneck, cargoes unloaded on the south bank could be cleared more quickly for Hunslet, Holbeck or any of the places served by the four turnpikes to the south. The first mills were Marshall's flax mills, but nearer the canal basin were lesser trades. J.W. & J. Kaye were sacking makers (Morris 1798) - possibly the 'flax mill' built in 1788 which became Titley, Tatham & Walker in 1805 (40). It is not likely to have been a power spinning mill, like Marshall's, but probably contained handlooms for weaving canvas. Next door was another concern which survived for almost a century, John Armistead, mustard and brush maker. His mustard mill was later steam-powered but before 1800 it was almost certain to have had a horse wheel for grinding and crushing the mustard seed (39).

To summarise, the situation by 1800 was, in Rostow's terms, 'ready for take-off'.[1] A good transport system by water and road was in existence and the Leeds-Liverpool Canal was once more under construction. There was an established nucleus of textile manufacture based on steam power rather than the water wheel, with ample supplies of cheap coal, thanks largely to the Middleton Railway. The mills were close to the main commercial centre but still rural, with lower rents and land prices. Industry was still sparse but there was a range of trades to provide employment for men, women and children. There was ample room for expansion both for factories and cheap housing. There was a relationship between industries: they were either complementary, like coal mining, iron founding and machine making, or alternatives, like the various branches of the textile industries. A change in demand for cotton might be balanced by a compensating demand change for, say, flax. This meant that, at relatively small cost, a mill could be changed from one fibre to another according to the state of trade over a period of a few years. One feature not peculiar to south Leeds was the availability of capital. Prosperous merchants would lend on mortgage or become partners in starting new mills, or the landed gentry would build a mill to lease to

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1. W.W. Rostow, <u>The Stages of Economic Growth</u> (1960) Chp. 3.

a promising entrepreneur. The only example of this in the district covered was the lease of the Hunslet Hall pottery by the Temple Newsam estate in 1800 to S. Rainforth.[1]

1. Leeds City Archives TN 245 (1800) 21 year lease to S. Rainforth.

THE DISTRIBUTION & DEVELOPMENT OF INDUSTRY 1800 ONWARDS

TEXTILES - The Woollen Industry CHAPTER 3

The beginning of the nineteenth century was in many ways traumatic for the Leeds Woollen Merchants. They had made their great fortunes by specialising in buying cloth 'in baulk' (i.e. unfinished), having it finished by independent cloth dressers, and then selling the bulk of the cloth abroad. At the end of the eighteenth century, in a period of unprecedented expansion, many merchants set up their businesses in Hunslet and Meadow Lanes and, as already noted, some took over the finishing processes. With the introduction of scribbling and carding machines the organisation of the trade began to change. Fulling millers installed scribbling and carding engines (machines) on the upper floors of their mills, clothiers bought hand-operated spinning mules and the widespread use of the fly-shuttle increased weaving output. Just as the merchants were placing orders with some clothiers directly, by-passing the Cloth Halls, so clothiers began to sell directly to customers and by-passed the merchants. The more or less continued depression of the first thirty years of the nineteenth century saw an end to the merchant per se and those who survived did so by becoming involved in the manufacturing side of the trade.[1] It has been said that the policy of the government in placing contracts only with

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1. R.G. Wilson, Gentlemen Merchants, 1700-1830 (1971)

manufacturers encouraged merchants to make this move.[1]

Leeds has never been a major centre of wool textile manufacture. The Leeds merchants specialised too much in the fine broadcloths which were less fashionable after 1800. The new fashion was for stuffs (worsteds) and the Bradford area developed this trade.[2] In a similar way the decline in the quality of the home wool clip and the higher cost of imported German wool stimulated the use of shoddy (wool clippings and rags) in the manufacture of cheap woollens and blankets in Dewsbury, Batley and Morley, a trade which spread into Hunslet and Holbeck in time.

This change in the trade, the emphasis on the importance of the clothmaker at the expense of the merchant, is well illustrated in the area south of the river. Hunslet was the most populous of the out-townships, lying alongside the Wakefield turnpike and by the Aire and Calder Navigation, with ample supplies of cheap coal from Middleton and local pits for the stoves, presses and dye vats. Hunslet had 10 clothiers with the franchise in the 1807 Poll Book and Holbeck had 12 so it is apparent that these were important centres of cloth making and ripe for development as the organisation of the trade changed. Edward Brooke, although not one of the great Leeds merchants, had moved into clothdressing and the family business was in Hunslet Lane

1. Oral communication: Wm. Lupton & Son, Whitehall Mills.
2. E. Sigsworth, Black Dyke Mills (1958).

under the day-to-day control of John Brooke, merchant, and Joshua, clothier. On a much smaller scale, Burrow Copley was a scribbling miller and his father was described as a merchant. Many of the more substantial Hunslet clothiers became merchants and mill owners in the early years of the century, but most of these 'new men' left Hunslet. David Dunderdale went into partnership with John Plowes and set up business north of the river at Woodhouse Carr mill. When Plowes went bankrupt in 1803, Dunderdale advertised for another partner with £20 - 30,000 to invest.[1] Willans took over Holbeck Mills (15), formerly Fisher & Nixon, the biggest fulling and scribbling mill in Holbeck.

The number of mills increased and in 1824 Lindley noted 9 woollen mills utilising a total of 208 h.p. Lindley's record indicates that the majority of woollen mills were in Leeds proper, 31 out of 40 in fact.[2] The Garnetts relied entirely on water power at Hunslet Soke Mill (207) and Inghams, in addition to finishing shops on Hunslet Lane, rented Waterloo mill (199) which had a waterwheel supplemented by a steam engine.

Taking the 1823 Hunslet Rate Book as a basis for comparison in Hunslet township, the biggest mill was Pym Nevins,

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1. LM 28.1.1804.

2. Leeds University, Brotherton Library, Ms 18. Number of Steam Engines ... from a survey made by Wm. Lindley in March 1824.

Larchfield (152) assessed at £83. Inghams were assessed at £73 for Waterloo Mill (199) but also occupied finishing shops and a dyehouse worth £52. Daw bridge mill, Faustino de Gama (139) was rated at £50, Copley's mill (210) at £33, Garnett's water mill (207) at £30 and J. & W. Wilkinson's scribbling mill (143) at £10. Sayner's dyeworks (104) were assessed at £63 but to the dyehouse of 1792 had been added a scribbling and fulling mill in 1813.[1] This was not noted in the rate book but the dyehouse and a gig mill were mentioned. This gig mill was burnt out the following year.[2] No other manufacturers were using power in Hunslet and there were numerous warehouses, glossing and cropping shops, dryhouses and press and packing houses. There were only a few 'weaving chambers' specified so the majority of hand looms must have been in the homes of the weavers.

In Holbeck, by a cross-comparison based on power used, the largest mill was Obadiah Willans' (15), closely followed by his neighbour over the beck, T. B. Hogg, Holbeck New Mill (14). Close by were Ripley & Son, Union Mill (18). Higher up Holbeck was Robert Atkinson in a steam mill built about 1803 (17) and Millgreen Mill (5). Blackburns were on Holbeck Moor with a scribbling mill[3] (105) and with a press shop and weaving chambers nearby. Potterdale

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1. Factories Inquiry (1834) Vol. II C1. 37.
2. Mayhall Annals 7.1.1824.
3. LI 10.9.1798.

Table 3.1

Clothiers in Hunslet and Holbeck (Source: 1807 WR Poll Book)	
HUNSLET	HOLBECK
W. Allison	C. Atha
A. Appleyard (stuff dresser)	S. Bentley
E. Brooke (merchant)	F. Braithwaite (cropper)
J. Brooke (merchant)	J. Britton
Joshua Brooke	T. Britton
J. Carr	J. Cooper
T. Carr	J. Croisdale
W. Clapham (fulling miller)	N. Dunderdale
B.Copley (scribbling miller)	T. Johnson (merchant)
J. Copley	S. Leathley
R. Davison (cloth dresser)	W. Maltby (woolcomber)
J. Flintoff (merchant)	G. Reynard
J. Goodman (gent.)	T. & J. Rhodes (scribbling millers)
J. Hird	J. Richardson
J. Ingham (merchant)	J. Simpson (woolstapler)
B. Kitching	W. Tillotson
W. Mason	J. Ward
G. Sayner	J. Williams
J. Sayner (dyer)	
B. Willans	

Mill (124), on the new Dewsbury turnpike, was built in 1823 as a dyehouse and dressing mill and on Fleece Lane was J. Young & Co., clothdresser, using 18 h.p. (56). The absence of fulling stocks from some mills usually indicates that there was insufficient power available for these heavy machines. Pym Nevins was a fully-integrated manufacturer of fine broad cloth employing over 550, nearly 300 of whom were men, 64 were women and the rest boys and girls.[1] The dressing mill was built in 1818 and there were 140 (hand) looms in use,[2] as well as a dyehouse. It is possible that Nevins at least fulled cloth for the Brookes since they had no machinery of their own and in 1795 John Brooke and Nevins jointly borrowed £2,750 from Abel Smith, the Nottingham banker.[3] Da Gama's Daw Bridge Mill (139), managed by another Italian, Antonio de Macedo, employed 75 hands, including 12 weavers and 4 spinners.[4] J. Wood & Sons, Potterdale Mill (124) employed 66

> "excluding burlers, dyers and weavers not dependent on the engine."[5]

Other new mills built in the 1820s were St. Helens Mill (143) replacing the smaller scribbling mill of J. & W. Wilkinson on Hunslet Lane and, in Dock Street, Hindes and Patchett

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1. Factories Inquiry (1834) Vol. II C1. 138.
2. LM 28.11.1829.
3. LCD 18098.
4. Factories Inquiry (1834) Vol. II C1. 137.
5. ibid 106.

became worsted spinners and by 1834 employed 331 hands at this steam-powered mill.[1] There were changes of use also. Burrow Copley's mill became Westley's flax mill (210) and Ard Walker's cotton mill became Ingham's Waterloo Mill (199). The merchant firm of Pickering, Buckton & Gamble (Wilson 1807) became J. Buckton, assessed at £32 for an 8 h.p. engine, mill, dyehouse, warehouse and tenter ground in 1826.[2] Buckton had become a clothdresser but by 1845 Joshua Buckton & Son had become testing machine makers, and the mill became the nucleus of their Wellhouse Foundry (118). The old established woollen merchant firm of Job Charnock in Meadow Lane went into manufacturing and what began as an iron and brass foundry[3] by 1839 had become the Perseverance Mill, let to a cloth dresser, W. Kershaw & Co. In the meantime Charnocks had ventured into flax dressing in the adjoining Trafalgar Mill, which was also let out to tenants. The only remaining mill of consequence was a cloth-finishing mill

> "to let ... 3 stories high with a 12 h.p. engine."[4]

in 1829 and which became J. Marshall's 'Providence Dyeworks', in fact, a manufacturing chemists. This mill would appear to have been the workshops of C.W. & F. Brown, woollen merchants, Grey Walk, Hunslet, listed until 1822 (Baines).

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1. ibid. 175.
2. Hunslet Rate Book, 589, 590, 591 (1823/6)
3. LCD 15658, 1826.
4. LM 26.9.1829.

There is no direct evidence of power spinning either by mules or by throstle frames before the 1840s. Hand loom weaving was increasingly becoming a workshop occupation linked to a mill by 1830. In south Leeds the manufacture of woollens was relatively unimportant and the making of stuffs (worsteds) even less so. The power loom was introduced at Shipley in 1822 by a stuff maker, but it had to be removed from the mill under guard. Following a successful attack by local weavers the warp beam and roller were dragged in triumph through Baildon.[1] By 1835 there were 200 power looms in Leeds but none of them were recorded south of the river.

The Woollen Workers

C. T. Thackrah, quoted by Parsons,[2] described the health of woollen workers as follows:

> "Slubbers - men who form the carded wool into tough loose threads, and spinners - who make the threads stronger and finer ... have a very active employment and are enabled to live well. Children who are employed as pieceners are generally free from disease. Clothdressers, or croppers, working at the shears, seem little injured by their employment. We found few clothdressers aged ... this results chiefly from the introduction of cutters."

1. E. Parsons, History of Leeds (1834) Vol. II p.215.
2. ibid p.232.

Weavers were apparently sedentary workers:

> "though the limbs are fully exercised, the trunk is comparatively fixed. Stuff weavers have low wages and are often out of employ. There are more old men in weaving. Giggers, men who dress cloth by machine, are also exposed to wet and steam but have no complaint. Glossers, who smooth cloth by carrying over-heated heavy iron plates, appear unhealthy and sallow. Stuff pressers carry heavy red-hot plates, are generally aged 14-16 and many die of consumption."

Apart from describing the jobs, Thackrah confirms the suggestions made regarding the state of technical development in woollen manufacture.

The first generation of manufacturers developed a variety of processes aided by power and under their direct control. In Hunslet the Inghams and Nevins were the leading manufacturers, in Holbeck the leaders were Obadiah Willans and the Hoggs. Power was used for willeying, carding and scribbling, and, in the larger mills, for fulling. Weaving, by hand, was leaving the cottage for the workshop and the finishing processes were becoming increasingly mechanised. Despite the strong opposition in Leeds to the introduction of raising machines before 1800 it seems clear that by the 1830s raising and shearing machines were widely used since so many clothdressers used power. Nevins added a dressing mill in 1818,[1] Inghams converted a new dryhouse in Sayner Lane into a mill by adding a steam engine. This development of the business required a mortgage of £9,300 from Beckett and Gott.[2] The jenny, introduced to the cotton industry in 1767, was manually operated and had been 'stretched' to a hundred spindles. This was generally used for spinning abb (weft) yarn in the first quarter of the nineteenth century. Walker depicted the 'great' hand spinning wheel as still being in use in 1814.[3] Benjamin Gott introduced the Arkwright frame to Bean Ing about 1800 but it was not widely used elsewhere in Leeds. The bulk of yarn production was by the self-acting mule devised by R. Roberts in the 1820s.[4]

These manufacturers controlled the entire production process from the staple to the finished cloth. Initially their output was small and much of their business was commission work for independent clothiers or as cloth finishers for other merchants. As the use of power became commoner the capital investment required to set up a mill increased and business became increasingly concentrated in the hands of a few specialists.

The Sale Notice for the Larchfield Estate in October 1820

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1. <u>Factories Inquiry</u> (1834) Vol. II C1. 138.
2. LCD 18098, 1834 636.
3. J. Walker, <u>Yorkshire Costume</u> (1814).
4. Brit. Patents 5138 of 1825; 5949 of 1830.

shows clearly that Nevins operated as a substantial merchant and manufacturer, with all processes under his control but that the spinning and weaving sections did not use power whereas the other sections did.

In the 1823 Rate Book[1] J. & E. Brooke had:

> "cropping shops, dry house, press shops, burling house, glossing shop, warehouse and clothdressing shops"

- no power was used. Raising machines were introduced after 1816 but their use was not universal until a generation later. The shearing machine was developed in Gloucestershire in 1818 by J. W. Lewis and Wm. Davis. In Leeds, Wm. Lupton of Whitehall Road Mills, were the first to use them and there was some controversy over patent violations in 1829.[2] Nevins' new dressing mill of 1818 had 72 pairs of shears according to the Sale Notice of October 1820. The Lewis machine cut the nap 'from list to list' and the Leeds merchants, Wm. Hirst & John Wood, were advertising Collier's patent 'Perpetual', a machine which cut from end to end, at £250 each. Sayners advertised their dyehouse for sale in 1839 with 3 Lewis' and 1 Davis shearing machines[3] and the inventory of Perseverance Mill (67) in 1859 gives a full list of the machinery of a clothdressing mill.[4]

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1. Hunslet Rate Book (1823) 744, 751, 758.
2. LM 28.11.1829, 12.12.1829.
3. LM 28.12.1839.
4. Leeds City Archives DB 104. Inventory & Valuation, August 1859. 16 h.p. condensing engine, 4 brushing machines, 5 Perpetuals, 2 Lewis', 10 gigs etc.

Fulling stocks, heavy trip hammers introduced by the Knights Templar at the end of the twelfth century[1] and powered by water, had remained unchanged in design and continued in general use in the heavy woollen industry until the middle of the century. J. Dyer of Trowbridge, Wilts. invented the Rotary Fuller in 1833[2] and it became widely used in the West Riding in the 1840s. A. Chevalier, of Dewsbury Road (125) advertised Dyer's patent machine at £59 from 1834[3] and his works were shown as a 'fulling machine factory' on the 1847 OS map. Within thirty years the rotary miller had completely ousted the fulling stocks in most woollen mills.

Wood Textile ~~Woollen~~ Manufacture after 1850

The manufacture of woollens in Hunslet and Holbeck in the second quarter of the nineteenth century shows remarkable stability in numbers of units but the normal fragility of firms was evident. At Waterloo Mill, Inghams were followed by Jabez Stead and then there was a change of use about 1845. At Potterdale, the Wood family continued until after 1850 when others took over the mill.

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1. B.A. Lees, Records of the Templars in England in the XII cent. (1934) p.212.
2. British Patent 6460 of 1833.
3. LM October & November 1834.

~~Worsted Manufacture~~

Nevins died in 1836, a number of tenants followed at Larchfield until 1852 when it was bought by Donisthorpe and Croft who turned it into a worsted mill. They were deeply involved in the development of combing machinery and the legal battles over patents. The first attempt at a combing machine was Cartwright's 'Big Ben'.[1] J. Platt used a different idea in his machine[2] but there was no real progress until G. E. Donisthorpe invented his machine.[3] J. Heilmann introduced the 'nip' principle[4] which was further developed by Lister, of Bradford, and Donisthorpe, of Leeds.[5] Noble also made an important contribution[6] and the complex legal battle involved not only the inventors but also Taylor, Wordsworth & Co. of the Midland Junction Foundry, Water Lane (23) who made the combing machines for Larchfield Mill. J. C. Lister opened a worsted spinning mill in Low Road about 1848 (209).

Blackburn's Holbeck Moor Mill was up for sale in 1844[7] and

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1. British Patents, 1747 & 1787 of 1790; 1867 of 1792.
2. British Patent 5560 of 1827.
3. British Patents 9404 of 1842; 9780 & 9996 of 1842.
4. British Patent 11103 of 1846.
5. British Patents 12712 of 1849; 13009 of 1850; 13532 of 1851; 14135 of 1862.
6. British Patents 890 & 894 of 1850.
7. LM 25.5.1844.

and it was 'standing', i.e. not in use, in 1848.[1] After 1853 it was taken over by Croisdales who ran the adjacent New Mill from 1822 (Baines). The great Holbeck Mill of Willans was taken over by Pearson, a former Holbeck clothier, after 1834 (Baines and Newsome 1839). Willans moved out to Armley to another mill. Pearsons concentrated on cloth-finishing so presumably Willans' 120 hand looms were taken away to Armley. Pearson soon had a partner, William Kempe, who developed independently as a machine maker. At New Mill, across the Holbeck, Hoggs went bankrupt in 1829.[2] The mill was taken over by R. Nussey & Co., woollen merchants. Nussey was the son-in-law of Job Charnock and inherited Perseverance and Trafalgar Mills on Meadow Lane (67 & 68) on the latter's death in 1847. In addition to the Nusseys, New Mill also housed J. Brownridge, cloth dresser (Baines & Newsome 1839). Hindes & Patchett, on Dock Street, became Hindes & Dereham (Baines & Newsome 1834) and when the worsted spinning business closed down in 1844[3] the premises became a paper mill.

The Union Mill in Isle Lane (Ripley & Son) continued under the name of Isle Mills after 1850. Ripleys shared it with Servant & Co. (White 1853) as they had also shared Millgreen Mill (5) with Robinson, in the 1820s. This illustrates the expansion which a successful firm might carry out in prosperous

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1. Holbeck S.V. Minutes 1848

2. LM 8.1.1830.

3. LM 4.1.1845 'For sale, former worsted spinning mill of Hindes and Dereham'

times, and the contraction when adverse conditions arose so that the base was eventually shared or sub-let. De Gama's Dowbridge Mill (139) closed down and the site became part of Kitson's Airedale Foundry after 1839, but Wilkinson's small mill expanded as the St. Helen's Mill (143) and changed from the making of stuffs to felt carpet manufacture. This business lasted until the 1870s when most of the premises became a dyeworks.

The Borough Mill (56) of J. Young & Co. became a flax mill in the 1840s (Williams 1845: G. Smith, flax spinner) but the change may not have been total since it later became a cloth dressing mill again. The Garnetts at the Soke Mills (207) were followed by J. Jackson, stuff dyer, woollen manufacturer and corn miller (Williams 1845) but within a short time the business closed down and the mill was shown as a ruin.

In the first half of the nineteenth century the number of mills increased from ten in 1824 to seventeen in 1847. Of the original ten, seven lasted over half a century and six of these were in Holbeck. The main factors influencing mill location seem to have a good supply of water for scouring, fulling the cloth and for the boiler. Five mills in Holbeck adjoined the Holbeck. At the Mint there was a pond and a stream leading to the Holbeck; this provided water for Holbeck Moor Mill. The Dawbeck flowed from Dewsbury Road (Buckton's and Potterdale Mills), by Dawbridge Mill and Larchfield to enter the Aire by the Old Soke Mill.

Waterloo Mill used Balm Beck and Copley's Mill lay by the mouth of the beck. St. Helen's Mill, on Hunslet Road, had its own borehole[1] and the Borough Mills and Perseverance Mill lay close to the Benyon Beck. The two main dyeworks, Chadwicks and Sayners, were on the bank of the River Aire which provided ample supplies of water for dyeing and steam power.

The only other significant factors in location seem to have been the mechanisation of existing merchants' cloth-finishing shops on Hunslet Road and the proximity to the Leeds cloth markets, all the mills being less than two miles from Leeds Bridge.

In the second half of the century the number of mills remained fairly stable but there were many changes of ownership and site. The industry changed as the use of power spread to all aspects of textile manufacture. Woollen cloth manufacturers tended to total integration but worsted makers tended to separate combing and spinning from weaving. Cloth finishing absorbed fullers and dressers and the felt carpet makers vanished completely. Of the twelve mills in use in 1860, only five were still manufacturing woollens after 1900 and even these were not exclusively woollen mills. Most mills had several occupants.

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1. <u>YI</u> (1888) St. Helen's Dyeworks.

The 1860s was a period of expansion. New mills included Airebank (171) in 1863, Highfield (175) in 1866 and a felt carpet works in Clarence Street (161) which seems to have lasted a very short time indeed.[1]

The last decade of the century was the most critical in terms of mill closures. Larchfield (152), Victoria (17), Brookefield (147), Millgreen (5), Holbeck (15), were the survivors. The casualties included Potterdale (124), Lowgate (209), Holbeck New (14), St. Helen's (143), Borough (56). Isle Mill (18) and Perseverance Mill (67) went out of use in the 1870s. There were compensations, however, as old mills changed to other uses new mills were opened. The flax mill on Wilson Street (59) occupied by Dodgson & Mann (Williams 1845) became a cloth dressing mill let to J. Sellers & Co. (White 1853). They were followed by Ellis & Lumb (Jones 1863) who continued as W. Lumb (Kelly 1889), clothdressers, to the end of the century, employing 100 hands.

There were two major developments reflecting the need to make large scale capital investment in manufacturing; the power loom and large scale mule spinning. Benyon's flax mill (50) closed down in 1861 and was bought by G. Hodgson, a cloth manufacturer from Beeston Road. He shared the mill with a flax spinner and in 1874 sold out completely. Within

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1. Rivers Commission (1867) p.194 Wilkinson & Fillingham, Airedale Felt Works. 3 men.

a short time the premises were bought by Thomas Ibbotson.[1] Hodgson had employed 70 hands making and dressing cloth[2] in Benyon's mill. Ibbotson rebuilt the mill in latest fashion and renamed it Holbeck Mills, which continued as a large woollen mill until 1918[3]. The Hunslet Flax Mill (172) built by J. Wilkinson in 1838 became a blanket mill for M. Oldroyd & Sons. The new owners added weaving sheds for power looms on the old bleach ground to the north of the mill buildings. By 1900 the blanket making business had passed to Dodgsons who occupied the part of the mill nearest the river, the rest of the premises had a variety of users including Chadwick Bros.

> "clothiers, manufacturers of fancy worsteds, coatings, serges, vicunas and coverts."[4]

By 1900 the term "clothier" had come to mean a maker of clothes, a clothing manufacturer. In Hunslet Mill there was a substantial unit: Chadwick Bros. has 150 looms and Dodgson & Hargreaves, blanket makers, had 100 looms and 3000 spindles.[5]

For comparison the same source gives Jas. W. Best, Brookfield Mill (147), 16 looms, J. H. Robinson (Mill Green) Ltd. 72 looms in his Wellington Mill (4), and at Larchfield (152) in multiple occupation, there were Sands & Mundell Ltd. (plain

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1. LCD 8585.
2. Rivers Commission (1867) p.200 Benyon Mills.
3. Yorkshire Textile Directory 1917/18. 8300 spindles, 150 looms.
4. L.C.Y.B. 1920 p.XVIII.
5. Yorkshire Textile Directory 1917/18.

and fancy meltons) 95 looms and 4800 spindles, Thomas McNaught & Co., 30 looms and the Donisthorpe Spinning Co., 40 looms and 2400 spindles. The effective size of the local industry in 1914 would appear to have been 6 woollen mills, 3 shoddy mills, 2 dyeworks and 3 cloth-finishers. Thomas and W. A. Boyd were at Victoria Mills (17) and W. A. Boyd also used Low Hall Mills (16). Marsden Bros. (Yorkshire Indigo Dyers) were at Manor Road Mills (45). Another member of the Yorkshire Indigo Dyers, Wm. Kitchen, had succeeded Chadwick at Bowman Lane Dyeworks by Crown Point Bridge. The shoddy mills were those of W. E. Kenworthy, 15 Bowman Lane, J. E. Marsland & Co. Ltd., Land Court Mill (58) and Thomas Vause & Sons Ltd., Lowgate Mills (209), all began business in the closing years of the century in old flax or woollen mills and, from the surviving buildings, seem to have been very much at the lower end of the trade. The woollen mills in Hunslet and Holbeck had become outliers of the heavy woollen district based on Dewsbury, Batley and Morley.

Numbers Employed in 1867

The evidence of A. M. Fowler, the borough surveyor, to the Rivers Commission[1] regarding numbers employed in works on the River Aire and its tributaries throws some light on the woollen industry at the time. The only active mills not mentioned were Potterdale, St. Helens, Isle and

1. Rivers Commission 1867 p.194-201.

Perseverance Mill (Dewsbury Road) (123). Larchfield employed 400; Lowgate, spinning worsted, 200; Holbeck, 150; Victoria, 100; Holbeck New, 153 (three firms); Wilson Street, 90; Borough, 100 and, in Benyon Mill, Hodgson employed 70. The leading woollen manufacturer in Leeds, Benjamin Gott, employed 700 and Marshalls' flax mills employed 2700. In Hunslet and Holbeck there were 1260 of a total of 8900 woollen workers listed by Fowler. Allowing for mills not listed it would seem that one-sixth of the Leeds woollen industry was located south of the river.

Amongst others, John Wilkinson & Sons answered a questionnaire:[1] they had St.Helen's Mill and Airedale Mills and were felt cloth and carpet makers, employing 300 to make, print and dye 1200 tons of goods valued at £150,000. They were rated at £984 and their 160 h.p. engine consumed 4,000 tons of coal annually. An examination of the returns shows no average or typical mill. The amount of coal used to produce 1 h.p. annually varied from as little as 12 tons to as much as 83 tons. The norm seems to have been between 20 and 50 tons. This doubtless reflects the continued use of low pressure beam engines in old mills and the introduction of high pressure compound horizontal engines in the newer or modernised mills. If there were an average mill it was rated at £368, employed 92 hands and used 42 h.p.

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1. _ibid_. p.110. Questionnaire p.79: number employed, value of output and input, water and coal consumed etc.

Cloth dressing Mills

Regarding equipment, the valuation already noted for Perseverance Mill[1] was checked as correct in 1864 and a valuation of Holbeck Mills in 1889[2] showed it to be a dressing mill with similar machinery: 19 raising gigs, 2 perpetuals, 3 steaming mills, 2 brushing mills, 2 tentering machines. The only new machinery was a washing machine and a hydro extractor. Most of the machinery was made by W. Kempe & Co. who shared Holbeck Mills with Pearsons from the 1860s. The power came from a 2 cylinder compound beam engine, probably put in after the serious fires of the 1870s[3] and the two boilers were installed in 1880 and 1883 by Horsfields of Dewsbury. Clearly this mill had been re-equipped and it seems that re-equipment of existing mills or a completely new mill was essential for survival in the harsh economic climate of the later part of the nineteenth century. A small group of mills was started in the boom period of the 1860s and went out of business in the 1890s. Highfield Mill (175) was a felt carpet works, Carr & Butterworth (White WR L866 - Kelly WR 1889) and then became a clothing factory. Alderman J. Atha's chamois leather works in Belinda Street (204) became Orchard Mills and was shared with Garret & Shaw, woollen manufacturers, from

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1. Leeds City Archives DB 104 1859.
2. Leeds City Archives, Hepper V.B.234 p.101-110. Buildings £5154,Machinery £2628 inc. 35hp engine £500 & 2 40hp Lancs. boilers £600.
3. Mayhall *Annals* 23.10.1871, 28.4.1874.

1875 (White). At the turn of the century E. Garret was succeeded by the Stanley Rug Co. who also had works at Huddersfield and East Ardsley, coincidentally at the same addresses as a twine makers, J. Holmes & Co.[1]

The expansion of the industry in the 1860s and its contraction in the 1890s reflects the pattern of the trade. The 'Golden Years' following the Great Exhibition of 1851 stimulated capital investment in the following decade, especially in power weaving sheds. The reaction to the 'Great Depression' was even more delayed in its impact, and the pattern of closures and openings does not suggest any marked slump; more a gradual decline and change to cloth dressing and shoddy manufacture.[2] In a period of contraction it is difficult to observe significant factors specific to a site. Where a site had good buildings which could be adapted or extended easily then they continued in use as woollen mills. The fortuitous availability of the Benyon Mills and Hunslet Flax Mill in the 1860s emphasises this. Both were excellent sites with good water supplies and close to the market. Similarly, Airebank Mill reflects the elements of chance. The Dennison-Wilkinson Estate was put on the market in the early sixties[3] making a

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1. Yorkshire Textile Directory 1917/18.
2. S. B. Saul, The Myth of the Great Depression 1873-1896 (1969) discusses this problem in general terms.
3. LCD 5505.

stretch of open land, between Larchfield and the already developed area around the New Dock available for development, and this provided the site for the Airebank Mill.

The Clothing Industry

If the woollen industry contracted rapidly at the end of the century then the clothing industry expanded equally rapidly.[1] The mass production of men's suits in Leeds was based on a number of factors.

The labouring masses of the West Riding and South Lancashire provided an immediate market for the finished product, low-priced suits of serge, melton and covert cloth.

The sewing machine and the band knife, developed by Greenwood & Batley at Armley, made mass production easy.

Add to these an influx of Jewish refugees from the Baltic and the clothing industry came into being in sweat shops in that part of Leeds known as Little London, north-east of the town centre.

The earliest workshops south of the river were established in the 1890s. Once again an important attraction was the

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1. J. Thomas, 'The Early History of the Clothing Industry' Leeds Journal Vol. 25 1954 p.259 et seq.

availability of suitable premises at low cost. Woollen and flax mills became clothing works and fresh sites were developed. Maclea & March's Union Foundry (62) was sold by the executors to a rising shoddy manufacturer from Dewsbury Road.[1] Rawson paid £23,535 for the works, basically a two storey block surrounding a courtyard, and divided it into several self contained units, one of which was let to B. Eastwood, clothier. The Union Foundry had become the Union Mills.

Marshall's flax mills (29), on the market in 1886, were also divided and the occupants included Albert Hudson, who in 1912 moved to Water Lane and took over the clothing works of John Holmes, renaming it Trebla Works (22) ("Albert" spelt backwards). S. Walton was another clothier using Marshall's Mills.

John Holmes moved to larger premises in Joseph Street, built as Paterson's flax mill (190) and then occupied by another clothier, Schofield, when Patterson went out of business.

Marshall's great Temple Mill of 1840 became the clothing works of J. Rhodes.

The Round Foundry (34) which became the Victoria Foundry under Smith, Beacock & Tannet in 1862, closed down in 1894

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1. LCD 21332.

and one part was used by Hunter, Barr & Co. and another by S. Rosenwig, both clothing manufacturers.

The Victoria (flax) Mill built by W. B. Houldsworth (168) before 1840 was partly let to Botterill & Seanor, and Horner & Son as clothing works.

Highfield Mill, Ladypit Lane (175) became Moores' clothing factory and at Holbeck New Mills (14) the numerous tenants included Wolfe & Lewis who soon became the Reliance Clothing Company (Kelly 1914).

Titley, Tatham & Walker's Low Hall Mills (16) in Holbeck Lane, built about 1827 as flax mills, went over to multiple occupation at the turn of the century and the main building became Liversidge & Cunningham, with rooms let off to another clothier, Lubelski & Co. (of Hillidge Road) for two years. Lubelski was followed by Newby, Riley and Hartley (Kelly 1914).

Jonathan Shackleton's Union Flour Mill (1) became the Union Clothing Factory of Mitchell, Walker & Crawford. By 1910/11 (Robinson) this had become Mitchell, Walker & Co.

On Holbeck Moor the woollen mills owned by Blackburns and Croisdales were demolished and replaced by the very large CWS clothing works.

In addition to the adaptation of existing sites or buildings, new clothing factories were built on undeveloped sites. These included the Standard Works on Hillidge Road (18) in the grounds of the old Hunslet workhouse. This was occupied by Lubelski & Son and Charlton Bros. Charltons were replaced by the Utilus Coat Co. (Waterproof) in 1914 but since Lubelski changed their telegraphic address to 'Utilus' at the same time it is likely that this company was a subsidiary of Lubelski. In Holbeck, by Shafton's brick-works on Ingram Road, a group of clothing factories was built: Clyde Works (13) for J. W. Campbell and Paddock Works for Barker & Moody. They were of the same style as the new works built for J. May & Son (Maenson) on Springwell Road in 1907, to which later extensions in a matching style have been made (11). This factory reflects the higher quality product made there: the building is faced in Burmantofts terra cotta. Opposite stand Wm. Blackburn's Springwell Works (12) which were in use before 1906 (Kelly) and are built in dark brick. Only one small clothing works has not been mentioned so far: in Bath Road (24) Lawton & Co. had a two storey works for about ten years from 1900.

The clothing industry developed rapidly south of the river after 1900 and showed a fair degree of stability. Taking Leeds as a whole, the trade developed in redundant textile mills in the central areas and in purpose-built works on the periphery. Where central sites became available they were developed as clothing factories but the high proportion of women employed as machinists gave an edge to the employers situated close to the speculative developments of back-to-back housing in Hunslet and Holbeck. These date from the period after 1860 and provided low-cost housing for the men employed in the numerous engineering works in Hunslet and the railway yards of Holbeck. The clothing factories offered opportunities for the women to work close to their homes and replaced the defunct flax mills as major employers of female labour.

Dyeing

The number of dyers increased from 2 in 1807 (Wilson) to 6 in 1853 (White). The leading dyers were Chadwicks with a 30 h.p. engine in 1824 (Lindley) but their works was cut through by the building of Crown Point Bridge in 1840. Chadwicks flourished until 1860 when the firm became W. Kitchen & Co. John Sayner developed a substantial dyeworks from 1792 (104) but as already noted, developed into manufacturing after 1813. By 1830 (Parson & White) the site was shared by G. Sayner, M. Moss, woollen manufacturers, Senton & Turner, J. B. Whilshire, cloth dressers, and J. Sayner, senior, calenderer. The Larchfield dye house was taken by Rayner & Scholey after the death of Pym Nevins. G. Scholey had operated a small dyehouse in Bowman Lane, near Chadwicks, in 1822 (Baines) and Rayner was a former partner of the merchant firm of Smithson, Rayner & Richie (Morris 1798). In the 1850s Rayner & Scholey were followed by J. & W. Armitage and in 1863 the dyehouse became part of the Goodman Street Iron Works site (163). In the 1880s Ellis, Wood & Co. turned the St. Helen's Mills into a dyeworks,[1] which lasted until about 1900, when it became, amongst other things, a flax spinner. Just as Sayner developed a manufacturing side to his dye house so other manufacturers did some dyeing, the most notable of these was Wood at Potterdale Mill and Nevins at Larchfield.

Dyeing methods had not changed appreciably for many years. The dye vessels were either heated directly over fires, or by steam. If made of lead the vats were 'leads' (c.f. lead house = dye house), if made of block tin then they were 'kettles' and stone vessels were 'cisterns'. The main dyes in use were derived from a variety of imported woods,[2] which were chipped for dyeing woollens and 'rasped' for stuff dyeing. Cochineal and madder provided reds and the commonest fast blue/black dye was indigo used for heavy woollens, serges and duffels, types of cloth greatly in demand for uniforms and other contract orders.[3] All these organic dyes were imported but dyers used large quantities of alum and Epsom salts (Magnesium Sulphate) as mordants to 'fix' the dye in wool. Hydrochloric and Sulphuric acids were needed and came from local chemical manufacturers. One dye, Cudbear, was made by macerating dried seaweed with ammonia.[4] Copperas (Iron II Sulphate) was used with oak bark

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1. YI (1888) '6 large kettles,6 dollys,12 burl dying machines'.
2. e.g. logwood,camwood,barrwood,limewood,sumac,myrobalan,fusti
3. Nevins' dye house had nine blue vats. There was a black dye house and an indigo mill at Larchfield in 1820.
4. Cudbear Street(1862)by the side of J.Marshall's Providence Works (94) and Orchella Place(orchella = a lichen used for dyeing).

to produce a fast black dye and again was an important product of the chemical industry. Most of the dyers, and some finishers, stoved cloth with burning sulphur or bleached it with Chloride of Lime, soda ash (Sodium Carbonate) and yet more Sulphuric Acid. Relatively new was the use of bichromate of potash (Potassium Dichromate) and acetate mordants derived from pyroligneous acid. Prussian Blue was obtained from the reaction of Prussiate of Potash with slaughterhouse refuse. Perkins' discovery of aniline in 1856 had little immediate effect on the industry in Leeds but in time contributed to its decline. Apart from the provision of dyestuffs and chemicals there was an important link with the chemical industry in the scouring of the woollen cloths which required soap and provided lanolin and other wool extracts.

The Decline of the Dyeing Industry

After 1863 the dyeing trade began to decline.[1] This can be ascribed to a variety of factors, the growth of the trade in the Bradford district, the increasing use of aniline dyes and the unfortunate inability of many 'organic' dyers to adapt themselves and their premises to the new techniques required by the new generation of coal-tar dyes, Other factors included the increasing tendency of woollen manufacturers to carry out dyeing on their own premises and the effects of the trade depression from 1873 to 1881. After

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1. E.M.Sigsworth 'The Development of Dyeing' Leeds Journal Vol.26 (1955) p.3.

this the only dyeworks left south of the river were Wm. Kitchen at Crown Point and Marsden Bros. in Manor Road (45). The plans of the Kitchens' Bowman Lane Dyeworks, dated 1889, show that the main business was in blue and black dyeing based on indigo. This indicates how specialised the trade had become, and how the large output of worsted uniform cloth in the area kept a specialised firm in business, dyeing a very limited colour range. Marsdens were cloth finishers as well as dyers and both firms were members of a group, the Yorkshire Indigo, Scarlet and Colour Dyers Association.

St. Helen's Mills (143) had become Ellis Wood's St. Helen's Dyeworks in 1885 but became a twine and canvas works after 1900. The use of power from the engineering works noted in 1834[1] continued and there were 12 burl dyeing machines, 6 dye kettles and 6 dollys (piece scouring/washing machines). Water supplies were obtained from an artesian well.[2]

After 1870 there was a small number of 'dyeworks' in the area, the largest being G. Heuthwaite's "Excelsior" dyeworks (191) in Richard Street, Hunslet. This was newly built, like the surrounding houses, in 1871.[3] It is clear from the

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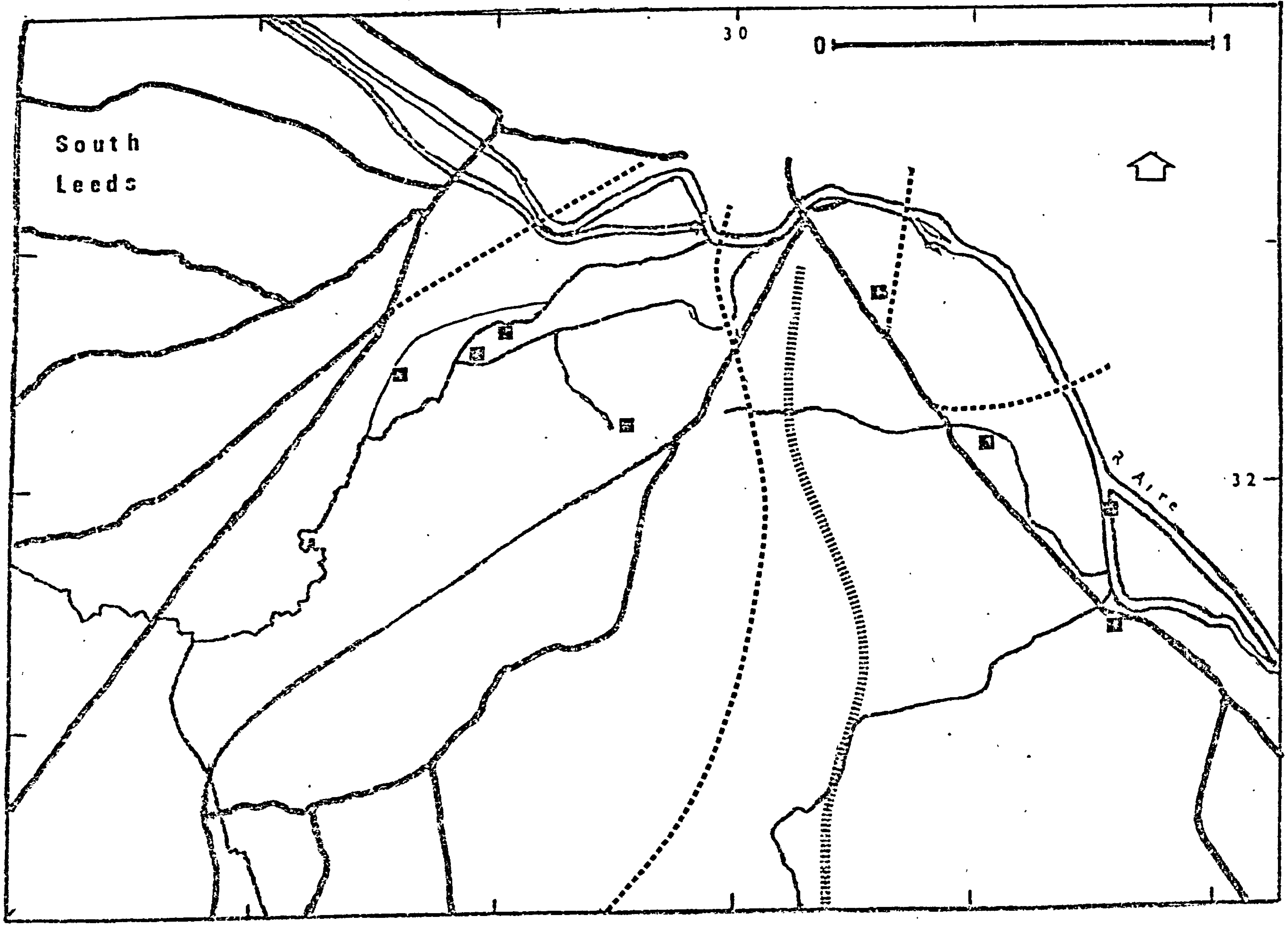
1. <u>Factories Inquiry</u> (1834) Vol. II C1. 190.
2. <u>YI</u> (1888) p.123.
3. LCD 6901.

description of the building and its contents, hydro-extractor and electric tumbler, 2 Hoffman presses and a steam still for spirit recovery, that this was a dry-cleaners and that dyeing was limited.

Sheet 3 (west)


NEW WORTLEY
Mill Green
HOLBECK
Holbeck Moor
Matthew Murray School
Playing Fields
ISLINGTON
Recreation Ground
Cricket Ground
Holbeck Cemetery
Transport Depot
Tennis Courts
32
31
29
30
5
14
15
16
17
18
56
58
59
118
120
122
205
OS SE23 SE
SE 33 SW
LOCATION of WOOLLEN MILLS
1900
1800
1875
1815
1850

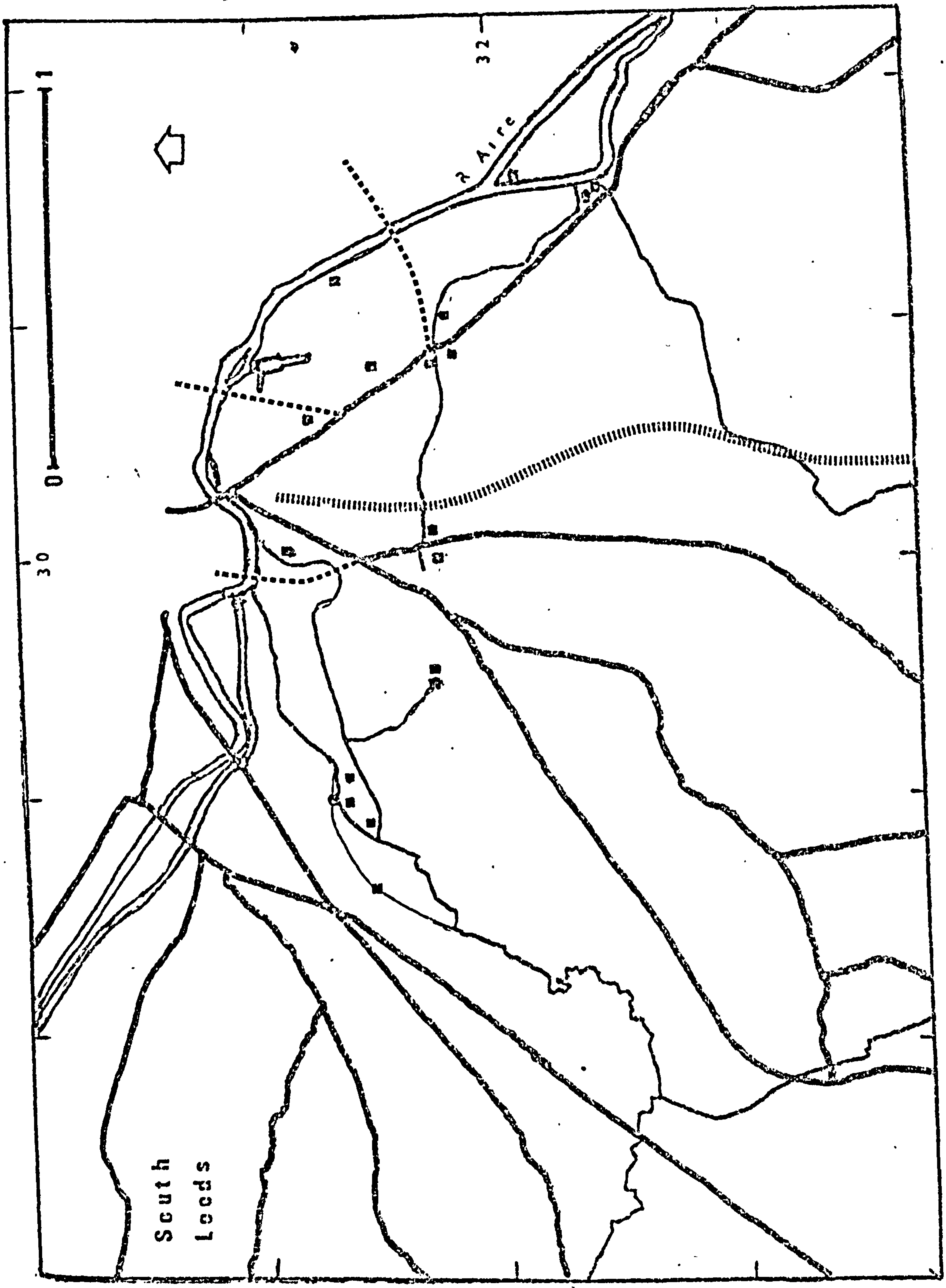

52
68
94
108
104
145
147
171
139
152
143
175
207
208
209
210
199
WAREHOUSE HILL
CROWN POINT
FEARN'S ISLAND
CAVALIER HILL
POTTERY FIELD
33
32
31
30
River Aire
KNOSTROP CUT
ATKINSON HILL
HUNSLET
Hunslet Moor
PUBLIC PARK
Recreation Ground
WOODHOUSE HILL
HUNSLET CARR
Allotment Gardens
Cricket Ground
Works
Brewery



WOOLLEN MILLS 1800

SHEET NUMBER 4

SHEET NUMBER 5



WOOLLEN MILLS 1824

CHAPTER 4

TEXTILES

The Cotton Industry in South Leeds after 1800

It has already been noted that by 1800 Hunslet had become a minor centre of the cotton spinning industry. Coupland & Wilkinson had two mills on Low Road (209), Musgrave's mill was in Simpson's Fold and Ard Walker's cotton & oil mill stood by the Balm Beck (199). Coupland's mills were running until 1821 when the concern went bankrupt. One mill was demolished and the larger mill continued to spin cotton until 1828 when it became a woollen mill. Musgrave's mill was destroyed by fire in 1806 and was rebuilt as a flax mill.

Walker's mill underwent extensive redevelopment at the beginning of the nineteenth century. A steam engine had been installed to return water from the tail race to the dam to keep up the supply to the water wheel in dry weather, but in 1800 the mill was rebuilt completely over a period of five years, with a new Murray engine of 36 h.p. No trading accounts have survived but by 1823 the 'Waterloo Mill' had been let by Walker to J. Ingham as a fulling & scribbling mill.

By 1830 the Hunslet cotton industry had vanished, completely eclipsed by flax. In their day the cotton mills used more steam power than most other textile mills in Leeds. In 1800 Marshall used 28 h.p. in his two flax mills;

Pym Nevins had only 16 h.p. at that date in his scribbling & fulling mill; whereas Couplands had a total of 58 h.p. and Walker was installing a 36 h.p. engine. Musgrave's mill used 10 h.p., as much as most of the woollen scribbling mills. Beverley, Cross & Billiam, who went out of business following a fire before 1800, had a 22 h.p. Boulton & Watt engine. Thompson & Naylor were described as cotton spinners on Hunslet Moor in 1802[1] but apparently used no power except possibly a horse wheel in a four storey cotton house of 806 sq. yds.

The problems and difficulties which beset cotton spinners in Leeds can be inferred from the accounts kept by Ard Walker relating to his new mill.[2] The main building was completed in 1801 and in December of that year 10 spinning frames were installed. These had been brought by the Aire & Calder system of waterways from Longbottom, near Halifax, and the transport costs increased the bill by over 13%. With 10 frames working Walker engaged William Farmery to build more frames over a period of two years. Farmery supplied the skilled labour whilst Walker provided joiners,

1. Sun CS 52/741102 (1802) Benjamin Thompson & Thomas Naylor cotton spinners. Millwrights gears £25, Clockmakers gears £275.
2. Leeds City Archives DB23 (1800-1805).

timber, rollers, bobbins and other items.[1] From the description of the various parts it would seem that these cotton mills used 'throstles', a development of the Arkwright water-frame, rather than mules.

It must be clear that any hard-headed Yorkshire merchant making such a large capital investment in the early years of the century fully expected to earn a high return for many years to come. The rapid decay of the cotton industry in Hunslet can be attributed to a variety of factors. The major source of raw cotton had become the United States, with Liverpool as the main receiving port. This gave Lancashire spinners lower delivery charges 'ex wharf' and also, since the Leeds industry was very small in terms of units, compared with the Manchester area, there were no specialist cotton-machine-makers in Leeds. The market for the cotton yarn produced in Leeds was not for cotton fabrics but mainly for sewing thread and, most of all, for weaving mixed wool/cotton fabrics such as 'swansdown' and 'toilinettes' which were highly fashionable during the period of the Napoleonic Wars. After the war there was a change in fashion and these mixed fabrics went out of favour; the local market for cotton yarn diminished. Techniques in woollen spinning were improving, the self-acting

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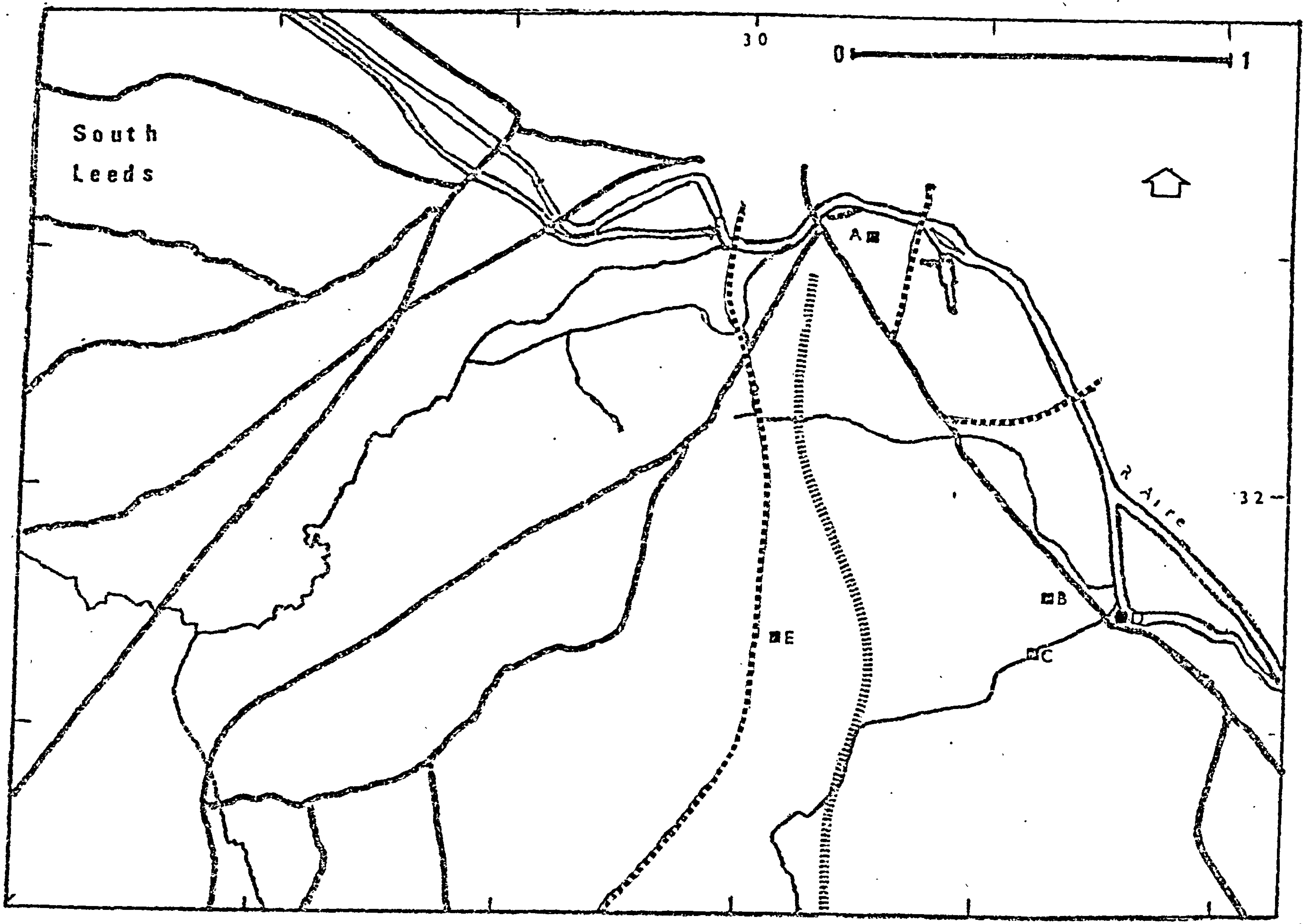
1. LM 1/3/1802. "Wanted, Eight sober, steady good workmen, viz. One spindle maker, One Flier maker, One Roller maker, One fitter-up of Machinery, and Four Young Men who wish to engage for a few years ... Apply personally to Mr. Wm. Farmery, of Leeds"

mule was adapted to spin wool in the 1820s and woollen yarns became freely available. The shoddy trade had hardly begun, it only developed in the second half of the century and the cotton warps used came ready for use on beam rollers, mainly from mills over the Pennines.

The industry died in Hunslet because it was too far from the cotton weavers of Lancashire and the frame-knitters of Nottinghamshire. The local demand for yarns for mixed fabric was ephemeral and the development of finer linen thread cut into the other local market. The financial crises which involved both Britain and America between 1816 and 1830 had more repercussions on the cotton trade than on flax spinning and it is hardly surprising that these few cotton spinners in Leeds, isolated from the main manufacturing area, were unable to survive very long.

Although short lived and small in size the cotton industry in Leeds was important in that it introduced to the district new ideas on the use of steam power. It has been shown that 'fire engines' were well known in the area as a method of raising water, either for draining mines, or to conserve scarce supplies of running water for mill wheels. Traditionally, the Crank Mill at Morley, 1791, was the first mill to use a steam engine for direct power, but this use of power was for fulling-stocks and then scribbling & carding, not for spinning. The cotton mills introduced the use of steam power on a large scale, they employed more powerful engines than the woollen mills. Linked with this was the introduction of power for spinning yarn as well as the pre-spinning processes of scribbling and carding.



COTTON MILLS in HUNSLET

A. Musgrave: Simpson's Fold

B. Beverley, Cross & Billam: Cotton Mill Row?

C. Ward Walker: 'Wellington' Mill

D. Coupland: Low Road(3 units)

E. Thompson & Naylor: Hunslet Moor

CHAPTER 5

TEXTILES

Flax-spinning and Linens

The success of Marshall stimulated a boom in flax spinning in Leeds based on the new machines. Outside Leeds, in the dales, corn and fulling mills were converted to flax spinning but in Leeds itself the available water-power was already in use for corn mills, fulling stocks, carding engines and scribbling mills. Most of the flax mills were purpose built and steam powered but there were many small firms of flax dressers working in lofts and similar small premises. A hackling machine was patented in 1795[1] but even by 1820 only a few mills used hackling machines and most of the machines in use were 'Thompson's Chain Gill' types.[2] Hackling by hand was a male occupation which balanced the use of female labour for spinning, providing work for entire family units.

Immediately following Marshall was Richard Paley, a merchant with fingers in many pies. In 1798 he built a flax mill in Marsh Lane - across the river, and let it to G. & J. Wright. The next mill to be built south of the river was for Thomas Benyon, off Meadow Lane. The hackling and spinning rooms were built first, in 1803, and hand loom

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1. British Patent 2034 of 1795, Sellers & Standage.
2. British Patent 2533 of 1801.

sheds added in 1804-5. The hackling sheds were extended in 1815 and gas-lighting installed at the same time.[1] The plans showed a five storey spinning mill with a 50 h.p. Murray engine on the south side. From the opposite end a four storey hackling shop formed an inverted L-shape. This lay-out became a square when the weaving sheds were added later. This mill is important because it was the first to use cast-iron beams in a rational manner for fire-proofing. Benyon's partner, Charles Bage, designed the first fire-proof mill for Strutt & Bage at Shrewsbury in 1796. The importance of fire resistance in flax mills cannot be over stressed. Contemporary insurance records for woollen mills show the high value of 'stock in hand' and wool has a relatively low fire risk in comparison with highly inflammable raw flax. Marshall built a fire-proof warehouse in 1806 which still stands on the corner of Water Lane and Marshall Street (28) but others were very slow to follow.

J. G. May, a Prussian Factory Commissioner, visited Leeds in 1815.[2] He commented that there were six new flax mills and gave a detailed description of Marshall's mills, where two mills provided work for 200 hands. The six mills included Marshall's, Benyon's and Titley, Tatham & Walker of Water Hall Mill (40). The origins of this firm are obscure:

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1. <u>Factories Inquiry</u> (1834) Vol. II c.25.
2. W.O.Henderson, <u>Industrial Britain under the Regency, 1814-15</u> (1966) p.12

Titley's thread mill was burnt out in 1807[1] but in their evidence to the Factories Inquiry[2] it was stated that Water Hall mill was built in 1788 and became theirs in 1808. Later it was claimed that the business began in 1805.[3] Another mill which was probably working in 1815 was Simpson's Fold mill. This had been William Musgrave's cotton mill which was burnt out in 1806[4] and then became a flax mill tenanted by Samu~~a~~el Grimshaw, later Grimshaw, Brady & Robinson. It also housed J. Holdsworth, who moved on to found the Hunslet Victoria Mill (168) in 1835. Holdsworth left Simpson's Fold in 1831[5] but from 1821 had been a part-user of Lands Court Mill (58) and its sole tenant from 1832 until 1835. This illustrates the growth and consequential movement of flax spinners at this time: small beginnings in the Dock Street cotton mill, expansion to share a newly-built flax mill, consolidation into sole occupant of this larger unit and then a final move to a larger mill financed from retained profits. W. B. Holdsworth employed 68 "mostly young girls" in 1834[6] and at the peak period in the Victoria Mill 400 were employed.

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1. Mayhall <u>Annals</u> 31.8.1807.
2. <u>Factories Inquiry</u> (1834) Vol. II c.188.
3. <u>YI</u> (1888).
4. Mayhall <u>Annals</u> 1806.
5. <u>LM</u> 5.3.1831.
6. <u>Factories Inquiry</u> (1834) Vol. II c.178.

Marshall set the pace in development, and spun medium yarns for bed linens when the rest were only able to produce lower counts of yarn. His Mill C was built in 1817 and 2 reservoirs were also built to ensure ample water supplies. The machines which Matthew Murray had designed for Marshall were not well suited to spinning fine thread. To some extent this was due to the nature of the flax fibres. It was found that if the flax was soaked, the natural gums softened sufficiently to permit the fibres to slip and allowed finer counts to be spun. This was done on a machine of French[1] origin which passed the rovings through a trough of water before the actual spinning. It was probably this system that Robert Busk used at Hunslet Moorside (179) when he introduced 'wet spinning' to Leeds in 1816. He prospered and the rateable value of his mill (83) in 1823 was increased in 1824 when extra rooms were added.[2] Others were slow to follow Busk until Kay of Preston patented a wet spinning system[3] which involved macerating the fibres then allowing the rovings to soak for several hours in cans. This was time-consuming and the earlier system was re-introduced by Marshall, Benyon and other prominent flax spinners, only this time hot water was used in the troughs.

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1. British Patent 3855 of 1815
2. Hunslet Rate Book 1823-4
3. British Patent 5226 of 1825

William Brown's Survey (1821)

In 1821 William Brown of Dundee made a comparison of the Leeds flax trade with the Scottish industry.[1] He found that there were 19 mills in Leeds using 565 h.p. Of this total 13 mills were south of the river, Marshall (4 mills) and Benyon, used 370 h.p. Others had engines of 18-30 h.p. only. The significance of engine size is important. Brown noted that 1 h.p. drove 2 frames (64 spindles) and therefore the total capacity was 1130 frames (36,160 spindles) and in a 12 hour day output would be 2531 English bundles. Leeds had just under half of the total h.p. used in flax spinning in England (Dundee had a similar proportion of the smaller Scottish power). In Dundee more yarn was produced per spindle but it was coarser. Most Leeds mills spun 2-3 lb lint and 4-7 lb tow but Marshalls were spinning some very fine yarns (1¼ lb). Often Brown's comments were to some extent contradictory - he stated that:

> "most mills were brick built, 3-6 storeys high, clad in large blue Welsh slates"

and later continued:

> "apart from one or two of Marshall's and Benyon's mills, none were fire-proof, many were converted houses".

This reflects the rapid growth of the industry with some

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1. W. Brown, Flax Spinning in Leeds (1821) LQP 667. 11/8815

accuracy: new mills were built by established spinners whilst new firms began in older, converted property and then shared a mill built by a speculative investor such as Paley. Lay-out was bad, commented Brown, but the spinning rooms were larger than in Scotland, 60-80 frames or 20-30 cards was the norm. Commenting on power units, Brown calculated that the engines in Leeds being nearly three times the size of the average Dundee engine, were more efficient and that since coal in Leeds was 2/3rds the Dundee price, then the running cost of a Leeds mill was half that of its Dundee counterpart. Although Benyon had the biggest engine, Marshall had the finest, a 70 h.p. Murray running at 18 strokes per minute, with a 8 ft throw and a 14 ton, 30 ft diameter flywheel.

In the larger mills hackling was done by machinery tended by boys. The machines were said to cost £20 each. These mills used the Thompson chain gill hackler and the Darlington type machines were superseded by Murray's drawing & spinning frame. In addition these mills used Garside's spreading machine whilst the smaller mills used one designed by Hammond. Hackling produced lint (long fibres) and short fibres (tow). Murray produced a tow carding machine two years after his first flax drawing frame. It was a small machine with a main cylinder 3 ft diameter and 26" wide, with two 10" diameter workers. From the carder the tow went to a roving frame and then on to be spun. The 'draw' for lint was 18:1 but for the shorter tow fibres it was half this. Leeds spinners imparted a higher twist to their yarns than did the Scottish mills.

Brown stressed that management in the Leeds mills was good and had been so for the previous decade. However, he foresaw no change in performance in the next ten years. He stated that it was found more profitable to run the spindles below top speed since this led to fewer breaks in the thread and one man, with a helper could then look after four frames. As to prices, most spinners sold yarn at 14/- bundle[1] of 14 lea yarn, with nine months' credit: Marshall's yarn was finer and commanded a premium of 6d per bundle. Brown estimated that John Marshall's income was £100,000 annually in 1821. He was the most efficient producer with a strict job demarcation at line management level, his production costs averaged 2/- bundle excluding rent, interest on capital and hacklers' wages: his profits were the highest in Leeds.

In the difficult times after the end of the Napoleonic Wars there was much commission spinning at 3/- bundle since few could afford to buy flax at 3 months credit and sell yarn at 9 months credit. The weekly wage rates quoted by Brown included 6/- for spinners and 7/- to 7/6 for reelers. He commented that there was no piece work, a week's pay was kept in hand and

> "no advances and 2 weeks notice required".

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1. 300 yds = 1 lea, 10 leas = 1 hank, 20 hanks = 1 bundle (14 lbs).

The flax industry rapidly gained a reputation for poor wages and working conditions.

In March 1824 William Lindley made a survey of steam power in Leeds[1].

The rating of any given engine frequently differs from Brown's and other estimates, but it seems that the total h.p. in use was unchanged. Six firms mentioned by Brown were not mentioned by Lindley but there were six others in their place. This indicates the general instability of business organisations at this time: some spinners lasted only a year and even when a business survived, the consortium of partners frequently changed as capital was withdrawn and then replaced from other sources. It has already been noted that successful firms began in a small way near the town centre and that as business improved they moved out a little to more commodious premises. Marshall extended his mills by new buildings. The original site was bought from William Naylor, maltster, for £600 in 1790, four more acres next to mill A were bought from D. Rider, the boat builder, for £2,300 in 1794, and land for a bleach ground was bought out at Wortley in 1796. Five acres south of Water Lane were bought for £3,610 in 1802, 3½ acres being sold or leased to Fenton, Murray & Wood for their Round Foundry, and a final five acres bought for £5,000 in

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1. Leeds University, Brotherton Ms 18 (1824)

1804.[1] This permitted new development right up to 1846 when the power loom sheds were built facing on to Sweet Street. Others took on extra rooms or mills and later, in the late 1830s, began to build large mills in Hunslet and Holbeck. The peak rate of growth of the Leeds flax industry was from 1815 to 1835.[2] The spinning of flax increased and, as the leading firm in Leeds and the world, Marshalls were subject to detailed investigation by the 1834 Factories Inquiry. The sheer size of Marshall's enterprise is clear:

Table 5.1

Numbers employed in Leeds	Adults(M)	Adults(F)	13-18 m	13-18 f	9-12 m	9-12 f
wool	2795	2113	768	759	475	428
flax	1052	1552	209	807	264	289
Marshall's	445	872	154	458	112	162

As already noted, Marshalls was the most profitable flax spinners and this was reflected in wages paid:

Table 5.2

Maximum adult weekly wage	M	F
wool	25/6	7/10
flax	19/2	6/2
Marshall's	23/6	6/4½

1. W.G.Rimmer, Marshall's of Leeds: Flax Spinners (1960) pp 45-6.
2. W.G.Rimmer, "The Flax Industry", Leeds Journal Vol.25, (1954) pp 75 et seq.

The degree of mechanisation was also reflected in the numbers of women and girls employed, almost 68% at Marshalls compared with 60% in the other mills and 43% in woollen mills. This is further emphasised by the small number of men employed at Marshalls.

Since William Brown's survey in 1821 Westley's mill had changed hands and become a corn mill. John Wilson, the linen & buckram manufacturer, was succeeded by Charles Dransfield. Grimshaw & Gardener underwent several changes: Grimshaw, Smith & Robinson, then Grimshaw, Brady & Robinson, and by 1834 Smith & Stabler occupied the Simpson Fold mill, and the Grimshaw, Brady business was in Marshall Street.[1] New firms included W. B. Holdsworth at Lands Court mill (58), Briggs and Liddle also off Lands Court (59), Wilkinson & Co. at Trafalgar Mill (68) and Hargreaves & Gill in Jack Lane (117). Marshall built Mill D in 1825 and Mill E in 1830 as well as providing a school for 286 children. Titley, Tatham & Walker expanded to a new mill on Holbeck Lane, Low Hall Mill (16), in 1827. At Lands Court, Tom Land had built a flax mill in 1815. He was followed by W. B. Holdsworth, in 1821 as a tenant and in 1832 as owner. Holdsworth moved on to a large new mill in Goodman Street, Hunslet (168) in 1835. On the newly opened Wilson Street, next to Lands Court, a mill built in 1830 (59) was let to Briggs & Liddle until 1839. A woollen mill on Balm Beck (214) became a flax mill

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1. LM 28.4.1829 "Grimshaw & Brady, flax spinners, 28h.p. 200 hands"
22.1.1831 "To let, flax mill in Bowman Lane, late Brady & Co."

in 1826[1] and was taken over by E. Briggs in 1845. Briggs left Liddle in 1836 and moved to Hope Mills, Water Lane (41) which he built on land which had formed part of John Wilson's Camp Hall buckram works site. The building of Victoria Bridge and Road split the site and Dransfield took over the buckram business, as already noted. In Meadow Lane John Charnock turned from wool to flax and built Trafalgar Mill in 1825. This mill was let to Wilkinson, a prosperous woollen merchant, in 1830 and extended in 1832. Wilkinson built Hunslet Mills (172) in Goodman Street in the late 1830s but retained some interest in Trafalgar Mill. In Jack Lane a small woollen mill (117) was let in 1833 as a flax mill to Hargreaves & Gill,[2] flax dressers. The former had a rope-walk on Jack Lane, between Meadow Lane and Dewsbury Road, so a move into flax dressing for coarse yarns was a natural progression for a rope & twine maker. An unnamed partner was Humphrey Boyle, whose father had been a flax dresser in Newcastle-on-Tyne. Boyle was apprenticed to Benyon, then became a flax buyer for Marshall before joining the new business. By 1840 Boyle & Gill had moved to Trafalgar Mill in Meadow Lane.

In the 1850s the flax industry in Leeds was nearing its zenith. South of the river there were over 14 mills at work.

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1. Hunslet Rate Book 1826. New mill & weaving shop for E.Woolf. RV £90.

2. <u>LM</u> 30/1/3. 1833 "Mill to let, 4 storey, 5200 sq.ft. late scribbling and carding"

Marshalls were still the biggest with new additions, in 1841, the Temple Mill and in 1843, Offices (30).

The growth in terms of labour and power was as shown in Table 5.3.

<u>Table 5.3</u>

Marshall			Benyon		Titley, Tatham & Walker			
1829	1890	275hp	560	80hp	698	90hp (Water Hall + Low Hall)		
1834	1317	266hp	480	90hp	447	70hp*	198	26hp (Tatham)
1848	1770	400hp	680	120hp	--------		220	26hp
* Tatham took over Low Hall and ran it on his own. Water Hall was 'standing' in 1848. (Hunslet S.V. Minutes)								

The big developments were over on Goodman Street, where Holdsworth had built Victoria Mills (168) and Wilkinson & Co. Hunslet Mills (172). Edward Briggs had two large mills, Hope Mills, in Water Lane (41) and Balm Road Mills (214). W. H. Kabery, who was in Lands Court in 1839[1] had moved to Springfield Mill on Holbeck Lane (24). Foster, Davey & Co. opened Calf Garth Mill in Hunslet (196) about 1839 and at Mill Green William Cornforth operated a flax mill (4) from the same date. Dodgson & Mann began business as flax spinners in a very small way in Holroyds Yard, Meadow Lane

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1. Baines and Newsome <u>D</u> (1839)

(Williams 1845) but by 1853 Dodgson & Co., rope & twine manufacturers, had taken over Hope Mill (103), formerly a worsted mill.[1] Other newcomers listed in the directories included three canvas makers, in Hills Yard, Meadow Lane, and three flax dressers (one in Hills Yard). These were still in the 'workshop' stage and used no power. Sarah Dovenor had a canvas weaving business at the junction of Meadow Lane and Dewsbury Road (61) for about ten years and there were various links with sack makers, twine makers and flag & bunting makers who were operating on the fringe of the flax industry.

Simpson's Fold Mill became T. Lupton's, following Smith & Stabler, by 1845[2] and Whitely, Luty & Co. took over Lands Court Mill (58)[3]. By the same date Calf Garth Mill had become J. & J. Ingham and Wellington Mill (4) had passed to J. Morfitt. Springfield Mill (24) had closed down and been demolished to make room for an extension of the Midland Junction Foundry (23) of Taylor, Wordsworth & Co.

The Leeds flax industry was basically the spinning of yarn for thread, linen thread was stronger than cotton and therefore, possibly, undermined the small cotton spinning

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1. White's D (1853)
2. Williams D (1845)
3. White's D (1853)

industry in Leeds. It was used for twine making, which was allied to ropemaking, and for canvas weaving. Canvas was increasingly in demand for sails, cart covers and mattress covers. The main elements in the industry were flax dressers, spinners, bleachers and canvas weavers. In Leeds linen weaving was not a substantial trade. Power weaving of linens was slow to develop since yarns which were tractable at hand loom speeds snapped when the process was speeded up by the application of power. The first step forward was in 1839[1] when a vibrating roller was devised which varied the tension of the warp to prevent the threads being strained too much. This was improved upon by A. Dobson in 1854.[2] Marshall built a steam loom shed in 1863 (31) for linen weaving. Steam looms only became common after 1846, being used at first only for heavier fabrics, sheets and tea towels mainly. The major market for weaving yarns was Barnsley where the linen industry was well established with many links with Leeds spinners, but this division of processes was to prove disastrous later.

Industrial Relations

The flax trade had its share of industrial problems and unrest. The strike of linen weavers in Barnsley in 1829 had little effect on the flax-spinners of Leeds and the troubles which beset the woollen industry in the early 1830s had

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1. British Patent 1898 of 1839, J. Schofield & E. Leach
2. British Patent 2190 of 1854

little impact either. There was general short time working and unemployment but nothing like the strike of the hand-loom weavers at Gotts in 1831 and at Willans' Holbeck Mills (15) in 1833. By 1842 times had changed, the general economic malaise of the previous year had become distress, and in August 1842 cotton workers around Manchester came out on strike. The strike spread as operatives marched on mills and called on the workers to leave their jobs. Where possible the strikers removed the boiler plugs, stopping the engines and this led to the strike being called the 'Plug Plot'. In Leeds the 'Chartists & Plug-drawing mob' assembled at Hunslet on August 17th to march on the town. The men at Petty's Pottery came out and plugs were drawn at Low Hall Mill (16) and others on the way to Marshalls. The strikers entered Marshalls but did not stop work and instead they carried on along Water Lane to Titley, Tatham & Walker's Water Hall Mill (40) but they were halted by Prince George and the lancers. The troops withdrew to Victoria Bridge and the mob turned along Meadow Lane where they stopped Benyon's mill. As they moved across towards Maclea & March's Union Foundry. police and troops arrived across Leeds Bridge and 38 arrests were made. 28 strikers were committed for trial at York by the magistrates and, for practical purposes, the Plug Plot was over.[1]

More serious for the flax industry was the strike in May 1847 against a reduction in the wages of flax reelers by

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1. based on Mayhall Annals and LM & LI reports, August 1842

Wilkinsons, Holdsworth and Boyle & Gill. Fifteen hundred reelers "turned out". Traditionally they had earned the top rates for managing the 8 ft diameter reels but, in an industry noted for poor wages, any attempt to cut costs by reducing wages in difficult times was likely to lead to a strike by the workers. The poor working conditions in some flax mills may be judged from the outbreak of cholera in 1854 which was centred on Wilkinson's Hunslet Mills.[1]

The Decline of the Flax Industry

The death of John Marshall on 6th June 1845 may be considered as the beginning of the decline of the flax industry in Leeds. This is not to assert that the industry began an immediate decay but the pioneer had gone and the others were imitators rather than innovators.

Charles Marshall could speak with confidence to the British Association in 1858 about the healthy state of the Leeds flax trade but already there was a chill wind of competition blowing from Ulster and the continent. The Belfast linen manufacturers were both spinners and weavers: they were forced into this situation following the 1846 famine which led to large scale emigration and a temporary shortage of labour. By taking 'cotton looms' from Barnsley linen mills and using warp yarns of a better quality than the hand loom weavers, they began steam-weaving plain linens. Although

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1. *ibid* July 1854

there was a temporary shortage of labour, wages were low and, like the continental trade, flax produced locally incurred no high transport charges.[1]

After the American Civil War, cotton became once more a serious competitor for its low price was a superior selling point to the durability of linen thread. The expanding boot and clothing trades used cotton thread, and survival was only for a few linen weavers, mostly new firms with modern equipment, and those flax spinners who moved back to coarser yarns and to hemp for rope & twine making. The expansion of the industry in the 1840s was matched by an increase in the number of flax workers. In terms of the labour force the decline began in the 1850s but was much accelerated in the 60s. The results of mechanisation are significant in the change in the ratio of men and women employed. After 1840 there were at least twice as many men employed as women.

Table 5.4

Leeds flax workers 1834-1881

	Men	%	Women	%	Total	
1834	1052	40	1552	60	2604	Factories Inquiry (1834)
1841	3087	65	1656	35	4743	C. Collier "Women's work in Leeds", Economic Journal (1899) pp 460-73 and Census Returns
1851	6150	71	2464	29	8614	
1861	5898	71	2351	29	8249	
1871	4018	67	1963	33	5981	
1881	2709	77	792	23	3501	

1. J.Combe, The Leeds Linen Trade (1856) L667.116 C731

There were nine flax spinners noted in the returns of the Royal Commission on River Pollution, 1867, and they employed 8,376. In addition there were five more flax spinners south of the river who were not included in the returns.

A study of the evidence given to the Royal Commission in 1867 reveals some interesting points. In Leeds, three flax spinners gave evidence, Ives & Tennant from north of the river, Patterson from Trafalgar Mill and Marshalls. In terms of labour Ives employed half as many as Marshalls yet produced almost twice as much yarn. In terms of tons/capita Ives' output was 1.93 tons and Marshall's 0.53 tons. Ives were rated at 59% of Marshall's £3,300 RV. Patterson employed a tenth of Ives' labour force yet output was 4.76 tons per head, but at almost half the value. This figure compares with other flax mills giving evidence, from Nidderdale, where the largest mill had only half the output of Trafalgar Mill and the others were below 100 tons. Measured by output in 'value per head' Patterson was the most efficient mill and Marshall the least efficient. There seems to be a correlation between output per man in tons and value. Where a mill specialised in the finer counts output by weight was low but the value of the yarn was high. By extrapolation the value of Marshall's output would be £170,000 in 1867 at £130 per ton. This suggests that in historic terms their profitability was falling.

The flax spinning industry in Leeds was based on steam power but with the emphasis on 'wet spinning' a good supply of water was essential. Marshall and Benyon built reservoirs fed by the becks. Briggs had Balm Beck and Holdsworth & Wilkinson were close to the river. Nearly all used bore holes and, later on, the mains supply.

The first of the giants to fall was Benyons in 1861. There had been no extensions to the mills since 1815/17 when the hackling shops and weaving sheds were lengthened. Benyon paid 10/- in the £ on debts of £35,248.[1] The mill was sold to G. Hodgson and part of it was let to Dogson & Co., flax spinners, formerly of Hope Mills (103), the rest used as a woollen mill. The next to go was Wilkinson & Co., Hunslet Mills. The founder, John Wilkinson, died on 7th September 1856 and it may be suspected that the business was running into financial problems since in 1865 the flax mill,insured for £15,000 with the London & Liverpool Insurance Co., was 'destroyed by fire'.[2] Then in 1866 a further fire did damage estimated at £9,000[3] and in 1867 Wilkinson & Co. went bankrupt, owing £20,000.[4] Marshalls opened their power loom shed in 1863 and in 1876 the weaving shed and the Temple Mill were let off to Rhodes & Fox, linen manufacturers. Naturally they used Marshall's yarns and when Marshalls closed down in Leeds and moved to New Jersey in 1886, Charles Fox &

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1. Mayhall Annals March 1861
2. Mayhall Annals 18.10.1865
3. Mayhall Annals 18.3.1867
4. Mayhall Annals 18.5.1867

Son bought the linen works and continued weaving on 200 looms until 1918.[1] In the case of Marshalls it was almost certainly the loss of interest in the business by the family which led to the closure in Leeds. There seems to have been a reluctance either to make decisions, or allow them to be made by the resident management. Interests were far from flax spinning. Boyle, Gill & Co. closed down at Trafalgar Mill in 1851 and their machinery was put up for sale two years later.[2] After a short period when John Wilkinson (of Hunslet Mills) used it, the mill was taken over by Alexander Patterson & Sons, previously across the river in Marsh Lane from 1843. Patterson prospered: he employed 126 workers in 1867[3] and moved to a newly built mill 'The Hunslet Shed' (Temple Works) (189) in Joseph Street in 1872. This flax & hemp spinning firm lasted until c.1900. Morfit, of Wellington Mill (4) moved across the river to Mabgate by 1867[4] and Wellington Mill was used as part of the adjacent corn mill (3). Holdsworths closed down their Victoria Mill (168) about 1880 and it became the chief mill of Titley & Co., formerly Titley, Tatham & Walker. In its heyday this mill provided work for over 700 but under Titley'a management there were only 400 employees. Titley's relinquished their original mill on Water Lane to James Grisdale & Son, candle makers, and Tatham's Low Hall

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1. Yorkshire Textile Directory 1917/18
2. Leeds City Archives DB5/94. Sale particulars (1853)
3. Rivers Commission (1867) p.105
4. ibid p.194

Mill (16) had become a woollen mill by 1870. There is evidence of retrenchment on a considerable scale into the most modern premises available. After 1900 Titleys were followed by one of their managers, E. Hawkesworth, who took part of the Victoria Mills as a twine works, the rest being let off, mainly to clothing firms. At Calf Garth Mill the Ingrams changed gradually in the 1860s to nail making and by the turn of the century the flax mill had become Hunslet Rolling Mills (196). Briggs, at Balm Road (214) and Water Lane flourished until about 1900. At Balm Road they employed 1,000 in 1867[1] and extensive development took place about 1890, by which time the Hope Mill on Water Lane had been sold to Brown Bros., flax spinners, who lasted until the early years of the twentieth century. When Briggs closed down at Balm Road the flax trade there did not end completely since by 1914 one of the tenants included the Leeds Flax & Hemp Spinning Co.[2] This firm was previously listed[3] at Sayner Lane, where they shared the Airedale Works with Parker Bros. (149). The Parkers have a curious history on the fringe of the flax spinning trade for many years. The earliest reference is to B. Parker, rope, twine & waste dealer, Water Lane.[4] In 1866 "Parker Bros. Sayner Lane flax mill was destroyed by fire".[5] After this Parker Bros. Airedale Works, were

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1. ibid p.200
2. Kelly D (1914)
3. Kelly WRD (1889)
4. Baines D (1822)
5. Mayhall Annals 15.5.1866 "part cover £6000 with the Liverpool & London Assurance Co."

regularly listed as a flax, mungo and waste spinners, until 1906 when they reverted to waste dealing and flax & hemp spinning was carried out by another firm, W. Smith[1] who was first noted in 1875 in Croft Buildings, behind Lands Court.

Mrs Sarah Dovenor's canvas making prospered and the business was moved to the Whitehall Mills in Wortley about 1860. The Quebec Foundry, Houghton Place (113) became Quebec Mills about 1875. It began as a foundry for Hyde, Dockray & Ambler about 1839.[2] From J. Dockray[3] it became A. Dockray, flax spinner & twine maker.[4] It ceased as a spinning mill in 1877 but was taken over by the present owners, Wm. Waites, Son & Atkinson, who moved from the Globe Twine Mills (103) in 1912. The Globe Mill had been C. B. Dobson in 1866[5] then part was let off and the main mill became W. Coutts, rope & twine makers. Coutts was followed by T. Briggs (of the Balm Road Mills family) and about 1900 by the Waites, who besides Globe Mill had other mills at Ripon, Pateley Bridge, Clayton West and a major rope & twine works at Trafford Park, Manchester. Survival seems to have been due to the willingness to move over to flax & hemp yarns for rope & twine. Some of the linen makers continued to do well, Charles

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1. Kelly D (1906)
2. Baines and Newsome D (1839)
3. White D (1853)
4. White D (1875)
5. White WRD (1866)

Fox & Sons and Sarah Dovenor have already been noted. Buckton & May began with hand looms in East Street in 1847 and after a stop at Atkinson Street moved to a new site on Goodman Street, The Hunslet Linen Works in 1868 (173). In a full page advertisement in 1910[1] the history of the business of Richard Buckton is outlined with pride; the engraving shows the ranks of weaving sheds, with 300 looms, and rows of 'tenter frames' in the forecourt for bleaching the cloth. This firm, like many others, specialised in heavy linens and canvas for government contracts. Thomas Leuty moved from Lands Court Mills about 1870 to the "Leeds Linen Works", Castleton Mills, Armley Road, where in a large new mill he hedged his bets by combining heavy linen and woollen manufacturing. Lands Court Mill was turned over to shoddy spinning.

After 1900 the St. Helen's Mills became T. B. Cumpston & Sons linen works, making canvas on 76 looms. The premises were shared for a time with M. E. Porrit, rope & twine makers[2] but by 1910/11 Porrit had moved out to Farnley Mills.

The industry in Leeds was very localised indeed, being restricted to Hunslet and Holbeck with a few mills on the north bank below Victoria Bridge. Relying initially on child and female labour, a pattern of male dominance soon evolved but, nevertheless, female labour was still substantial and

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1. LCYB 1910 p.242
2. Kelly D (1906)

complemented the exclusively male employing engineering works which began to increasingly dominate the district from about 1840. Other factors influencing location were the transport facilities, the Aire & Calder dock for Baltic flax imported via Hull and the Humber, then the Midland Railway from 1839. The Middleton Railway and then the Midland line, provided abundant and cheap coal for steam power. As the industry expanded, specialist textile machine makers were encouraged. The market for twine for boot making increased as did more general markets for binder twine and for packing string.

As with many other industries in the nineteenth century there was a high failure rate in new ventures. In flax spinning it seems that firms that survived the first few years of growth in old premises, grew to the stage of moving out to larger, newer mills. Having reached this level of development it was only a matter of time before collapse came. Marshall lasted 90 years, Benyon 60, Briggs about the same. Titley equalled Marshall but most firms in the trade lasted under fifty years. The longest surviving firm was the canvas & twine makers, flax dressers _etc_., S. Stone & Co., who ended up with a warehouse in Great Wilson Street. The firm began in 1783 as G. Grimshaw, then became Samuel Grimshaw & Ellen Wilkinson in Meadow Lane,[1] later at Simpson's Fold and then a move across Leeds Bridge to Bridge

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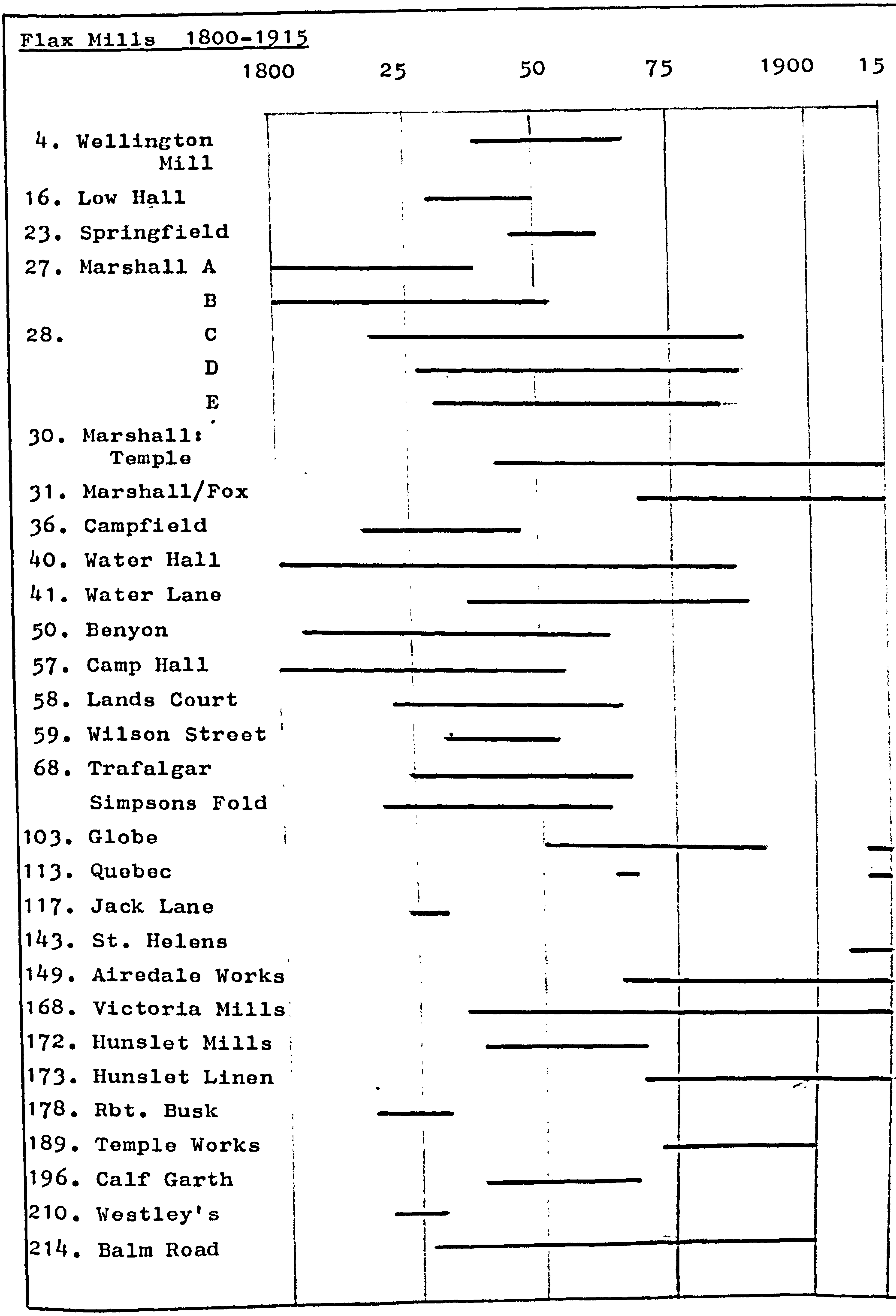
1. Baines _D_ (1822)

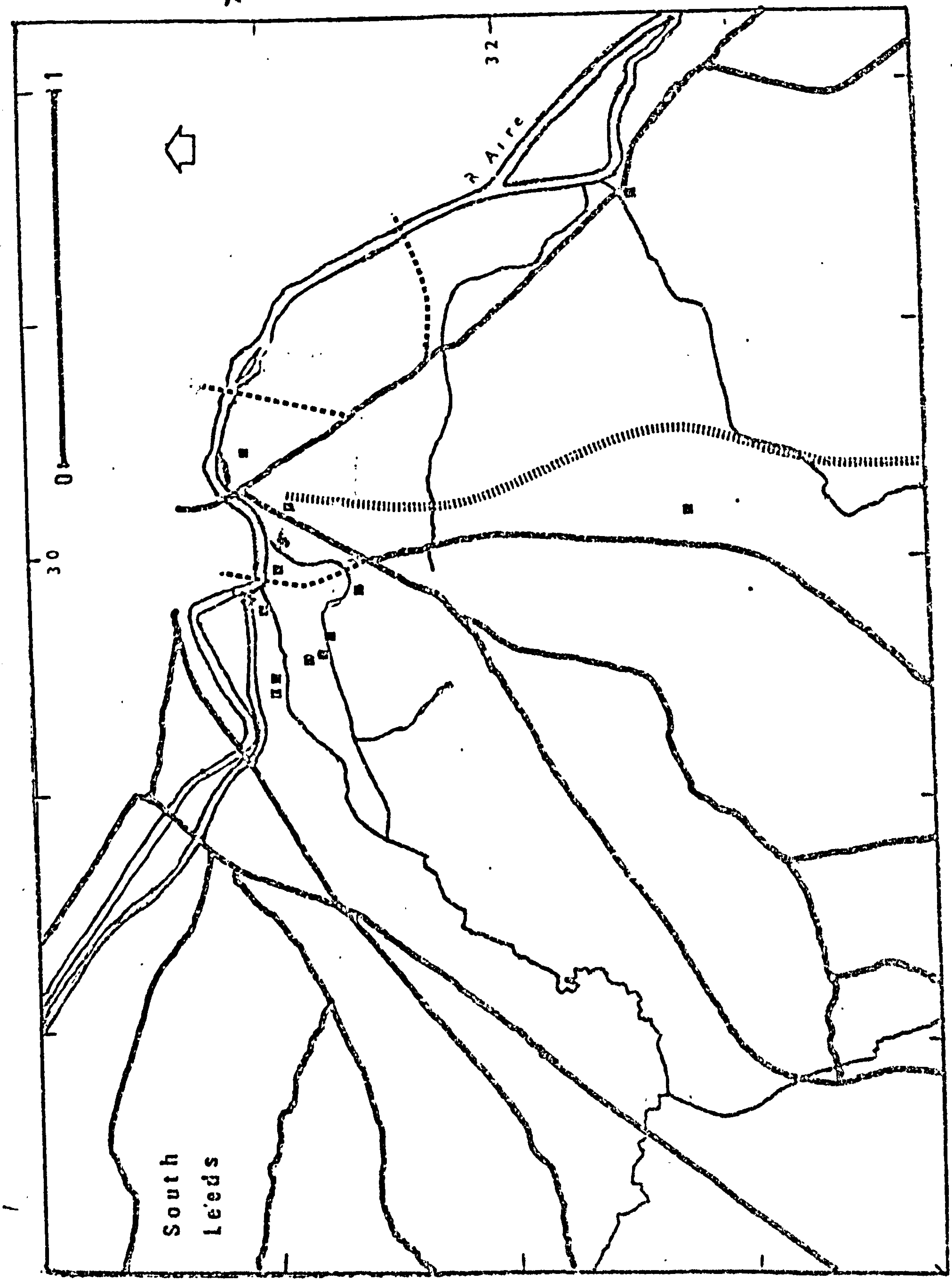
End, finally in 1856 moving to Great Wilson Street as S. Stone where they survived until very recently.

Marshalls dominated the trade completely in the first half of the century at least. It was twice the size of any other unit and because of this it was not typical of the Leeds trade; in every way it was exceptional. Typical firms were Benyon, Holdsworth, Wilkinson, Titley, and Briggs. Patterson was much smaller than any of these yet the output of Trafalgar Mill compared to that of the Nidderdale mills was like Marshall compared to his nearest rivals.

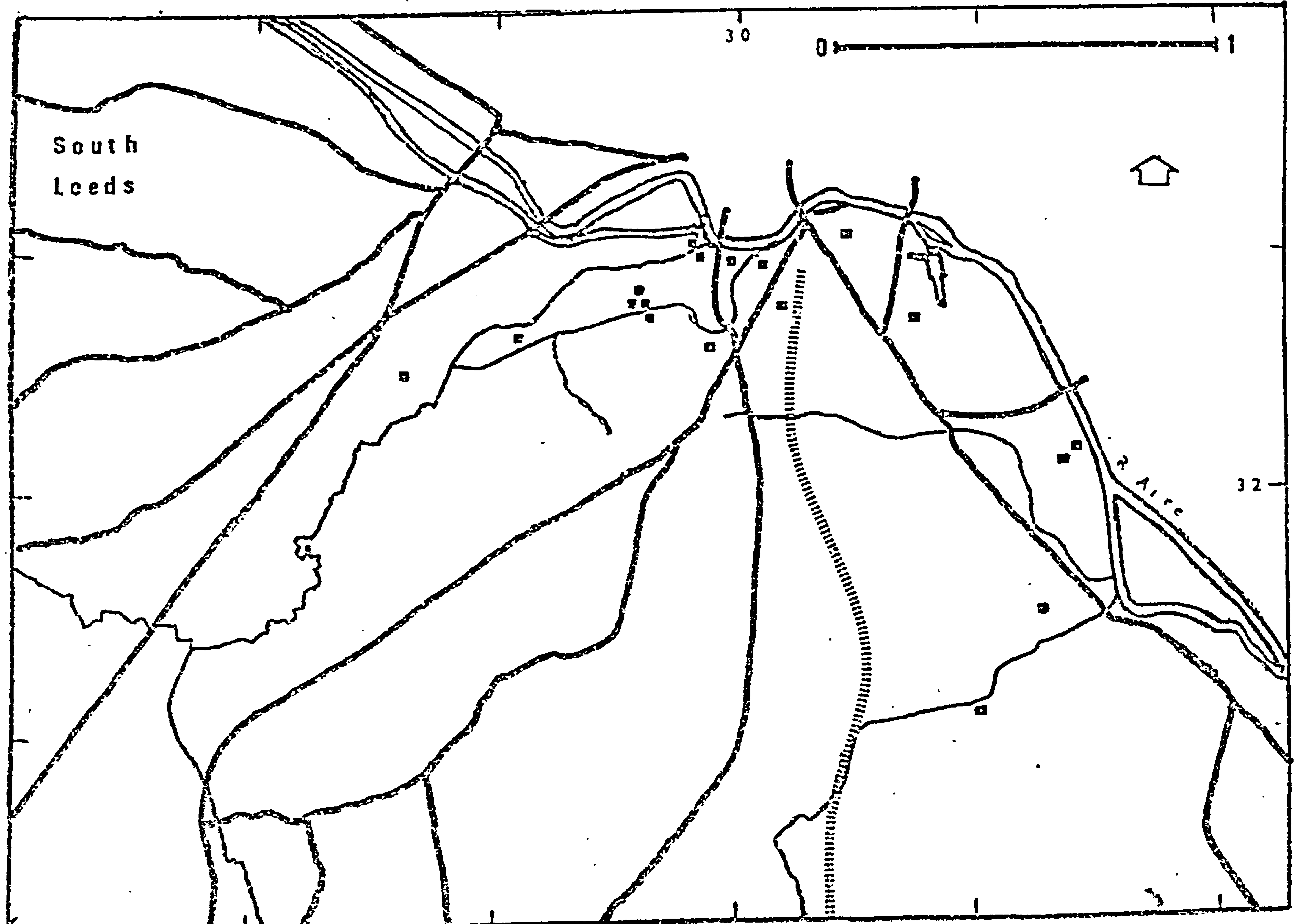
Table 5.6


Flax Mills 1800-1915
1800
25
50
75
1900
15
4. Wellington Mill
16. Low Hall
23. Springfield
27. Marshall A
B
28. C
D
E
30. Marshall: Temple
31. Marshall/Fox
36. Campfield
40. Water Hall
41. Water Lane
50. Benyon
57. Camp Hall
58. Lands Court
59. Wilson Street
68. Trafalgar
Simpsons Fold
103. Globe
113. Quebec
117. Jack Lane
143. St. Helens
149. Airedale Works
168. Victoria Mills
172. Hunslet Mills
173. Hunslet Linen
178. Rbt. Busk
189. Temple Works
196. Calf Garth
210. Westley's
214. Balm Road

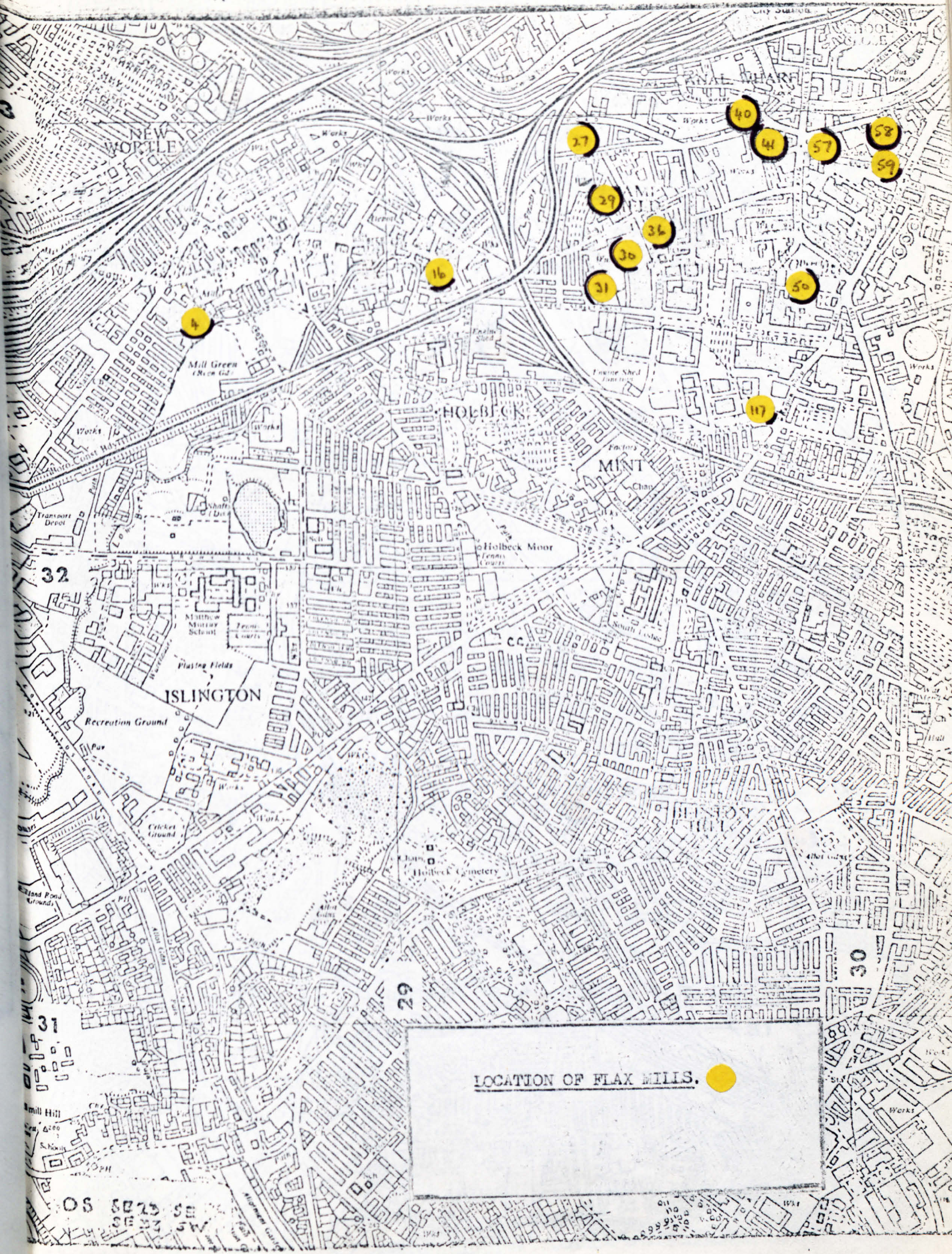
SHEET NUMBER 7

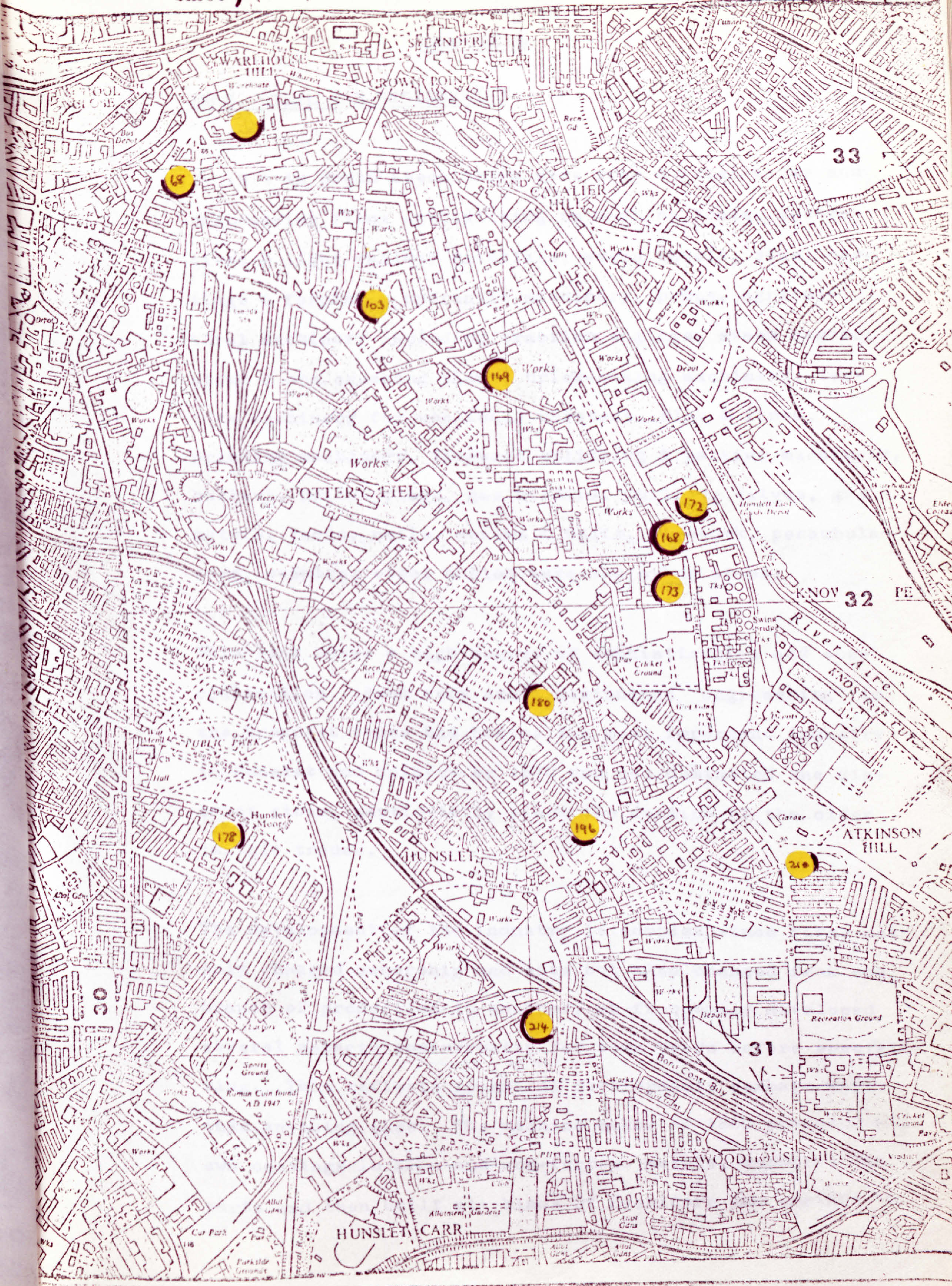


FLAX MILLS 1824



FLAX MILLS 1853


NEW WORTLEY
HOLBECK
MINT
ISLINGTON
Holbeck Moor
Holbeck Cemetery
Matthew Murray School
Recreation Ground
Mill Green
4
16
27
29
30
31
36
40
41
50
57
58
59
117
32
31
29
30
LOCATION OF FLAX MILLS.
OS SE23 SE
SE33 SW


WAREHOUSE HILL
CAVALIER HILL
FEARN'S ISLAND
33
Works
Depot
POTTERY FIELD
Hunslet East Goods Depot
32
River Aire
Cricket Ground
PUBLIC PARK
Hunslet Moor
HUNSLET
ATKINSON HILL
Recreation Ground
31
30
Sports Ground
Roman Coin found A.D. 1947
Boro Const Bdy
WOODHOUSE HILL
Allotment Gardens
HUNSLET CARR
68
103
149
172
168
173
180
178
196
214

CHAPTER 6

IRON, STEEL AND ENGINEERING

By 1914 in South Leeds there were iron & steel works and engineering firms specialising in machine tools, locomotives & light railway materials, wagon wheels, steel castings & forgings, hydraulic machinery, pumps, agricultural machinery including traction engines, steam wagons, stone & ore crushing plant, brick-making machinery, textile machinery for woollens, worsteds, flax & linen, printing machinery, firewood splitting & packing machinery, boilers, boiler flues, gas holders, pulleys, valves, gas meters, locks, nails, screws & bolts, wirework, perambulators, seamless steel hollow ware and other items.

This list shows a high degree of sophistication and specialisation. From very small beginnings 'engineering' in the broadest sense had become the most important industry in Hunslet and Holbeck by 1870 and has dominated the district since, particularly since the decline of the older textile trades.

The development of the industry is complex since firms not only changed ownership and site but also changed from one branch of production to another, or frequently developed several aspects concurrently for some years before specialising. This reflects technical developments perhaps more than anything else. The machine maker of 1800 produced his own castings in iron and non-ferrous metals, machined the parts and then built all kinds of machinery and engines to order. Large amounts of wood were used in machine building and in the case of scouring machinery wood has only recently been superseded by stainless steel, whilst it is still the main material for milling machines in woollen mills. As machinery developed, specialisation followed and in this process some firms changed to different products. Taylor, Wordsworth & Co. began in 1793 as textile-machine makers with a reputation for flax dressing machines, hardly surprising since their works was next to Marshall's Mills on Water Lane. By the 1840s they had changed from flax to worsted machinery and were deeply involved in the legal battles between Noble, Donisthorpe and Lister over combing machine patents, since they built Donisthorpe's machines, and were parties in the action between Jean Jacques Heilmann and Joshua Taylor Wordsworth & others for infringement of the Heilmann patent in February 1852.[1] Having established a reputation in this field the business continued until 1966 when it was absorbed by Prince, Smith & Stells of Keighley, as part of the consolidation of the Stone-Platt group.

Joshua Buckton began as a woollen merchant[2] in Meadow Lane and then built his own woollen mill on Meadow Road, but by 1844 had turned to machine tool making and developed into

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1. Bound volume of verbatim report of the trial, now with TMM, Helmshore, Lancs.
2. Sun CS 1641292 (1796) Morris D (1798) Pickering, Gamble & Buckton, woollen merchants.

a specialist builder of testing machinery for anchor chains and armour plate, a business that lasted until 1960 as the Well House Foundry.

In general a 'foundry' was an engineering works and a 'forge' a place where iron was cast and worked up into wrought iron. The distinction was perhaps a nice one at the beginning of the nineteenth century. At Matthew Murray's Round Foundry, iron cylinders and other parts needed to build machinery were cast and at Hunslet Forge, at Thwaitegate, iron was smelted and boiler plates were made. Perhaps the distinction made by the Iron & Steel Industry Training Board in recent years is most helpful. A 'Class A' foundry mainly produces castings, whereas a 'Class B' foundry is part of a larger engineering complex, the first stage of an integrated manufacturing process. This would put Hunslet Forge into Class A and the Round Foundry in Class B. Most of the foundries in Hunslet and Holbeck were in the latter category, using small cupola furnaces to remelt brass or iron for castings for their own use in machine making.

Iron Works

The situation of Hunslet and Holbeck at the northern extremity of the Yorkshire coalfield was fortunate since in the outcrops and shallow pits to the immediate south there was to be found ironstone associated with the coal, and limestone as a flux was readily obtainable from Fairburn and

Map Sheet 10 Ironstone Pits south of Hunslet.

Based on 6" O.S. 1947

Brotherton by the Aire & Calder Navigation, or by the Leeds & Liverpool Canal from Skipton. The ironstone pits were small but many local coal mines also produced iron ore so that supplies were adequate during the first part of the century.

Abraham Darby developed the use of coke for iron smelting at Coalbrookdale in 1709. The process was slow to spread but by 1800 coke had replaced charcoal smelting in most districts. The use of cast iron was limited because of its brittle nature. Apart from the Iron Bridge the major use was for firebacks, cooking pots and armaments until it was taken up in Victorian times when its uses were almost limitless. The Great Exhibition was a triumph for cast iron as a building material although it had been used since the beginning of the century for T-section beams and for pillars; Bage used it for roof-trusses and window frames when he designed Benyon's flax mill in 1803. Its later use for decorative ironwork was outstanding. Matthew Murray introduced the use of cast iron for machine frames but, apart from these and cylinders, machine makers used mainly wrought iron, which was produced by puddling molten iron in a reverberatory furnace of the kind patented by Cort in 1783-4 and then rolling the finished ingots into suitable shapes.

In 1772 Salt & Gotthard bought the Hunslet Foundry (211) and had cast the iron rails for the Middleton Railway before 1800. There were other small iron works in the area, such as Hodgson's at Balm Beck (214). John Sturges, of the Bowling Iron Works, Bradford, had Holbeck Forge (22) which he advertised for sale in 1804.[1] It remained his property a little longer since he was listed in the 1807 WR Poll Book as an ironmaster of Holbeck. Sturges was a partner of Richard Paley, the prominent Leeds entrepreneur and they shared interests in the Bowling Iron Works and Fall Ings Foundry at Wakefield. The reference to hammers shows that wrought iron was being worked in the forge, rather than grey iron being cast.

Nearer the town Nathaniel Prior & Warwick opened a foundry in Simpson's Fold in 1801,[2] which closed down in 1807. Prior was then described as a 'brassfounder' rather than an iron master.[3] The foundry was 46 ft square and contained 'a large iron throw for boring and turning iron pipes and shafting.' [4] Since there was a model room[5] the inference is that iron castings were made and bored out for piping. Both Matthew Murray and D. Wood of Fenton, Murray & Wood, were described as 'iron founders' in the 1807 Poll Book although the Round Foundry, built in 1802, was really an engineering works.[6] Two other foundries are known: J. Shaw

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1. LM 4.6.1804
2. LI 21.9.1801
3. Wilson D (1807)
4. LM 6.4.1807 RE 57/223583/4 (1806) listed 'building for boring iron £800 steam engine £300 Total £2550
5. model room = pattern making shop.
6. RE 37/172611/2(1800) "2 buildings in Water Lane used as model warehouses £400, a mill for boring iron & machine shops over steam engine house £1000" Steam engine £150 RE 50/210456/7(1804)"Circular building heated by steam £2000" Iron foundry with 2 steam engines £6050".

had taken over Fenton's Hunslet Forge at Thwaitegate, and Richard Pullan had the Soho Foundry (203).

Ard Walker's accounts for the building of the Waterloo Mill in 1801 show that boiler plates were bought from Shaw for £161 but the boiler was built by Pullan for £64 in January 1802 and Matthew Murray supplied the 30 h.p. engine.[1] Both Pullan and Shaw supplied general ironmongery and files, and carried out repairs to tools whilst the mill was being built. Once again there is the implication that these foundries were becoming engineering works and that Shaw was producing wrought iron boiler plates and possessed a slitting mill to cut bar into rods.

The Hunslet Rate Book[2] which was begun in 1823 shows that the Gotthard brothers had two small foundries and 'Salt's assignees' had an empty (disused) foundry, the three being assessed at 5 gns. Pullan's foundry was assessed at £16 and there was a 'flax and turning mill, brass and iron foundry' belonging to J. Procter with a total value of £26. This was another Soho Foundry on Meadow Lane (64). The previous occupant was John Jubb, millwright, so this was most likely to have been really an engineering works rather than a 'Class A' foundry. Part of the site was sold to J. Ainsley who developed a 'Class A' foundry for domestic cast iron work. In 1827 John Day opened the Leeds Iron Works

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1. Leeds City Archives DB23 (1800-1801)

2. Leeds City Archives LO/HU/5

in Pottery Fields (127), which was rated at £7 but this was increased to £35 when a 30 h.p. engine was added later that year. The original site lay between the Middleton Railway and Kidacre Street but extensions followed across the railway towards Dewsbury Road. Day went bankrupt in 1829.[1] The works were bought by George Jones[2] and then by Hood & Cooper who were responsible for the extensions of 1837. By 1848 the work force had risen to 180 men[3] and as trade increased more capital was raised by a mortgage in 1853.[4] Cooper became the chief partner and employed 600 men in 1867.[5] By 1873 there were 13 puddling furnaces and 6 mills,[6] and it was a major supplier of wrought iron to the local engineering works. The closure of the Leeds Iron Works in 1888 reflects the decrease in demand for wrought iron for general purposes in the face of competition from cheaper mild steel produced in open-hearth furnaces.

The Hunslet Foundry (211) passed to John Gotthard's son-in-law, John Gledhill, who traded as Gledhill & Williams until his death in 1853. The foundry was then bought by Richard Kilburn, the fulling machine maker from Holbeck (21). Richard Gotthard seems to have kept a small foundry of his own, on

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1. LM 30.1.1830
2. Baines & Newsome D (1834)
3. Holbeck S.V. Minutes 1848
4. LCD 565
5. Rivers Commission (1867) p.201
6. Griffiths, Guide to the Iron Trade (1873)

Balm Road, until the 1860s (Jones 1863). It is possible that this was the forge on the Balm Road flaxmill site (214) but it was not recorded in 1823 in the Rate Book. Kilburn operated the foundry at Hunslet until 1889 when the ownership passed to Samuel Denison & Son, whitesmiths & scale makers, from north of the river, now part of the Avery group. Under Kilburn the foundry produced 'steely cast iron' for ingot moulds and hydraulic cylinders, from a cold blast reverberatory furnace.[1] Although Nielson had introduced the hot blast for iron smelting in 1823 Yorkshire iron masters persisted in the use of the cold blast for the production of 'Best Yorkshire Iron'.

The Growth of Small Iron Foundries

The middle of the century saw the growth in the numbers of small foundries where pig iron was remelted in a cupola furnace to produce castings of all kinds, especially domestic goods such as fire baskets, cookers, gutters and downpipes. Apart from directories and advertisements, physical evidence of these foundries can still be seen in the coal chute covers on the walls of many older houses in Leeds. It is convenient to deal with these foundries at this stage since they tended to be 'Class A' foundries. One of the first was Newton, Taylor & Co. who were listed at Croft Street, off Water Lane, from 1831 to 1839 as the Globe Foundry (58)[2] and then moved to Globe Road to a new Globe

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1. Leeds University, Brotherton Mss.165/37 Kilburn Scott papers
2. LCD 18135

Globe Foundry in 1844,[1] which employed 250 men in the 1860s. Their next door neighbour, Colonel T. R. Harding, extended his Tower Works onto the site so that Newton, Taylor once more moved the Globe Foundry to another site. By then the owner was W. Towler and the new site on Water Lane (21) had previously belonged to Richard Kilburn in the 1850s before he took over the Hunslet Foundry. Towler developed domestic castings and specialised in crucible steel. In 1853 Green & Jackson were also operating a Globe Foundry at 12-14 Water Lane, near Leeds Bridge. This became J. Green[2] and he employed 30 iron workers in 1867.[3] From Water Lane, Green moved to the Globe Iron Works on Crown Point Road (85) formerly the Prospect Works of Hutton & Macdonald, engineers.[4] As J. Green & Nephew, the firm were there until 1911 when they moved to 47 Hunslet Road (86). Like Towler they produced mainly domestic castings, especially coal chute covers and fire baskets.

One foundry which changed over to engineering was James Bray's New Dock Foundry (96). Bray, from Bradford, began business on the New Dock site in 1838 and cast the iron work for Crown Point Bridge (1840) but soon moved to general foundry work in iron and brass as well as machine making. The main

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1. LM 9.3.1844
3. Rivers Commission (1867) p.200
2. Jones D (1863)
4. White D (1875)

market for his output was civil engineering works, particularly railways. At its peak New Dock Foundry employed 500 men[1] but following Bray's death in 1873 the site was taken over by Catton & Co., crucible steel casters, as the Yorkshire Steel Foundry. Cattons are still in business on this site. Technically, crucible steel casting, based on the process developed by Huntsman in 1722, was a small scale method of making steel: it was used for high grade special steels. Perhaps more important in the Hunslet context is that it was the only way of remelting the swarf produced when steel was machined, before the introduction of the electric-arc furnace. With so many users of steel in the district there were good supplies of swarf for crucible steel making.

In 1864 Lot 21 of the Goodman estate, originally Pym Nevins' Larchfield estate, was bought by Rhodes & Kenyon for £306. This became Kenyon & Co's Soho Foundry[2] but within a decade it was known as J. Rhodes. Rhodes employed 25 men[3] but in 1879 went bankrupt for £1500 and W. Sands took the works over as the Accommodation Foundry (158). He sold it to J. B. Jubb & Sons, brass, iron & steel founders, in 1908. The conveyance listed 'foundry, cupola, engine etc.'[4] so

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1. Census Enumeration 1861 RG 9
2. White WRD (1866)
3. Rivers Commission (1867) p.201 J. Rhodes & Co.
4. LCD 4343

this seems to have been basically an iron foundry rather than an engineering concern. The relationship of these foundries with the local engineering firms may be judged from Hill Bros. Nevins Foundry (169) which began in 1865 and from 37 employees two years later[1] had increased to employing 100 men as specialist cylinder casters, mainly for railway engines, which were supplied to the three locomotive builders in Hunslet. Recently this foundry was taken over by the Hunslet Engine Co.

Steel Works

It has been said that the real "Iron Age" was the early and middle nineteenth century and steel was not widely used until Bessemer developed a cheap method of production. Because of the limitations imposed by the need to use haematite or other phosphorous-free ores the Bessemer process did not immediately become a serious competitor to wrought iron. The Siemens open-hearth furnace increased steel production and made use of sc~~ar~~rap iron but the major breakthrough in the mass production of mild steel was the introduction of the Gilchrist-Thomas basic hearth in 1879, first used by Bolckow, Vaughan & Co. at Middlesborough. Not only did this permit high phosphorous ores to be used but the phosphorous became part of the slag which could be ground into a fine powder and, as 'Basic Slag', provided a valuable phosphatic fertiliser. Mild steel was really a new

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1. Rivers Commission (1867) p.201 Hill Bros.

material, differing from crucible steel, wrought and cast iron in many ways, and rapidly replaced wrought iron for many purposes, especially for boiler plates and ship-building.

The growth in the demand for mild steel at the expense of wrought iron has already been noted in connection with the 'Leeds Iron Works' which closed down in 1888. The opposite may also be seen in the growth of the 'Leeds Steel Works' on New Pepper Road (200). This was originally the site of Ard Walker's cotton mill (199) but after closing down as a textile mill it became a chemical works for a few years until by 1867 it had become the 'Waterloo Iron Works' of R. U. & T. Garside.[1] However, by 1871 it had become the Airedale Haematite Co. which changed its style to the Airedale Häematite Iron Co. by 1875. There is a strong suggestion that the new works was producing Bessemer steel from ore transported from Barrow-in-Furness by the Midland Railway. By 1895 it was known as the 'Leeds Steel Works', with 3 basic blast furnaces producing 2000 tons per week, 4 basic Bessemer converters, and a Fowler blowing engine,[2] showing a change to the Gilchrist-Thomas method but not the adoption of the open-hearth furnace. By the turn of the century the style had changed again, this time to 'Walter Scott, Leeds Steel Works'. The site by then covered about 100 acres between Balm Road and New Pepper Road on the north-east side of the Midland Railway. At first the mild

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1. Rivers Commission (1867) p.200, Waterloo Iron Works, 90 iron workers.

2. Soc. Chemical Industry. Leeds Meeting (1895) p.40

steel ingots were rolled into blooms and billets for the numerous engineering firms in the area but in 1892 alloy steels were introduced and the rolling of girders and constructional steel sections was begun. The 'Leeds Steel Works' was the first steel mill to roll 6" round bar into 60 ft lengths. Harder steels were developed and this led to the rolling of manganese steel rails, one of a wide range of railway and tram lines produced.[1] Manganese steel, discovered by Sir Robert Hadfield of Sheffield, was not hard like a carbon steel but was very tough and non-magnetic. In railway points it outlasted ordinary Bessemer steel five or six times. In addition to producing a high tonnage of steel rails, large amounts of basic slag were produced and on the same site was the 'Leeds Phosphate Works' which ground and packed it as "Thomas' Phosphate Meal"

> "used in all parts of the world".[2]

Not all the wrought iron producers closed down with the advent of tonnage steels. Taylor Bros. were in business at the 'Clarence Iron Works' in 1863 and had bought land from the trustees of the Denison & Wilkinson estate in 1866. They employed 500 men in 1867[3] and operated 17 puddling furnaces and 5 rolling mills.[4] They had a high reputation

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1. LCYB(1910)p.54
2. LCYB (1910) p.262
3. Rivers Commission (1867) p.194
4. Griffith's, Guide to the Iron Trade (1873) p.198

as suppliers of 'Best Yorkshire Iron'. This was smelted, with a cold blast, from local ironstone and sulphur-free coal found in adjoining seams. The liquid iron was then puddled and rolled to produce extremely tough wrought iron which was highly regarded for boiler plates, cranks, axles and mine cages. In addition Taylor Bros. also produced cast forgings:

> "some of the largest steel hoops, $10\frac{1}{2}$ feet in diameter, 6 inches broad and $1\frac{7}{8}$ inches thick".[1]

Cast steel, made from Swedish pig iron, was used for railway and tram wheels which were supplied to the local railway-locomotive and wagon building works. The firm continued until after the Great War and at present the business is a 'Class A' foundry, the "West Yorkshire Foundry" of the British-Leyland group.

Engineering

It has already been shown that many iron works evolved into engineering establishments and that initially most foundries carried out a wide range of activities concerned with the casting of metals and the making of machinery. Matthew Murray undoubtedly deserves the title of 'Father of the Leeds Engineering Industry' but there were others whose contributions perhaps were less but who played an important part in the foundation of the trade. These were men like John Jubb

1. Mayhall Annals 28.1.1868

a prominent millwright working from a 'yard' in Meadow Lane (64) between 1791 and 1817. He installed Boulton & Watt engines in various mills in the West Riding as well as making textile and agricultural machinery.[1] His yard became the 'Soho Foundry' which was used for brass & iron founding and then became a steam engine manufactory for Zebulon Stirk, of York Street, until about 1840. William Kilburn, of Holbeck Lane, founded a millwright and fulling machine-making business before 1800, which still survives. From the original site expansion took place first of all to build a foundry (21) at the corner of Bridge Road and Holbeck Lane in 1850. In 1855 the 'Hunslet Foundry' (211) was taken over to provide extra working capacity. The firm remained at Hunslet until 1899 and in Holbeck until 1866 when Richard Kilburn built the new 'Perseverance Works' (219) on Elland Road, and this is still in use.

Other millwrights who became textile machine makers included Richard Cluderay, 'established 1815'.[2] As C. & W. Cluderay the 'Star Foundry' (7) employed 13 men.[3] In the early 1890s the business became Myers Bros., engineers & millwrights, who remained there until after 1914.

One of the oldest established machine-making firms was Taylor, Wordsworth & Co. of the 'Midland Junction Foundry',

1. LI 2.6.1794 'John Jubb, millwright, wants 3 journeymen. Makes scribbling & carding machines also thrashing machines
2. Advertisement in Jones *Directory* (1863)
3. *Rivers Commission* (1867) p.199

Water Lane (23). It was started in 1793 by Joshua Wordsworth and he was joined by John Taylor in 1806.[1] The development of this firm is of interest since they began by making flax-dressing machinery and then in the 1840s turned to the development of wool combing machinery for Noble and Donisthorpe. Improvements were constantly being made after 1874 and by 1892 Charles and John Whitehead, whose father had been an early partner in the firm, had registered 16 patents to increase the efficiency of wool combing machines. The growth of the business may be surmised from various sources. In 1824 they used 8 h.p. and by 1834 this had risen to 10 h.p.[2] By 1848 it had become 26 h.p.[3] In 1834 they employed 350 men but by 1851 this had fallen to 135[4] and in 1867 they employed 150 men.[5] The number employed varied considerably:

> "when trade is good, employment is found for over 500 hands."

Apart from wool combing machinery Taylor, Wordsworth made:

> "worsted preparing & spinning & twisting machinery, stocking yarn and carpet machinery. Eastwood and Ambler's patent wool washing machine as well as machinery for flax, tow and hemp".[6]

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1. Mayhall Annals 3.2.1848. "Died, John Taylor aged 71"
2. W. Lindley (1824) op. cit. Factories Inquiry(1834)Vol.II C 47
3. Holbeck Select Vestry Minutes 1848
4. Census Enumeration 1851 HO 107/2317 John Taylor, 135 men
5. Rivers Commission (1867) p.199
6. The Textile Manufacturer 15.5.1892

Their name is also associated with the successful development of the condenser which made the slubbing billy obsolete.

Taylor, Wordsworth & Co. were absorbed into Prince Smith & Stells (established 1795) of Keighley, in 1967, both being members of the Stone-Platt group.[1]

Such were some of the firms who began making textile machinery at the same time that Matthew Murray began working in Holbeck. The link with millwrighting is strong. Millwrights originally made water and wind mill gearing and shafting, based on hand cut wooden gear teeth set into cast iron built-up wheels. The earliest textile machinery was always described as "clockmakers' gear" in insurance documents, but it seems that in Leeds the clockmakers were too busy making long case clocks to be bothered with textile machinery.

Matthew Murray's Influence

Although the fame of Boulton & Watt is universal, Matthew Murray's achievements were a major contribution to engineering in general and to Leeds in particular. Murray came to Leeds from Stockton-on-Tees in 1789 at the age of 24. He was a

1. Various letters from Mr M.I.Bramwell, works manager, Taylor Wordsworth & Co. In 1830 they advertised for some 40 skilled men (LM 4.6.1830) stressing that overtime was always paid for. They employed no boys under 10 - hardly surprising since they had limited the normal day to ten hours from 1824.

He was a
journeyman mechanic and was familiar with Kendrew & Porthouse flax machines. In Leeds he found employment with John Marshall who was opening a flax mill on the upper reaches of the Meanwood Beck at Adel. Murray proved capable of translating Marshall's ideas into working machinery and in 1791 Marshall moved to Water Lane (27) where he began to develop his mill complex, initially north of the Holbeck. Murray set up in partnership with David Wood, iron founder, at Mill Green in 1795. Almost at once they moved to Water Lane, across the road from Marshall's Mill B. The business traded as Fenton, Murray and Wood. James Fenton provided capital and financial management, Murray was the engineer-designer, Wood the machine builder and William Lister was a sleeping partner. The 'Round Foundry' (34) was built in 1802 and was so called because the fitting shop was circular in plan. Further buildings were added until 1830. Basically the firm were textile-machinery makers but almost from the start Murray showed an interest in steam engines. His engines began to sell well and Boulton & Watt were anxious to prevent piracy of their designs and also to find out details of Wood's greensand moulding & casting techniques, which were in advance of those used at the 'Soho Works' in Birmingham. To this end they bought, through a third party, land to the east of the 'Round Foundry' to block expansion by Fenton, Murray & Wood. They also intrigued to plant one of their employees in the works and to rent the malt-kiln on Foundry Street, let to T. Skelton, so as to be able to overlook the entire site.

By 1824 the 'Round Foundry' itself used 4 engines totalling 32 h.p. and had supplied 77 engines, of almost 1500 h.p. in all, to other local works. These were all stationary engines similar to Boulton & Watt's design but with improvements to circumvent patents. In the Leeds district Pullans, of Hunslet, had built 22 engines, Boulton & Watt had supplied 7 and Zebulon Stirk had built 9, but these were smaller than the Birmingham-made engines. The largest engine at work in Leeds was by Murray, Marshall's 70 h.p: others included Hives & Atkinson's and Benyon's each of 60 h.p. in flax mills whilst Jos. Medley of the 'Crown Point Oil Mill' had a 64 h.p. Murray engine. Boulton & Watt had provided Benjamin Gott's 40 h.p. engine at Bean Ing. Rhodes, worsted spinners, had a 45 h.p. engine from the Low Moor, Bradford, works.

Murray's engines were adaptable to transport needs and in 1812 he was commissioned by John Blenkinsop, 'viewer' of Brandling's Middleton Colliery, to provide an engine to haul coal chaldrons to Casson Close near Leeds Bridge. Blenkinsop had patented the rack rail[1] which was to be used and the casting of these was done by Salt & Gotthard at Hunslet Moor. Murray built the 'Prince Regent' for £380 including a royalty of £30 for the use of the Trevithick high pressure boiler design.[2]

"The experiment which was witnessed by thousands of

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1. British Patent 3431 of 1811

2. British Patent 2599 of 1802

spectators, was covered with complete success".[1]

In all, four engines were built for the Middleton Railway by 1813 and others were supplied to collieries on Tyneside. A 3 h.p. engine was fitted to a boat which sailed from Leeds to Hull and possibly out to sea.[2] His first export engine went to Sweden in 1803. Murray's inventions included the first engine all on one bed-plate, cyclic gears for rotary motion, a modified D-slide valve[3] which was the basis of the combined cylinder and valve chest used on locomotives, and a metal planing machine. Apart from his founding of the locomotive building industry in Leeds his most significant contribution would seem to be his use of cast iron for machine frames and engine beams, giving lightness, strength and fire resistance. Others had always used wood for these parts and with use they became soaked with lubricants and constituted a high fire hazard.[4]

The 'Round Foundry' became as well known as the 'Soho Works', and it was visited by the Grand Duke Nicholas in 1816. J. G. May, a Prussian Factory Commissioner, visited Leeds in February 1815 and inspected the 'Round Foundry', the Middleton Railway and other major industrial sites.[5] He

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1. LM 27.6.1812.
2. Mayhall Annals 18.6.1813
3. Originally patented by William Murdock. British Patent 2340 of 1799
4. T. Turner, 'History of Fenton, Murray & Wood (1966)unpub. M.Sc thesis. University of Manchester Institute of Science & Technology
5. W.O.Henderson,Ind.Britain under the Regency 1814-15 (1966) p.18

commented on the Blenkinsop locomotives and stated that Murray employed over 100 men, making steam locomotives, spinning machinery for flax and gas lighting apparatus. Both Murray and Marshall had their own private gas works, which also lit adjacent streets. The 'Round Foundry' gas plant produced 600 cu.ft of gas from one hundredweight of coal, this lit 126 burners for 3 hours.

Matthew Murray died in 1826[1] at his home in Water Lane, Springfield Lodge ('Steam Hall'). David Wood, 'mechanician' died in 1820 aged fifty-nine.[2] Murray's share of the business passed to his son-in-law, Robert Jackson, husband of Murray's elder daughter, and the style of the firm became 'Fenton, Murray & Jackson' until it closed down in 1843. Their biggest engine order was in 1842 for 20 broad gauge locomotives for the G.W.R. The workers attempted to run the business themselves but they were unsuccessful and the 'Round Foundry' was for sale in 1848.[3] In 1855 it was bought by Smith, Beacock & Tannet of the 'Victoria Foundry' (54) who redeveloped much of the site.

The influence of Matthew Murray as a locomotive builder and engineer was extensive. Apart from the technical developments he introduced, his apprentices spread his influence

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1. Mayhall, <u>Annals</u> 24.2.1826 aged 61

2. Leeds University, Brotherton Mss. 163 E. Kilburn Scott Papers.

3. <u>LM</u> 4.11.1848

further. His younger daughter married C. G. Maclea who, with Charles March, set up the Union Foundry (62) in 1825. Both had trained at the 'Round Foundry' and became successful engineers and textile machine makers. Another 'Round Foundry' apprentice was Charles Todd who, with Kitson, started the 'Railway Foundry' (137) in 1837 and then in 1844 Todd sold out and took over the 'Sun Foundry' (125) from Sugden, who moved to another works in Kirkstall Road. Textile machine-making gave way to steam engines under Todd and then in 1858 the 'Sun Foundry' was taken over by Garret, Marshall & Co.[1] Kitson was also Murray trained and soon after starting the 'Railway Foundry' left to start the 'Airedale Foundry' (140) in 1839, with Thompson and Hewitson. From 1863 until 1960 it traded as Kitson & Co.[2] When the 'Round Foundry' closed W. M. Jackson took a foreman moulder and a blacksmith with him to Switzerland where they were employed by Hans Kasper-Escher to found the Escher-Wyss engineering works at Zurich.[3]

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1. E.K.Scott, Matthew Murray (1928) and R.N.Redman, The Railway Foundry, Leeds (1972)
2. E. Kitson Clarke, Kitson of Leeds 1837-1937 (1938) and R. J. Morris, 'The Rise of James Kitson' Thoresby Soc. (1972) pp 181-190
3. Leeds University, Brotherton Mss. 165/25 and 165/38E E. Kilburn Scott papers

Other engineers trained at the 'Round Foundry' included:
Benjamin Hick, Hick, Hargreaves & Co. Bolton (mill engines),
Richard Peacock - Beyer, Peacock & Co., Gorton Foundry.
John C. Craven - 1st Loco Superintendent L.B. & S.C.R.
David Joy - inventor of the Joy radial valve gear.

Table 6.1

Steam engines in use in Hunslet and Holbeck before 1800			
Site	User	Industry	Notes
3	Wm. Atkinson	Scribbler	)atmospheric
5	J. Grimshaw & Co.	Scribbler	)engine + wheel
14	Longbottom & Co.	Scribbler	
15	Fisher & Nixon	Scribbler	
27	Marshall & Co.	Flax	2 Boulton & Watt
36	Brown & Co.	Scribbler	
	Wm. Chadwick	Dyer	N. Strong
	Beverley, Cross & Billiam	Cotton	Boulton & Watt
105	Glover & Co.	Scribbler	
	Rogers	Paper	
143	Wilkinson & Pullan	Scribbler	
199	Ard Walker	Cotton	+ wheel
152	Pym Nevins	Scribbler	Boulton & Watt
209	Coupland & Wilkinson	Cotton	Boulton & Watt
210	Burrow Copley	Scribbler	
214	Hodgson & Co.	Scribbler	+ wheel

Table 6.2 Source: Lindley (1824)
Brotherton Mss 18

Steam engines in use in Hunslet and Holbeck in 1824								
Industry	Fenton		Pullan		Others		Totals	
	no.	hp.	no.	hp.	no.	hp.	no.	hp.
Woollens	4	108	1	16	3	40	8	164
Cotton	1	35					1	35
Flax	13	394	2	56	1	16	16	466
Dyeing	2	32			1	30	3	62
Seed-crushers	1	20			1	18	2	38
Machine-makers	5	40					5	40
Pottery	1	40					1	40
Paper					1	34	1	34
Buckram	1	10					1	10
Totals	28	679	3	72	7	138	38	889

Table 6.3 Source: Lindley (1824)
Brotherton Mss 18

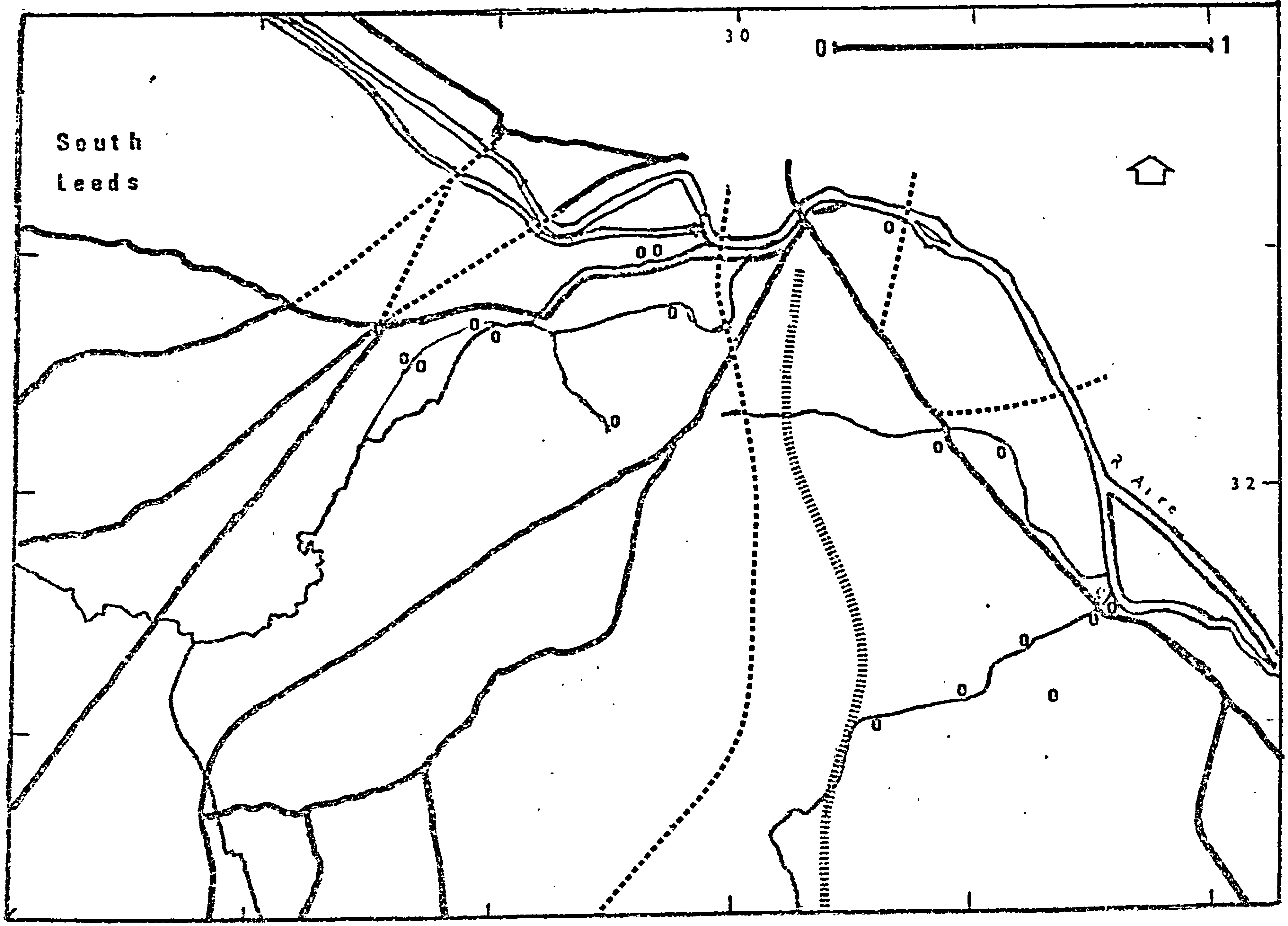
Fenton, Murray & Co. engines in use in the Leeds district: 1824								
Industry	10hp	16hp	20hp	26hp	30hp	36hp	40hp	60hp
Woollens	3	5	3	1	4	-	2	-
Worsteds	-	-	-	-	-	1	1	-
Cotton	-	-	-	-	-	1	-	-
Flax	-	3	1	1	2	-	2	3
Dyeing	6	-	1	-	-	-	-	-
Seed-crushers	2	1	2	-	-	-	1	1
Machine-makers	2	1	-	-	-	-	-	-
Pottery	-	-	-	-	-	-	1	-
Buckram	1	-	-	-	-	-	-	-
Totals	14	10	7	2	6	2	7	4

Table 6.4

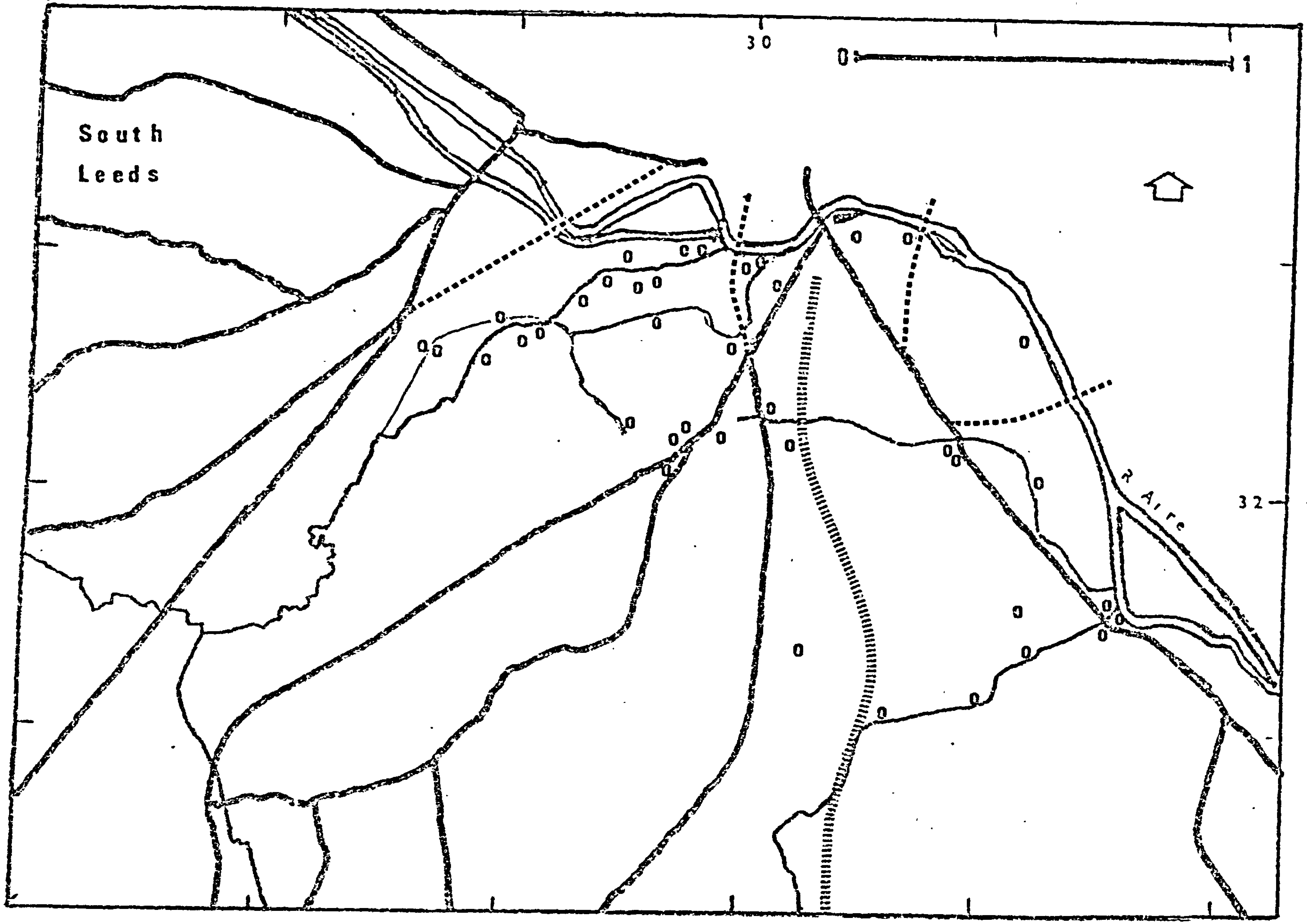
Prices for Fenton, Murray & Co. Steam Engines, 1809		
Horse power	Price (£)	
10	550)	Including one best iron boiler to each, deliver in Leeds, payable in three months.
16	750)	
20	870)	
26	1050)	
30	1170)	
36	1290)	
40	1370)	
60	1550 *	exclusive of boilers which might cost c. £360 extra

Based on a letter to Henry Teal, agent to Denison & Wilkinson. 10th July 1809 University of Nottingham. Denison Mss. De H 50.

I am grateful to Dr. Ward for drawing this letter to my notice.



STEAM ENGINES in use ; Before 1800



STEAM ENGINES IN USE IN 1824:: Sources, Lindley(1824), Hunslet Rate Book.

Locomotives

From building the Blenkinsop locomotives in 1812 until the present time, Leeds has been noted for railway engine building. Blenkinsop's rack-rail system was not developed generally since it became apparent that the weight of the engine on the smooth track would provide sufficient adhesion for effective traction and that there would be no real problems of wheel-slip under power, as had been predicted. Murray competed unsuccessfully for the Stockton and Darlington Railway contract in 1825 and on the Middleton Railway a boiler explosion combined with the cheapness of horse fodder led to a return to horse-drawn coal wagons.

Railway engine building in Leeds did not revive until 1837, when Todd, Kitson & Co. opened their 'Railway Foundry'. Both of the partners were of a somewhat volatile temperament and in 1839 Kitson left to start the 'Airedale Foundry'. The partnership then became Todd and John Shepherd but in June 1844 Todd left to take over the 'Sun Foundry' on Dewsbury Road from Sugden. The new partner now was E. Brown Wilson, a Hull shipowner. After withdrawing for some months in 1846 he returned to take effective control of the business so that in 1848 Shepherd left to join Hill at the Union Foundry (145). The business now traded as E. Brown Wilson & Co. From 1846 onwards the works were extended and more land bought on Jack Lane. Wilson died in 1856 and the 'Railway Foundry' was valued at £12,000.[1]

1. L.T.C.Rolt, A Hunslet Hundred p.25 and R.N.Redman op.cit. p.14

The 'Railway Foundry' was for sale in 1859, all except the original works on Pearson Street (Lot 1) which was not part of the Brandling estates. In 1860 the land south of Jack Lane (Lot 6) was bought by Hudswell, Clarke & Co. and on it they built their 'New Railway Foundry' (138). John Clarke was previously works manager at the 'Airedale Foundry' and W. S. Hudswell was the son of the pastor of Salem Chapel. Next to the main site had already been developed in 1858 by Manning, Wardle & Co. as the 'Boyne Engine Works';[1] the management all ex-Railway Foundry men.

The main site was bought by J. T. Leather in 1864, for £2766, and became the 'Hunslet Engine Co'. Leather sold his interests to G. & J. Campbell in 1871 for £25000 and the company was incorporated in November 1902.

The 'Airedale Foundry' was extended in 1853 when William Spong's 'Airedale Brewery' was taken over for extensions. In 1880 Kitson bought Lot 1 of the old Railway Foundry and added it to his works.

Thus, by the end of the nineteenth century there were three major railway engine builders in Hunslet on adjacent sites between Hunslet Lane and the Midland Railway line beyond Jack Lane. All could claim lineal descent from the Round

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1. After Lord Russell (Viscount Boyne) the land owner.

Foundry of Matthew Murray. All of them made other things besides railway engines, especially the 'Airedale Foundry' which made armaments, including Whitehead torpedoes, built the original Fowler ploughing engines in 1860 and Charles Parson's electrical generator in 1884.[1]

The Railway Age began in 1830 with the Liverpool & Manchester Railway which combined the essential four features:

a) Specialised track. b) allowed public traffic.
c) carried passengers. d) relied on mechanical traction.[2]

Matthew Murray by then was dead and the 'Round Foundry' built fewer locomotives. The Stephensons had developed Murray's ideas at their Newcastle Works and at the Rainhill Trials had won the contract for the locomotives for the Liverpool & Manchester Railway. It was an immediate success and others rushed along to develop new lines. The first 'Railway Mania' was in 1836 and by 1837 Parliament had approved 1,500 miles of new railways. This kind of development meant that there was great scope for locmotive builders. Kitson and Todd had good grounds for optimism when they opened the 'Railway Foundry' in 1837. The economic difficulties of the last years of the

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1. British Patent 6734 of 1884

2. C.E. Lee, The Evolution of Railways (2nd Ed.) 1943 p.104. This definition has been adopted by M.Robbins The Railway Age (1962), p.12; see also J. Simmons, The Railways of Britain (1961) p.3.

decade slowed down investment and it was not until the 'Railway Mania' of 1844-47 that business began to prosper again. By then E. Brown Wilson was in control of the 'Railway Foundry' and from 1847 began to build one of the best known engines of the time, David Joy's 'Jenny Lind'. These were widely used by George Hudson's York & North Midland Railway' and the 'London, Brighton & South Coast Railway'. By the 1850s the days of rapid development had passed and the emerging main line companies had begun to build their own engine works so that independent builders, like Kitson, Hudswell, Clarke, and the Hunslet Engine Co. no longer supplied main line engines to British companies. Instead they developed export markets for their larger engines and supplied small engines to the minor companies, for branch line use, and for industry, as well as the export markets of South America, India, eastern Europe and the 'colonies'. Wilson concentrated on three basic models, Hudswell Clarke on 'narrow gauge' locomotives.

The importance of the export trade may be seen from the existence of a 'stripping shop' at the Hunslet Engine Co. between 1875-85. This was where export models were dismantled after a trial run and packed for despatch. The classic story is of a narrow gauge engine which was packed in units small enough to be carried by mules to its destination in an Andean mine.

Numerous illustrations exist of contractors' locomotives being towed by Fowler traction engines from the Leeds works to their work site by road:

> "All sizes and classes of locomotives are produced, from the small plantation engine weighing four tons to the modern mammoth engine weighing, with its tender, 130 tons".[1]

Most of the developments in locomotive design after 1860 were in detail and size. The increased weight of these newer and more powerful locomotives called for changes in building materials and this in turn led to the development of new machine tools to fabricate the parts, in particular hydraulic rivetting and flanging machines, as well as giant presses and hammers. The construction of these tools will be dealt with later but Leeds engineers made them as needed. The building of locomotives also relied on specialist sub-contracting for many parts. With such a nucleus of engine builders in Hunslet there was a good market for supporting specialist engineers and iron works, who provided these parts. The Hunslet Engine Co. drew supplies from Manning, Wardle & Co. next door, Hill Bros. of 'Nevins Foundry' on Goodman Street, and brass castings from Chadwick Bros. of 30a Dewsbury Road. The 'Clarence Iron Works' made wheels and forgings for axle and crank-shafts whilst the 'Leeds Steel Works' made the rails, in sixty foot lengths, in contrast to the fifteen foot long

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1. LC.Y.B. (1910) p.55

lines cast for the Middleton Railway by Salt & Gotthard.

These locomotive builders established a great name for sound engineering and service. Their model shops (pattern making shops) retained the patterns and engines have been returned after fifty years' service for overhaul and re-building with castings made from the original master patterns moulded and cast by the grandsons of the men that built these engines. When the Railway Foundry of E. B. Wilson closed down in 1858 all the drawings were bought by Manning, Wardle & Co. When they, in turn, closed down Kitsons bought all their drawings.

Traction and Steam Engines

The third quarter of the nineteenth century was an era of high farming in Britain and there were great developments in agricultural engineering. The use of the portable high pressure steam engine assisted these developments since steam power could be harnessed to farm work conveniently. At first these agricultural engines were drawn by horses from site to site but in 1850 Robert Ransome produced a self-propelled engine, 'The Farmer's Friend' - the first true traction engine, designed by Robert Willis and built by E. B. Wilson.

One of the great names in agricultural engineering in the middle of the century was that of John Fowler (1826-84), a Wiltshire born Quaker who trained in the iron works at

Middlesborough. Using a stationary engine for power he invented a mole plough for laying tile drains. He next turned to the application of steam power to ploughing and in 1856 invented a balance plough, which was pulled to-and-fro across a field by stationary engines. He began his business in Leeds in 1850 and Kitson made the engines and machinery for him until he opened his own works on Leathley Road (136). By 1867 the Fowler Steam Plough Works employed 800.[1] Apart from the balance plough Fowlers became one of the leading builders of traction engines in Britain. These engines could be used either for haulage or to be converted into road rollers. Fowler engines were exported to the United States between 1861 and 1864 and there were design variations to permit them to use wood or straw for fuel. The Prussian army used two 20-ton Fowler traction engines for hauling heavy artillery in 1870 at the Siege of Paris. In 1877 a model was produced with 14 ft diameter driving wheels and at the beginning of the present century a 40 ton engine on caterpillar tracks was exported to the Yukon. Steam ploughing and threshing, by contractors' gangs, developed rapidly in the 1860s and the system persisted until after 1940. Fowler traction engines pulling a train of wagons were a familiar sight in the 'colonies' of Australia, New Zealand and Africa, whilst at home Fowler fair ground (showmen's) engines built between 1885 and 1932 were things of beauty with their gay livery,

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1. Rivers Commission (1867) p.201.

barley-sugar twists of brass supporting the canopy, solid rubber tyres and dynamos to power the fairground rides. Fowlers were contractors to the War Office and their engines did sterling work in the Boer War, as well as for more normal civil engineering work for the War Department.

Lot 7 of the 'Railway Foundry' estate was bought by J. & H. McLaren in 1873 and formed the site for their 'Midland Engine Works', which opened for trade in 1876. McLarens built traction engines but they were never so well known as Fowlers. Their contribution to design was improvements in driving wheels by the use of rubber strakes on the rims and spring loaded spokes to absorb shocks. Most of the McLaren engines were "light", i.e. they complied with the requirements of the Light Locomotive Act of 1903 and this allowed them to travel at speeds of over 20 m.p.h. since they weighed under 5 tons.[1] McLarens also made 'improved' steam ploughing machinery, which won first prize at the Hungarian International trials of August 1909[2] - an arrangement remarkably like Fowler's system. In recent years McLarens have specialised in diesel engines and moved into Kitson's 'Airedale Foundry' when it became vacant.

Traction engines were basically steerable locomotives with a boiler running 'fore and aft'. They were either general

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1. Legally the "light" locomotive would be driven by one man instead of two and at 5 m.p.h. instead of 2 m.p.h. in towns or 4 m.p.h. otherwise.

2. <u>LCYB</u> 1910 p.130.

purpose with 2 speed gears, used for haulage, or as a mobile power plant or road engines which pulled heavy loads as a prime mover, with 3 gears. The earliest steam lorry was on the road in 1829 but interest in this form of haulage did not develop until later in the century. Once again Leeds was an important centre with two works next to each other on New Pepper Road. Mann's Patent Steam Cart & Wagon Co. (217) and the Yorkshire Patent Steam Wagon Co., which was a subsidiary of the Deighton's Patent Flue & Tube Co. (218). This later company made vehicles which were more like a modern lorry with the steam engine under the cab and the boiler athwartships across the front. Mann's wagons were basically a box body built on to the stern of a conventional traction engine. Such was the influence of the Road Traffic Acts of 1861-5 - the 'Red Flag' Acts, that speed was severely restricted. Mann's 2-tonner could maintain 8 m.p.h. on steel tyres or 10-12 m.p.h. on solid rubber tyres. These wagons had an average running cost of 2½d/ton/mile.

> "The works engaged on the production of these vehicles are entirely modern, electrically driven, and are fitted with the latest machinery for the production of wagons on commercial lines ... special attention is paid to standardisation ... every part being made to standard gauges and templates, to facilitate the renewal of parts".[1]

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1. <u>LCYB</u> 1910 p.58

Mann's trace their origin to Fowlers but the Yorkshire Wagon Co. was a subsidiary of a boilermakers. The Riddell family of this business are related to the Claytons of the 'Moor End Iron Works' (184), another boiler making business.

Both firms continued in business making steam wagons until the 1930s but since then the Yorks. Patent Steam Wagon Co. has become specialist producers of gully-emptiers.

Boiler Making

The earliest steam engines, of the Newcomen type, operated on steam hardly above atmospheric pressure. Steam was provided by boilers like giant kettles, beehive or haystack shaped and made of copper. Such a boiler and a beam engine, almost certainly built by Matthew Murray, are shown in the background of 'The Collier'.[1] Ard Walker's accounts for the building of his cotton mill[2] clearly show that the boiler was made of wrought iron plates rivetted together. At low pressures these boilers were adequate but as steam pressures increased the haystack boiler became unsafe.

Matthew Murray introduced cast iron boilers with a wrought iron insert next to the fire but these boilers were small in size and were intended for locomotives. Watt introduced the 'wagon' boiler built of wrought iron plates with the

1. J. Walker, Yorkshire Costumes (1814)
2. Leeds City Archives DB23

fire at one end. Unfortunately wrought iron was very variable in quality and boilers often blew up when steam pressures increased. By 1830 cylindrical boilers with hemispherical ends were introduced to withstand higher steam pressures but the line of development which showed the way to a more efficient use of fuel was Trevithick's Cornish boiler of 1812 which took a flue through the boiler. This was followed by the Lancashire boiler which had two flues.[1] The logical development was to add more flues and in 1867 Herman Babcock and Stephen Wilcox patented a water tube boiler in which tubes of water were surrounded by hot furnace gases to raise steam very quickly.

Boiler making developed as a specialist trade in Hunslet in the 1850s. Benjamin Pullan's 'Soho Iron Works' (203), where Ard Walker's boiler had been built, had become a steam engine builders. He built 22 engines before he installed one in his own works. Presumably he bought in cylinders which were already bored out to size. The Pullan family died out and their works became William Humphrey's, boiler makers, by 1853. Humphrey moved the works across Low Road in 1906 and the old 'Soho Works' became McCulloch Bros. & Co., 'Wellington Iron Works'.

One of the biggest boiler making works in Hunslet was started in 1864 on Belinda Street (204) by Clayton & Sons,

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1. W. Fairbairn, British Patent 10166 of 1844

millwrights & boiler makers, and they moved some ten years later to a site between the Midland and Middleton Railways, the 'Moor End Iron Works' (City Boiler Works) (184). The business expanded and from bigger boilers they turned to building water tanks and gasholders from steel plates and girders. Their masterpiece was a mammoth water tank for Calcutta assembled there in 1909 with a capacity of 9 million gallons.[1] By the end of the nineteenth century steam engine builders were using steel tubed boilers with copper fireboxes for locomotives and small engines, but for larger mill engines, for process steam and for marine engines, the corrugated furnace was developed in Leeds about 1880. At first these were made from 'Best Yorkshire Iron' but as steam pressures increased[2] steel replaced wrought iron and a wide range of patent designs were introduced. At the 'Vulcan Works', Pepper Road (218) it was Deighton's Patent Flue & Tube that was made, other designs used by Leeds firms included 'Fox's Corrugated' and the 'Morison suspension bulb' furnace. With the expansion of steam ship building there was a growing market for ships boilers in which Hunslet firms took an active part.

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1. <u>LCYB</u> (1910) p.114
2. 1874 S.S. Britannic, 8 double ended oval boilers, steam 70 p.s.i.

   1888 S.S. Philadelphia, 10 cylindrical boilers, steam 150 p.s.i.

   1907 T.S. Mauretania, 192 corrugated furnaces in 25 'Scotch' boilers for four turbines, steam 195 p.s.i.

Just as the steam engine created a demand for boiler-makers so boiler-making developments created a demand for machinery to flange, plane and rivet steel plate and to make seamless copper and brass tubing. Just south of Hunslet, at Stourton, the 'Leeds Copper Works' (later Yorkshire Copper Works and now Imperial Metal Industries) developed the manufacture of seamless copper tube by electrolytic deposition but in 1907 a piercing plant to draw out tubing from cylindrical rod was set up which was much more effective. The use of Copper Sulphide as a raw material for the manufacture of Sulphuric acid had led to Nicholson's producing copper at their 'Hunslet Chemical Works' (186) so that there was a local source of copper for refining and manufacturing.

The introduction of gasholder building by Clayton & Sons when they moved from Belinda Street to Moor End in 1874 is shown in their address "Gasholder Street". These gas-holders were designed and fabricated in the huge cathedral-like workshops and in the yards were stocks of steel girders waiting to be cut to size. The girders and pre-formed plates were then delivered and assembled on site. The shaping of flat steel plate to curves of a given radius needed powerful hydraulic presses, similar presses flanged boiler plates and hydraulic power was used to rivet the finished plates to each other.

Hydraulic Machinery

In 1795 Joseph Bramah invented the hydraulic press[1] which

1. British Patent 2045 of 1795

was soon developed for baling cloth, crushing oil seeds and expressing the 'sod' oil from chamois leathers. In 1810 hydraulic machinery began to be used for testing the tensile strength of metals. Sir William Armstrong introduced a system of hydraulic power transmission to operate cranes at the Tyneside quays and followed this in 1851 with a hydraulic accumulator to store energy. From the late 1870s hydraulic mains and motors were widely used for cranes, lifts, lock gates and bridges, including the Tower Bridge in London. The first hydraulic forging press was built in 1860 and in 1863 a 1250 ton press was built at Kirkstall Forge. The oldest makers of hydraulic machinery in Hunslet were Tannet, Walker & Co. on Goodman Street (163). They bought the old dyehouse site when the Larchfield estate was put on the market by the Goodman trustees in 1861. (Tannet was also involved with Smith, Beacock and Tannet of the Victoria Foundry) (34). The active partner was Benjamin Walker and he was followed by his sons in 1891. By 1867 the Goodman Street Works employed 500 men[1] and the business increased steadily so that in 1893 they employed over 900 men.[2] The business lasted until well after 1920. They made all kinds of hydraulic machinery, from presses and rivetters to coal hoists. By 1893 the largest hydraulic press in Germany, at the Krupp works in Essen, and the largest in England, at John Brown's Sheffield works, had

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1. Rivers Commission (1867) p.201

2. Century's Progress (1893) p.160

been built by Tannet, Walkers.[1] Next in the field was Henry Berry, who came to Hunslet from Barnsley. He built the 'Croydon Works' (183) on Beza Street in 1882. This works specialised in hydraulic pumps and as trade increased extra assembly shops were built so that the entire site became covered with a series of lofty halls with ample headroom for gantry cranes (goliahs) to run overhead for the length of the shop. The last of the hydraulic engineers was Rice & Co. who opened the 'Neville Works' (220) on Elland Road about 1900 and continued to trade from there until after 1960. They specialised in machine tools, particularly flanging presses up to 2000 tons.

Not all boiler making needed the use of hydraulic machinery and Campbell & Hunter took over the Dolphin Foundry (142) in 1889 to specialise in drilling & boring machines, such as a 6-drill machine for making the tube holes in the end plates of water tube boilers.[2]

Machine Tools

The development of the steam engine created a need for machine tools. Watt's steam engine became feasible only when John Wilkinson developed a machine for boring out cannon, which could produce a true cylinder and Matthew Murray's contribution to the development of the planing

1. Century's Progress (1893) p 160
2. Cassier's Magazine (1900) pp 34, 37 & 46

machine has already been noted, as was his use of cast iron for machine frames and engine beams. The greatest pioneer of machine tools was Henry Maudslay. His screw-cutting lathe paved the way towards standardisation of parts and in turn led to the introduction of the micrometer screw gauge. His pupils included James Nasmyth, the inventor of the steam hammer, Richard Roberts, who perfected the self-acting mule in 1821, and Joseph Whitworth who produced the first standard screw thread system.

Murray's pupils were less noteworthy as inventors but in Hunslet and Holbeck there were many firms producing machine tools apart from those already noted under 'Hydraulic Machinery'. Tannet, Walker & Co. made steam hammers, mechanical cogging and corrugating mills as well as Siemens-Martin and Bessemer steel making plant. Smith, Beacock & Tannet began at the Victoria Foundry (54) in 1837. In 1848 they employed 180 men[1] and in 1855 took over the old 'Round Foundry' (34) The site was steadily redeveloped and when the 'Round Foundry', the 27 ft diameter machine shop, burned down in 1873 it was replaced by a 3 storey fitting shop. The 'Old Foundry' had been replaced by a new and larger workshop in 1870 so that there was little left from Matthew Murray's day. The firm closed down in 1894. It had links with Tannet, Walker & Co. (163) and

1. Holbeck Select Vestry Minutes 1848

amongst those who trained there were the Krupp brothers who went home to start their Essen works with heavy hydraulic forge presses made in Hunslet.

The Union Foundry (145) was built on the site of J. & J. Ingham's press shop by Walton, Morton & Co. in 1839. It became Gill & Wainwright and also Shepherd, Wilkinson & Co., flax-machine makers.[1] John Shepherd had been at the Railway Foundry and the business changed its style to Shepherd, Hill & Co:

> "The firm gives employment to about 300 hands, the majority of whom are highly-skilled workmen ... important tools, such as slotting & drilling machines, punching & boring machines, shaping machines and lathes for all purposes ... specially adapted for use in dockyards, arsenals and railways, and for the use of locomotive and marine engine builders".[2]

Shepherd's two sons continued to run the business as tool-makers until 1900 when the 'Union Foundry' became an iron foundry once more under J. Bowling & Co. The making of machine tools and of machinery overlapped in many cases. Shepherd, Hill & Co. were described as

1. Williams <u>Directory</u> (1845)
2. <u>Century's Progress</u> (1893) p 154

'machine makers, iron & brass founders, steam engine builders and boilermakers' (White CD 1853). At the older 'Union Foundry' (62) of Maclea & March, the products were textile machinery, tools, lathes and hydraulic presses, as well as being brass & iron founders (White 1853). This firm started in 1825 and the works were extended in 1831 to form a courtyard surrounded by workshops with a reservoir behind for boiler water. Between 1850 and 1870 they employed two to three hundred men and, following the death of the founders, Miss March put the premises (with fixtures) on the market in 1890 when it made £23000. The list of fixtures indicates the kind of heavy equipment used in an engineering works in the latter part of the nineteenth century. There were two steam engines with their boilers, three strong oak cranes in the foundry, an iron crane, a 'goliah' (sic) in the loam foundry and another in the box yard, a 'drop' for breaking metal, a well crane and a blowing fan.[1]

John Wood began as a millwright with a small workshop in Jack Lane, Hunslet (Baines 1822) and moved to Goodman St. where he bought a part of the Larchfield estate and built a foundry in 1854 (150).[2] This became known as the 'Larchfield Works' in 1860. In 1875 it was taken over by Holroyd, Horsfield & Wilson with a mortgage of £8000[3] and this machine-tool factory became G. Mann Ltd., printers

1. LCD 21332

2. LCD 18098

3. Ibid

engineers, in 1905.

Joshua Buckton began his career as a woollen merchant before 1796 and set up a mill in Meadow Lane (118). About 1835 there began a move away from woollens to machine making and by 1845 Joshua Buckton was listed as 'engineers specialising in testing machinery', at the 'Wellhouse Foundry'. The site was redeveloped and testing machinery 'to test the strength of the biggest anchor chain' was produced.[1] Apart from testing machinery the Wellhouse Foundry produced machine tools for making heavy ordnance, steam engines and locomotives, with an emphasis on drilling and planing machinery to work with tough alloy steels. These alloy steels were introduced by David Mushet in 1840 and developed by his son Robert at the 'Titanic Steelworks' in the Forest of Dean from 1862 onwards.[2] Apart from making tougher steel for guns and armour plate Mushet's self-hardening steels were used for cutting bits to cut the tougher steels and to cut ordinary steels faster, a superiority first demonstrated at Fowler's Steam Plough Works on Hunslet Lane. R.M.S. (R. Mushet Special) steel cutting tools were rapidly adopted by the other Leeds tool-makers since the use of tougher steels for boilers and armour plate required even tougher cutting and drilling tools. Much has been written about the Quaker iron masters and the railway pioneers and it seems probable that there was a link between Mushet and

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1. <u>YI</u> (1888) p 108

2. F. M. Osborn <u>The Story of the Mushets</u> (1952)

the Quaker John Fowler through the Pease family of Darlington, who were financial supporters of the Titanic Steel Co.

Many testing machines were basically spring balances and in Leeds Samuel Denison was an old established 'Whitesmith & Scale maker' in North Street. In 1899 Denisons bought the 'Hunslet Foundry (211) from Kilburns and had much of it rebuilt by Nicholsons as a works building weighbridges for up to 100 tons capacity as well as a wide range of horizontal and vertical testing machines. The company is now part of the Avery scale making group.

Textile Machinery

It has already been shown that in the first half of the nineteenth century machinery making in Leeds generally included textile machines and several notable firms have been mentioned, including Taylor, Wordsworth & Co., Maclea & March, Fenton, Murray & Co., and others. Most of these initially were involved in making flax-dressing machinery:

> "Leeds was the seat of the chief flax machine establishments ... of the whole world".[1]

Others made wool scribbling and fulling equipment. Spinning machinery as such was not made extensively. Ard Walker

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1. S.C. Exportation of Machinery 1841 (201) VII 210 Q.3098, Evidence of Peter Fairbairn.

employed William Farmery, a spindle maker, to assemble bought-in parts as copies of spinning frames 'imported' from Longbottom, near Halifax.[1] Robert Robert's patent self-acting mule of 1821 became standard in the wool spinning section but was not made in Leeds. When wool combing became mechanised, firms like Taylor, Wordsworth & Co. were in the forefront of the developments and new firms came into being to supply hackles, gills and cast-steel pins, which were the main replaceable parts of the combing machines and the screw-gill flax dressing machines. This trade could be carried out on a small scale, as a cottage industry, or in a larger workshop situation.

There were three prominent producers south of the river. Thomas Harding began making wool combs, for hand combing, in Lille and moved to Leeds in 1830 when he was recorded as a trustee of the Friends Meeting House.[2] In 1853 he bought the Wilson Street Mill (59) for £1300, it is possible that he had previously been the tenant since the firm claims to have started in 1836.[3] The introduction of the Noble comb added a new dimension to comb making and Hardings moved to Globe Road in 1864 where the 'Tower Works' were built (33). The 'Tower Works' were architect designed in the Italian style which implies that business was extremely good at the time. It was so good that the works doubled in size by 1900 and in addition to hackles, gills

1. Leeds City Archives DB 23, 1801
2. LCD 18422
3. Century's Progress (1893)p.164 T.R.Harding & Sons,Tower Works.

and pins, counting machinery and speed indicators were manufactured. The power came from a 150 h.p. Corliss type engine[1] built by Middletons of the Sheepscar Foundry, a name chiefly associated with hydraulic presses. The other hackle & gill makers began business in the 1850s. James Taylor advertised his new business in White's 1853 Directory, and it was taken over by Hargreaves & Co., the 'Victoria Machine Works' (54) who moved to the adjacent 'Albert Spring Works' in 1891 and remained there until after 1914. C. Wormald & Co. started by sharing the Croft Street bobbin mill (58) in 1863 and as trade improved moved out to the 'Holbeck Moor Foundry' (107) about 1906. This foundry was opened in 1853 and within ten years had changed to textile machine-making and then to machine tool making. Apart from a change of name to H. Wormald & Son, the hackle making business has continued. In about 1853 C. Sutcliffe set up as a textile machine maker[2] but by 1863 the business had become William Bywater's 'Sweet Street Foundry' (37) where he made textile machinery and machine tools. In 1907 the business was incorporated[3] and is still in being.

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1. G.H. Corliss patented a valve gear giving instantaneous cut-off, in the USA in 1849. Ten years later the first Corliss engine was imported into Scotland and from 1863 horizontal Corliss engines were widely used in mills.
2. White CD (1853)
3. LCD 5248(1)

Not all the ventures into machine making were so successful. Robert Busk, who had two flax mills on Brewery Moorside, was responsible for the introduction of 'wet spinning' of flax in 1816. He took over part of the St. Helen's Mills on Hunslet Lane (143) just before 1839[1] to build flax-dressing machinery but failed completely because he was developing the wrong system and lacked sufficient capital to finance further development.

Other Engineering Trades: Pumping Machinery

The 'Sun Foundry' (125) had a chequered history. It began as Sugden's textile machine-making works in 1823 and when Sugden moved to Kirkstall Road in 1844 it was taken over by Charles Todd, from the 'Airedale Foundry' to build steam engines, including 20 locomotives. Todd was followed by Carret, Marshall & Co. in 1858 who not only built steam engines but also a steam lorry for Sir Titus Salt of Saltaire. In 1875, Hathorn, Davey & Co. bought the business to develop the making of steam pumps.

With the increasing demand for coal, new mines were being sunk and existing pits deepened. The need for efficient pumps became more important than ever since deeper pits were usually wetter. Not only coal mines but Cornish tin & copper mines and gold mines in South Africa ordered Hathorn, Davey pumps. With an increased interest in public health,

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1. Baines and Newsome D (1839)

sewage pumps and water pumps for bulk supplies were increasingly required. Many pumping stations used beam engines but Hathorn, Davey built compound rotative engines and in 1892 one of their triple expansion pumps established a world record by pumping over 100,000 gallons per hour from a depth of almost a thousand feet. These massive pumps were steam powered but smaller models were made which were operated by electricity or by hydraulic power. The business expanded to take in the site of Chevalier's fulling machine works so that it occupied a site from Potterdale Mill to Jack Lane. In recent years Sulzer, the Swiss pump makers have taken the business over.

Stone Crushing Machinery

The second half of the nineteenth century witnessed a rapid improvement in highways and the slow adoption of tar coated aggregates in place of the dry stone Macadam style of road making. One aspect of this development was the demand for steam rollers which was met by Fowlers, McLarens and Thos. Green of Leeds, but the principal national supplier was undoubtedly Thomas Aveling of Rochester.[1]

Another aspect was the increased need for properly graded aggregates, not only for road building but for railway ballast and for making concrete for civil engineering projects

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1. W.J.Hughes, A Century of Traction Engines (1959) notes that Aveling and Fowler made use of McLaren & Boulton's patent wheel (1887)

all over the world. First in the field in Leeds was W. Marsden, who rebuilt the 'Soho Foundry' on Meadow Lane in 1863 (64). He was succeeded by his son Henry who became responsible for the manufacture of 'Blakes Stone Crusher'.[1]

William Marsden was twice Mayor of Leeds before he died in 1876, and this family business continued until 1973, only with a Sweet Street address for the same works due to the clearances on Meadow Lane.

Somewhat later was W. H. Baxter, who built the 'Leeds Stone Crushing Works' (2) at Mill Green in 1879.[2] He made a whole range of stone breaking and grading machinery and had over fifty patents to his credit, including rotating drums for applying tar dressing. This firm is still in business and has extended its premises right down to Mill Green and the beck in recent years.

Brick Making Machinery

The needs of the ever increasing industrial population of the West Riding created a massive demand for cheap housing. To meet this demand there was a corresponding demand for cheaply produced bricks. Many of the Leeds out-townships were generously endowed with brick earths and fireclay in

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1. Griffith's Guide to the Iron Trade (1873) p.152, illustration
2. YI (1888)

association with the 'Better Bed' coal seams. There were brick works between Beeston Hill and the Low Beck and most of the potteries also made bricks. Mass production of bricks required machinery capable of withstanding the strains of extruding moist clay through the rectangular dies; machinery built of steel, with hydraulic presses to force the clay out. In St. Helen's Mills (143) J. Simpson started a pail and perambulator manufacturing business in 1864.[1] He was joined in 1866 by Thomas Fawcett and they were listed as Simpson, Fawcett & Co., machine tool makers, White's Directory. In 1868 Fawcett began to make brick making machinery at Burmantofts, an important brick making area to the east of the town and Simpson moved the pram & pail making side of the firm to Black Bull Street in 1871, leaving Thomas Fawcett in sole possession of the 500 h.p. engines to make brick-making machinery at the 'Whitehouse Engineering Works' where the firm still carries on in business.

On Elland Road, near to the brick yards, Barker Bros., millwrights, opened the 'Paragon Works' in 1852 (222). By 1875[2] the business had developed into very different fields. Samuel Barker made brick-making machinery, and George Mann was building printing-presses, as the Paragon Litho & Letterpress Printing Machine Co. The printing-press making was transferred to Goodman Street in 1905 and the brick-

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1. LE 14.4.1883 'Peeps into Leeds Industries'.
2. White D (1875)

making machines were made by Pullan, Gill & Tuke, later Pullan & Mann, at the 'Cambrian Engineering Works'. The half dozen makers of brick works machinery in Leeds were the major builders in the country with a flourishing export trade. They adapted the basic clay models to use clinker, shale, sand, ashes and slag and had an annual output valued at £100,000.[1]

Printing Machinery

Although Otley firms were the leaders in the area in the building of printing presses there were firms in Leeds who developed the building of litho presses as well as letter-press machinery.

George Mann & Co. had begun business at the 'Paragon Works' by 1875, and moved to Larchfield (150) in 1905, where they specialised in lithographic presses, both direct and off-set, and in tin-plate printing machinery. In the previous section the origin of Mann's as an off-shoot from a mill-wrights was noted. In a similar way Newsum, Wood & Dyson began business at the 'Meadow Road Works' on Charmouth Street (114) in 1873 making printing presses and also as heating engineers. As George Newsum & Co. Ltd. they continued until 1910 when they were absorbed by George Mann at Larchfield. The heating aspect of the business was taken over by Vincent Roberts & Co. Ltd., from Cherry Row, north

1. LCYB (1910) p.58

of the river, who called themselves 'hot water apparatus makers' and they also took over Newsum & Co. (Corrugated Boiler Works) in the old Wilson Street Mill (59). The main manufacturer of printing machines, R. W. Crabtree, did not set up in Water Lane until after 1914, in what was formerly the 'Holbeck Steel Foundry', part of the 'Round Foundry' Site (34), the new workshop of 1870 built by Smith, Beacock & Tannet.

The needs of the large printing industry in Leeds extended beyond presses to 'leads, clumps and type metals' and to printers inks. T.G. & J.Jubb provided the former: they built the 'Vulcan Foundry' on the site of Joseph Bower's Epsom Salt works (194) on Jack Lane, in 1860. Originally it was a lead works and in 1875 they were listed, perhaps erroneously, as manufacturing chemists & engineers.[1] Until the works was demolished in 1970 Jubbs continued in business as type metal specialists rather than makers of plumbers' leadwork.

Frank Horsell made printing inks, litho roller coverings and zinc litho plates. He began business in 1881 in Mill Street by the 'Holbeck Mills' (50) and then moved to the 'Tabernacle Works' at 47 Meadow Road before 1888. In 1906 he moved again to the corner of Victoria & Manor Roads, to part of the 'Providence Cart Works' (46) where the firm remained until 1974. This is an example of a very specialised

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1. White D (1875) T.G. & J.Jubb 'manufacturing chemists and engineers'

business which grew to meet the needs of the local printing industry. The period from 1880 to 1910 witnessed a great development in lithographic colour printing and this expansion provided ample room for a local specialist supplier of printing inks and other lithographic sundries.

Nail Making and Boot Protectors

It was the nail makers of the Black Country who provided Adam Smith with his classic example of the economic gains from specialisation. Nail making was commonly practised in Yorkshire on a domestic basis before 1800 but when 'cut-nails' were introduced mass production in a factory situation became feasible, and John Roberts introduced a 12 h.p. Boulton & Watt engine for his slitting mill. In the middle of the century 'wire nails' were introduced which could be mass produced by fairly simple machines. Wrought iron cut nails were supplanted by mild steel wire nails and for the growing boot & shoe making trade copper and brass rivet-nails were produced, copper nails were also in demand for boat building. Leeds was favourably situated for the production of nails with iron and steel works and a copper smelter to provide the raw materials.

Allied to boot rivets were 'boot protectors' and as 'Hoover' is to vacuum cleaners so is 'Blakeys' to boot protectors. Blakey invented these in 1880 and set up a malleable iron foundry at Armley to make them and a variety of hobs and studs for working boots.[1]

There were four nail makers in Hunslet in 1822[2] but they were operating on a domestic basis and were not listed as being at work later. Fothery & Litherland appeared in 1829[3] and as Litherland & Son were listed in 1839[4] at Union Place, Marshall Street (this is an opening between Marshall's warehouses and blacksmiths shop and Mill C, all dating from 1817. Union Place as it is now did not exist but it seems likely that Litherlands used Marshall's blacksmiths shop as their 'works').

The first factory nail makers in Hunslet were James & Joseph Ingham. A Joseph & Joshua Ingham had been woollen merchants from before 1800 and built a mill on Hunslet Lane: it is possible that these Ingham Bros. were the same, or closely related, and that when they sold the woollen mill it was to

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1. Normal cast iron is very hrd and brittle, properties due to its high carbon content. Malleable iron is made by re-melting pig iron in a cupola furnace, casting it into moulds and then carefully annealing the castings to give a hard-wearing iron which is tougher than mild steel, less brittle than cast iron and a means of mass producing small castings cheaply.
2. Baines D (1822)
3. Pigot D (1829)
4. Baines & Newsome D (1839)

move to the more profitable flax trade. Inghams took over the 'Calf Garth Mill' in 1839 (196) on Chapel Street, Hunslet: possibly after a spell at Ard Walker's mill. By 1853[1] it was making flax thread for boot making and also cut nails. The change over was completed by 1875[2] and the works was known as the 'Hunslet Rolling Mills'; Inghams continued nail-making there until after 1914: specialising in wire nails of steel, copper, brass and zinc. John Roberts introduced steam power to nail making in Leeds and his business continued for over half a century in Hope Street.

Charles & Edwin Roberts were nail makers in Swinegate by 1853[3] but moved to Atkinson Street (167) in 1869 and are still in business there. The size of their works may be judged by the power they used, a 200 h.p. compound beam engine built by Witham & Son at the Monkbridge Foundry.[4]

Across the road was the slightly earlier 'Hunslet Nail Works' (166) of B. Mountain & Son, which was opened in 1868. They claimed an output of 120 tons of wire nails and brads per week[5] and the business was taken over by Roberts about 1900. In 1920[6] it was estimated that the six nail

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1. White D (1853)
2. ibid D (1875)
3. White D (1853)
4. Leeds Illustrated 1892
5. YI (1888) p.102
6. LCYB (1920) p.67

makers in Leeds had an output of 250 tons per week so that in their day Mountains must have been a major producer.

J. Grimshaw began business in Church Lane, Hunslet[1] and moved to the newly built 'Albert Nail Works' (156) on the Larchfield estate[2] and by 1906 had moved to Stafford Street (165) where they continued to make iron & brass wire nails, as Grimshaw & Armitage, until recently.[3] Their old works on Donisthorpe Street was bought by Henry Richmond & Sons who were nail-makers to the boot & shoe trade. This was mainly iron and brass rivet-nails and a wide range of malleable castings, hob nails, cricket studs, heel plates and 'Star' boot protectors. They had started next door to this site at the 'Star Works' (157) only a few years earlier and in 1910 they took over the 'Albert Tool Works' (159) across the road, so that they had a large site on either side of Donisthorpe Street.

Recently both Richmonds and Inghams have been taken over by Blakeys of Armley and the group turn out 1½ tons of boot protectors each week still, the main products now being small malleable castings up to caterpillar tractor tracks.

Screw and Bolt Works

Reference has already been made to the importance of standardised parts in the development of engineering in the nineteent

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1. White D (1875)
2. Kelly WRD (1889)
3. Kelly D (1906)

century. As Leeds established itself as a major centre of the industry there was clearly scope for manufacturers of screws & bolts. J. Parker began as a nail & chain maker in Marsh Lane but in 1853[1] moved to South Accommodation Road (170) as a screw & bolt maker, a business that lasted until 1884. Smith, Beacock & Tannet were listed as screw & bolt makers in 1853 at the new 'Victoria Foundry' (34) but Luke Pool claimed to have set up his 'Lion Screw Works' (38) in 1836.[2] The evidence suggests that he began as a whitesmith, with only 8 men in 1848[3] and, with Bell, bought the site of his works from William Browne in 1851.[4] By then Luke Pool & Son employed 40 men[5] and the business continued until after 1914, without any appreciable growth.

Samuel Stead & Co. were listed as 'Whitesmiths & Boilermakers' in 1845 at Grey Walk. They moved to new screw & bolt works on Fleece Lane (60) in 1864 as Banks, Stead & Goodison.[6] The works were rebuilt to provide better facilities in 1880, by which time the style had become Banks & Stead. The name was changed again at the turn of the century to the 'Kirby Banks Screw Co.' and eventually closed down in 1965, when the area was redeveloped. It will be noted that both of these screw makers began as white (i.e. tin) smiths.

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1. White D (1853)
2. YI (1888) p.120
3. Holbeck Select Vestry Minutes (1848)
4. LCD 4971 Wm.Browne owned a 60 acre farm, 'Holbeck Closes'.
5. Census Enumeration 1851 HO 107/2317
6. YI (1888) p.106

Wilson Bros. began as blacksmiths, making screws, bolts and axles, in Hills Yard (52) in 1851. The building reflects the blacksmiths 'factory' with hearths arranged against the outer walls between the windows. The trade was in hand-forged screws and cart axles and as business improved they moved up Victoria Road to larger premises, the 'Victoria Machine Works' (54). Screw & bolt making by this date had become increasingly mechanised and Wilson Bros. soon changed over to the production of woodworking machinery instead. One of the brothers, the sons of the founder of Wilson Bros., set up on his own across the road in Cross John Street and continued to hand-forge axles and bolts in a part of the 'West Riding File Works' (51).

A late-comer to the trade in Hunslet was the Spensal Screw & Bolt Co. who opened up in part of the old Wilson Street mill (59) in 1914.[1]

None of these trades required extensive sites and produced items of very low unit value so that to be profitable a high volume production was essential. Nail making seems to have centred around Atkinson Street, whilst screw & bolt making was centred around the Wilson Street, Meadow Lane and Victoria Road triangle. It will be noted that these sites had good access to supplies of boiler water, the nail works from Dow Beck and the screw-makers from Benyon Beck.

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1. Kelly D (1914)

In this connection Wilson Bros. changed over to a gas engine for their power supply in 1905 because of the contamination of the Benyon Beck by stone dust from the 'Victoria Marble Works' (51).[1]

Brass & Copper Works

With the growth of the engineering industry the need for brass and copper castings also increased. Copper was chiefly needed for pipework and small boilers, including open kettles and mash tuns for breweries, as well as for cast fire boxes for locomotives.

Brass, an alloy of copper and zinc, had become more generally available for casting after 1738, when the difficulties of smelting calamine (Zinc Carbonate) were overcome and the output of zinc could be increased. Brass was harder than copper, malleable, ductile and produced fine castings, and as such was an ideal material for small machine parts, bearings and valves.

The early engineers, like Matthew Murray, were both brass and iron founders and this continued in many engineering shops. Apart from this there were brass founders pure and simple. Since brass castings were generally small in size, requiring only a few pounds of brass to be melted at a time

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1. Oral communication by G. Wilson

in a small crucible, a brass foundry might be a substantial works or a back-kitchen business.

J. Wodler had a brass foundry at the end of Fleece Lane in a bend of the Benyon Beck (55) before 1815. This family business expanded and they built the 'Albion Brass & Iron Works' (84) on Crown Point Road.[1] The old Fleece Lane works were demolished but new works were built, nearer the corner of Victoria Road, by Sunderland & Broadbent.[2] The series of business premises on Wilson Street included a brass foundry, opened by Rose & Parkin in 1875 (70). It had a frontage of 12 ft and a depth of 30 ft with the upper floor of the building lit only by sky-lights.

Similarly, 56 Goodman Street (164) was opened as a machine-tool makers by E. A. Walker (Kelly WR 1889) and in 1900 became W. H. Smith's brass foundry. Basically this was a double fronted shop, part of a terrace of houses. On the site of Russell's Meadow Lane Pottery (111) was built Shand Street etc. in the 1890s. At the end of one block of back-to-back houses, by the railway line, was an outbuilding which was R. H. Nutter's 'Quebec Foundry' (brass), 14 Shand Street - this is the smallest brass foundry recorded in the area.

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1. YI (1888)
2. Kelly WRD (1889)

Hanley, Atkinson & Co. opened their brass foundry at 30 Dewsbury Road (119) in 1858 and by 1863 were using a Crossley gas engine for power. In 1876 the site was split and the brass foundry became 30a Dewsbury Road (120). This was taken over by J. Chadwick & Co. and they continued here until after 1914 as major suppliers of brass castings to the Hunslet Engine Co. Chadwicks were possibly more representative of the bigger brass founders, who were also engineers, than the smaller firms mentioned previously.

Off Meadow Lane, Lee's Yard was laid out by 1788[1] and amongst the small works was one which became Verity Bros. in 1876, makers of brass window fittings. The business developed and changed to E. Verity (Mfg.) Co., wholesale ironmongers with a head office in The Calls. Apart from window fittings Verity's cast 'plumbers' fittings' such as taps and ball valves etc.

Probably the largest brassfounders in Hunslet were Whitley Partners at the 'Railway Works' (89). They began before 1875 near Vine Street on Hunslet Road[2] and moved to the Butterly Street site in 1890 having spent almost a year on the opposite side of Hunslet Lane whilst the new works were being built. The present building dates from 1914 and the firm closed down in 1972. Whitleys were brassfounders-engineers, and specialised in valves for steam, water, gas

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1. Sun CS357/350886(1788) R.& W.Lee, merchants, New warehous dressing press and rowing shops, £400.
2. 'Established 1844' painted over door

and for oil pipes operating at up to 1500 p.s.i. These oil pipe valves were parallel faced and as the Royal Navy changed over from coal to fuel oil, Whitleys won major Admiralty contracts for the supply of these valves.[1]

William Hepton began business as a brass founder next to Tetley's brewery in Salem Place in 1853. By 1863 he had moved to South Brooke Street (74) and in time the whole of this triangular site became W. Hepton & Son's 'Yorkshire Copper & Brass Works'. Apart from the usual brass castings for domestic use, Heptons were coppersmiths and made hot water cylinders, tin plated sugar boilers and brewing coppers, including a 16 ft diameter mash tun for Tetleys in 1875.

Miscellaneous Engineering Works

In the thirty years before the outbreak of the Great War in 1914 many specialised engineering firms were established in Hunslet and Holbeck. The decline of the flax industry, and to a lesser degree, of woollen manufacture, left plenty of empty mills to let at low rentals. Firms which took advantage of these opportunities included M. Glover & Co. who began in the 'Potterdale Mills' (124) then moved to 'Holbeck Mills' (15) in 1910 and on to Low Hall Mills (16) in 1914, where the firm remained for over 30 years. Glovers made machines for splitting & bundling firewood and a range of woodworking machinery and saw guards.

1. Following trials in 1902-5

Joseph Kaye & Sons started as lock-makers on Kirkstall Road in 1868 and then moved to South Accommodation Road (170) in 1884, after a short interlude at the Bank Works in Kirkgate.[1] Much of their new trade was in safety locks for railway carriages but as corridor and vestibule coaches became more usual this market began to decline. The company introduced patent oil cans and also locks for motor cars and so the business continued, with an emphasis on light pressings.

Heavier pressings were made by T. F. Braime & Co. who built a 'Lamp Works' (153) on Hunslet Road in 1905. These lamps were paraffin oil lamps of the kind used by the railways as 'head & tail lights' on trains. From this beginning a large business grew and a new, larger works was built on Hunslet Road on part of the site of the Union Foundry (145). The main products were seamless steel hollow ware; buckets, industrial trays, elevator buckets, steel cylinders, mine and torpedo pressings. With the development of the motor car Braimes made hub pressings, gearbox cases and brake drums.

One engineering trade which seems to have been centred on Leeds was the making of perambulators:

> "There are no less than ten manufacturers of babycars in the city ... The exceptional advantages enjoyed by the trade ... cheap transit of wood from the ports,

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1. YI (1888) p.94

the proximity of manufactured steel, and effective labour. The largest baby carriage factory in Great Britain, if not the world, is situated at Leeds".[1]

The reference was to Simpson, Fawcett & Co. of Black Bull Street (100). This firm has already been mentioned in connection with brick making machinery at St. Helen's Mills (143) and the perambulator side was moved to the 'Leeds Pail & Pram Works' in 1871 where the one-acre site was soon fully developed. The firm made pails and prams, with a labour force of 130 men turning out 10,500 prams each year. The works included a saw mill, boiler & engine house, and a blacksmiths shop with an 'oliver' (tilt hammer) for forging pram axles.[2]

The other leading pram maker south of the river has continued to expand and is now one of the biggest of its kind in Britain. Behind the Silver Cross Inn on Dewsbury Road was built the 'Perseverance Mill' (123) for worsted spinning. In 1840 part of the site was developed by John Milner as the Silver Cross Works, making wool cards. Milner was followed by his manager, Joseph Naylor[3] who soon shared the premises with W. Wilson[4] a perambulator maker. In

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1. LCYB (1910) p.65
2. LE 14.4.1884 'Peeps into Leeds Industries'
3. YI (1888) p.151
4. Kelly WRD (1889) Extra Workshops were added on Alpha Stre in 1873/4. City Engineers (Factory Plans) Vol.9 August 18

1898. Wilson moved to a new factory on Whitehouse Street 'The Silver Cross Works' (144). As Wilson & Sons the business continued there until 1950 when it was moved to an old woollen mill at Guiseley where the entire works produces 'Silver Cross' prams.

One of the longest surviving businesses in Leeds must be Procter Bros. (Wireworks) Ltd. William Varley began as a wireworker on Low Road, Hunslet (206) in 1740. On his death in 1794 the partnership of Wm. Varley & Son became H. & W. V. Varley. William, junior, died in 1805 and the style became James Varley, wireworker & cardmaker. This indicates the general scope of the business: they made sieves for farm use and for corn millers as well as wire-cards for wool (these were leather strips into which were affixed wire teeth). The introduction of carding engines caused this side of the business to prosper and in time the wireworking included fencing wire, machinery guards and colliery screens. A much later introduction was the manufacture of wire rat traps and bird cages. The business developed steadily under various titles: in the Hunslet Ratebook of 1823 the owner was described as 'William Varley, gent.' Control passed to William's stepson, William Sedgwick, and in turn the business passed to his brother-in-law, Charles Procter. In 1879 the works was moved to The Calls and then in 1902 the final move was made to Whitehall Road where the firm still flourishes.[1] The

1. Procter Bros. (Wireworks) Ltd. <u>During Nine Reigns, 1740-1940</u> (1941)

link with Hunslet was not completely broken though since from 1901 onwards 8 Great Wilson Street (71) was owned by an animal-trap maker, J. H. Atkinson[1] and Procters claimed to have a trap making shop in Wilson Street.

Another card maker was John Milner, who opened the 'Silver Cross Works' (123) and was followed by his manager Joseph Naylor, who carried on the business until c.1890. Card making declined in Leeds as the manufacture of pure woollens declined in the face of competition from the more fashionable worsteds and lower grade woollens made from shoddy, an industry which was centred on the Calder valley and bought specialist machinery from textile engineers in Cleckheaton, Liversedge or Heckmondwike.

In a class of its own was Joseph Henry's 'Manor Road Foundry' (44). At the age of nine Joseph Henry began work as a heckler in one of the Marshall Mills, and at 14 took up an apprenticeship as a moulder with Smith, Beacock & Tannet. As a journeyman he worked for Burnley, Nichols & Nichols at the 'Old Victoria Foundry' (45), C. H. Taylor's 'Cyclops Foundry', and Dyson & Towler at Crown Point. In 1874 he bought the 'Quebec Foundry' (113) from Dockray and moved in the following year to Obadiah Nussey's iron foundry on Manor Road. When Burnley, Nichols & Nichols, next door, closed down he bought up their patterns and was soon

1. LCD 16109

producing 100 tons of castings per week.[1] The business grew still more and the 'Larchfield Foundry' was acquired (151).[2] The prosperity of the firm was based on machine moulded gear wheels, cast, or cut, from steel and up to 20 tons in weight. An off-shoot of the business was J. Henry jnr. who set up the 'Holbeck Steel Foundry', with Wildsmith, in a part of the old 'Round Foundry', when Smith, Beacock & Tannet closed down.

The problem of significant size has been referred to in connection with brass foundries. On Wilson Street the 'Excel Works' were built about 1889 and were shared by W. B. Leachman, maker of cloth presses, and Franklin & Isaacson, makers of paraffin generators, who later became the Pelapone Engine Co.[3] This small works also housed Hattersley, Pickard & Co. As Hattersley & Jackson the firm were at Kirkstall Road in 1851 employing 134 men as spindle makers.[4] On Wilson Street they were listed as textile machine makers but this was really drying and ventilating machinery. It may be wondered how three firms managed to operate in such a small works at the same time. The answer, it seems, lies

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1. LE 17/61/1884 'Local Celebrities'
2. LCD 18098 Plan of 1905 (Consisting of a large & small four cupola furnace, coke oven, engine & boiler house and a small brass foundry)
3. Robinson D (1910/11)
4. Census Enumeration 1851 HO 107/2317

in the nature of the actual work done, and the 'Excel Works' must be considered as an office and design section rather than a manufactory. Hattersly made large drying units of sheet metal with heater/blower units, for cloth finishers. These were designed, costed and the parts ordered from Wilson Street and the parts were delivered to the mill for assembly in situ. Similarly, the Pelapone Oil Engine Co. did not make engines but had them made with their name plate affixed before delivery. It will be recalled that John Fowler's first traction engines were made by Kitsons, as was the earliest Whitehead torpedo. The tradition of having goods made in one name by another maker is well established and continues today with such firms as Marks & Spencer.

Certain aspects of engineering did not establish themselves in Leeds. Electrical engineering did not develop to the extent of the large scale manufacture of electric motors or generators. South of the river there were Thomas Churton, Harding & Co. who began in 1906 at the 'Atlas Works' (42) and moved the following year to part of the old 'Round Foundry' where they followed C. Flather, electrical engineers, on the Marshall Street side. Green & Smith moved into 'Low Hall Mills' (16) in 1910 and at the same time Ingleby & Co. set up on Elland Road next to Rice & Co., 'Neville Works' (220). Later they became Ingleby Motors, but there is no evidence that they ever built electric motors. These firms were electrical engineers and they carried out installations and repair work as well as assembling equipment for a particular purpose,

The Blackburn Aeroplane Co. was started in Telford Terrace (215) in 1909 in a very small workshop. In 1912 it produced a motorised sledge for the ill-fated Shackleton expedition to the Antarctic and in 1913 the firm moved to the Olympia Works on Roundhay Road. Motor car building in Hunslet began about 1910 when Job Day & Son set up on Hunslet Lane next to the Elementary School (80). By some error they were listed there as 'soap makers' by Kelly in 1914 but they built the Day-Leeds Light Car, a 10 h.p. 4 cylinder model, the Day-Leeds cycle car and a 375 c.c. single gear motor cycle.[1] These were not particularly successful but they had a main works on Ellerby Lane where they made packaging machinery for tea, coffee, cocoa and sugar. They were not the only firm in the packaging industry in Leeds. In 1901 Forbes & Groves started to build machinery to pack sweets and chocolates in the 'Union Mills' (62). The firm was called 'Forgrove' after the owners and they won export orders to Switzerland, France and Germany for their wrapping machines. Very soon they moved to 8 Admiral Street, Dewsbury Road (176) and then later to a new works further along Dewsbury Road. Now, as Rose-Forgrove, a part of the Baker-Perkins group, they have moved into a still larger works on the Seacroft estate.

The development of the engineering industry in Hunslet & Holbeck must be considered against the background of general

1. <u>LCYB</u> (1913) Advert. p 200

development in the town at least. W. G. Rimmer emphasised that:

> "there was both a continuous fragmentation of existing trades and the advent of new ones".

and in discussing occupations in Leeds shows that in the first half of the nineteenth century factory employment was for a minority. Within this context, however, were included those employed in service industries and in private households. Within the terms of reference of this study, engineering was the biggest employer of males in South Leeds in 1901. Many employees were skilled craftsmen who worked at the bench or the blackmith's hearth but the number of machine operatives increased steadily as more and more processes were mechanised.

The genesis of the engineering industry may be regarded as the establishment of the Round Foundry by Matthew Murray. Not only did his personal contribution aid the foundation of the trade but, perhaps more important, his pupils, who remained in South Leeds, developed the industry to the extent that Leeds became a major centre. In one sense, engineering is 'footloose' and firms often

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1. W.G.Rimmer 'The Industrial Profile of Leeds,1740-1840' Thoresby Soc. li II (1967) pp 140-148
2. W.G.Rimmer 'Occupations in Leeds': 1841-1951 Thoresby Soc. li (1967) pp 149-156
3. R.C. Poor Law Cd. 4690 (1909)

settle on a particular site for no valid economic reasons. In Hunslet there were cogent reasons for establishing not one, but three, locomotive works. For practical reasons Blenkinsop's rack rail was not developed so the initial impetus to growth was in the building of steam engines for the textile mills. With the first 'Railway Mania' came opportunities to sell locomotives, and railway iron in quantity, and with this must be linked George Hudson's decision to route his North Midland Railway into Leeds from the south, in 1839, by way of Hunslet.

The Influence of the Railway

The first railway into Leeds, from Selby, completed in 1834, provided a rapid system of transport for goods to the sea. Almost immediately on leaving the Marsh Lane terminus a train enters the tunnel under Richmond Hill and on emerging travels on an embankment to Halton.[1] This north bank route allowed little room for lateral branches but Hudson's south bank route to Hunslet Lane entered the borough by a cutting and then ran over level ground to the actual terminus. This meant that short lateral branches, private sidings, could be made into the locomotive works. The construction of railway engines needed relatively extensive sites since the high floor-loading of machinery and of the finished engines precluded multi-storey workshops

1. E. Parsons, History of Leeds 1834 Vol II p.221 et seq., describes the route and its various gradients, embankment and the tunnel

Between the out-township of Hunslet and the South Ward of Leeds there was open land ripe for development, with the added advantage of the Dow Beck running from Dewsbury Road to Hunslet Lane before tuning across the Larchfield estate to the River Aire at Mill Lane. There were ample supplies of cheap coal by rail and water as well as iron from local producers. The prime need for locomotive building was an extensive, level site with access to a railway by a private siding. The Hunslet location can be compared with the site of the Beyer, Peacock Works at Gorton, Manchester or James Nasmyth's Bridgewater Foundry at Patricroft, both being on level ground and with sidings on to the Liverpool & Manchester Railway.

As with locomotive building, the need for an extensive site applied to all heavy engineering works because of the high floor-loadings, the need for firm foundations to absorb vibrations from the machinery and to provide for the sheer size of many of the products, such as industrial boilers for process steam. The development of heavy engineering in Hunslet between 1840 - 1870 reflects the availability of good sites, first of all on the Jack Lane side of Hunslet Lane and then in the 1860s the Larchfield estate and the Denison-Wilkinson estate came on to the market to provide industrial sites between the main road and the river. In Leeds itself the only similar sites suitable for heavy engineering were on the north bank of the river above Wellington Bridge and running towards the ancient 'Kirkstall Forge' site. Peter Fairbairn built the 'Wellington Foundry' by the bridge on the north bank and on the south side, by Monkbridge, Witham built a forge with access to the Leeds & Bradford Railway. The works of Thomas Green on North Street and of Robert Middleton at Sheepscar, were constrained in size and lacked railway sidings. It might be considered that what developed without plan in Hunslet was a forerunner of the planned development of the Trafford Park industrial estate in Manchester, begun in 1903.

The relationship between the making of steam engines of various kinds, boiler-making and brass-founding has been shown and the extension of these trades into special products has been noted. The existence of the basic industry on a large scale encouraged the establishment of ancillary industries to supply parts and to provide machine tools. As technology developed, mild steel replaced wrought iron for many purposes, higher steam pressures called for stronger boiler materials, and the tool makers devised improved machinery to fabricate these tougher steels. Not only did they serve the immediate local market but, like the locomotives themselves, these machine tools were exported to many countries.

The building of textile machinery needed less extensive sites since the floor-loadings were considerably less, consequently many firms were able to make good use of redundant mills, with little modification to the basic structure. Once again the industry's success was based upon its ability to adapt itself to changing needs. The impact of mechanisation on the Leeds textile industry after 1800 falls into more than one distinct phase. There was a small but well established group of fulling machine makers-millwrights, some of whom were also building slubbing billys and willeys. The initial impetus was in flax-dressing machinery, which brought Matthew Murray into prominence. Because the nature of the fibres was different, flax-dressing machinery had to be different from cotton spinning equipment. Cotton machines were adaptable to worsted spinning more easily than to wool, but there was an overlap in technology in carding wool and cotton. Flax machinery developed on its own but was found to be adaptable to dress hemp, jute, manilla and waste silk. As well as spinning these fibres the spinning of heavier yarns progressed to twines and then to ropemaking.

The 'Wellington Foundry' of Peter Fairbairn became part of a group, including Lawson of Leeds and Coombe, Barbour & Co. of Belfast, with a branch works in Lille, which dominated the flax machine trade completely, a combination made essential as the linen trade began a secular decline in the fact of competition from cotton.

The next phase of development came in the woollen trade with the introduction of the rotary miller, which, in a generation, replaced the older fulling stocks almost completely. Few Leeds firms became prominent in the building of wool spinning machinery, since the most suitable machine was based on Robert's self-acting patent mule. The building of power looms also missed Leeds so that the next phase of development was linked with the worsted trade, and Leeds firms, such as Taylor, Wordsworth & Co., played a leading part in the making of wool combing machinery. At this stage there was a link with flax dressing where the screw gill wet-spinning system had become established, both the combing machine and gill boxes used steel 'pins' to feed the fibres forward. This was an important factor in the growth of firms such as Thomas Harding, 'hackle and gill makers'.

Towards the end of the century there was a decline in the manufacture of woollen cloth in Leeds. The more fashionable worsted trade had moved towards Bradford[1] and the woollen trade, now increasingly dominated by shoddy, had moved into the Calder valley, in both cases leaving Leeds as a peripheral production centre, but still strong in cloth finishing. This encouraged the production of finishing machinery by such firms as Taylor, Wordsworth & Co. and the growth of new businesses such as the Longclose Engineering Co. who started in a very small way in Bowman Lane, building dyeing machines. Firms like Hattersleys changed from making spindles to cloth drying machinery.

The variety of engineering work carried out in Hunslet & Holbeck reflected the ability of the trade to continue to innovate and so prosper steadily and withstand the various financial crises of the second half of the nineteenth century.

1. E.M. Sigsworth, <u>Black Dyke Mills</u> (1958)

"The inventor-entrepreneur was often prominent, imparting to the trade its feeling for the latest ideas and insuring the industry against decline by over-specialisation in obsolescent technology".[1]

With a tradition of employment in engineering for men, the availability of good sites for development or of low-rental space in old textile mills, Hunslet & Holbeck attracted engineers who wished to start up new businesses. Bearing in mind the cost of cartage of coal, raw materials and finished goods to the rail and canal terminals there was little to choose between sites within the district.

Armaments

The skills acquired in working steel plate for boilers and heavy machinery were equally valuable in the manufacture of armaments. From the Crimean War onwards there was a steady flow of government contracts for 'war material', from the British government for various colonial wars in India and Africa up to the naval programme initiated by Winston Churchill in 1909. Other contracts came from the Prussian government for traction engines etc. which were used in the Franco-Prussian War in 1870 and from various South American republics. Not all these orders were for armaments but included traction engines, camp kettles, picks,

1. J. Buckman 'Later Phases of Industrialisation' Leeds & Its Region (1967) p.161

spades, buckets - all essential supporting supplies for an army. By 1914 most of the products of the Leeds engineering industry, which was dominated by Hunslet firms, were exported:[1]

Table 6.5

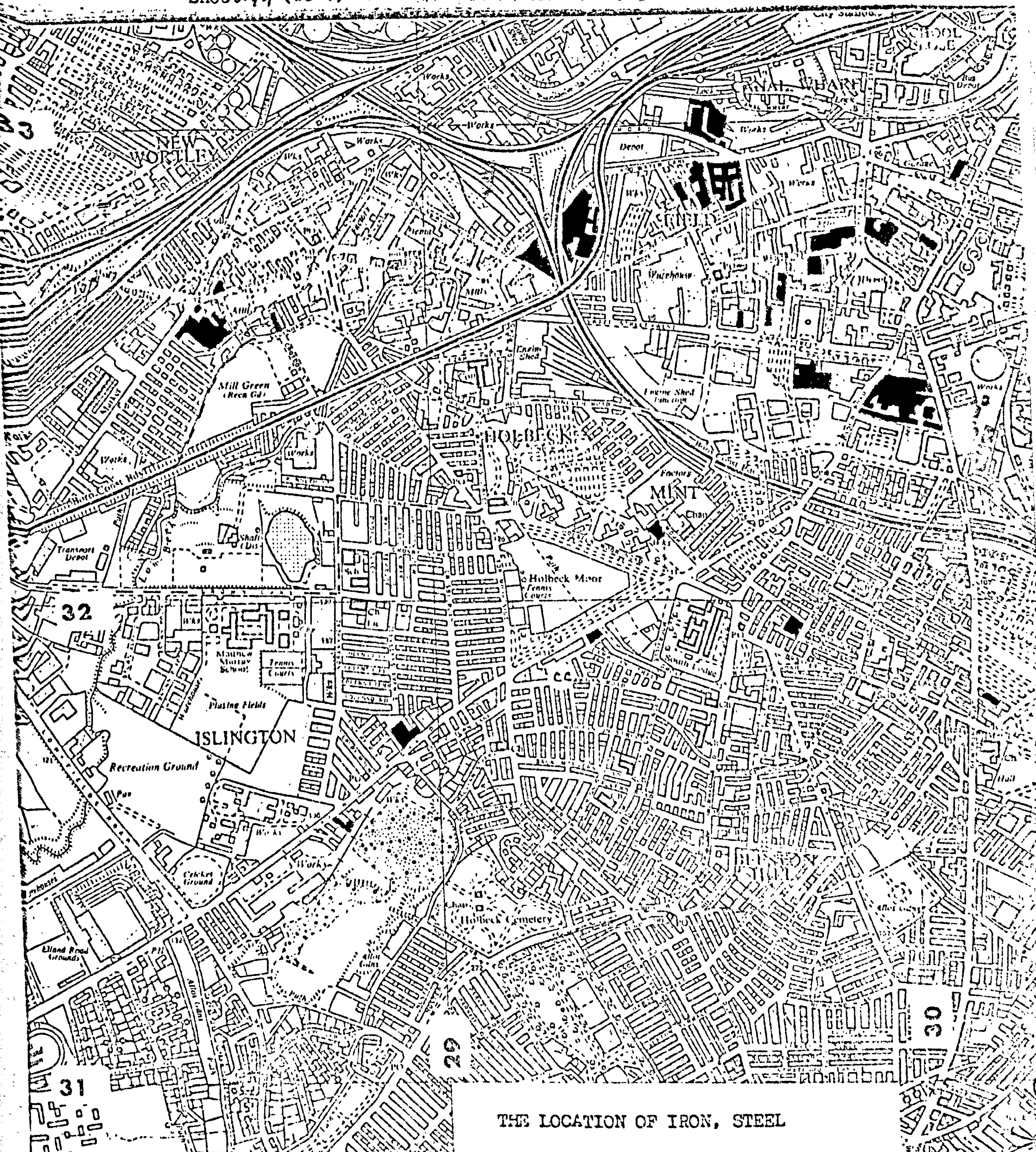
Proportion of output exported by Leeds firms	
Engineering & Machinery	75%
Locomotives	95%
Traction Engines	80%
Textile Machinery	50%

The importance of the excellent transport services which were available to Leeds' manufacturers cannot be overlooked in this respect.

1. Oral communication, A. Bennett, Leeds Chamber of Commerce

LOCATION OF IRON, STEEL
and ENGINEERING WORKS :: 1850

Sheet 13 1850



THE LOCATION OF IRON, STEEL

and ENGINEERING WORKS :: 1914

(with railway sidings emphasised)

1914

CHAPTER 7

FOOD INDUSTRIES

Corn Milling

In 1800 both Hunslet and Holbeck had water powered corn mills, Mill Green Mill in Holbeck (3) and Hunslet Mills (207) on a loop of the River Aire. The latter were corn mills, fulling and scribbling mills, a dyeworks and also a coal staithe. They had fallen into disuse by 1850. In terms of rateable value the corn mill was worth a little more than the fulling mill which in turn was rated at three times the value of the scribbling mill.[1] At Mill Green the original mill was rebuilt by Jonathan Shackleton in 1809 and sharing the water supply were two other mills, a woollen mill dating from 1796 and a flax mill which was originally a scribbling mill and an extension of the corn mill building. Shackleton had another mill nearer the town and was at that mill when a Luddite mob attacked the Mill Green mill in August 1812[2] but they were driven off by his wife without the mill being damaged. The corn mill shown on the rate map of 1786[3] was horse-powered but by 1817 it had become 'Holbeck Steam Mill' (22) with T. Roberts as the miller. None of these mills was particularly large. When Mill Green mill was advertised to let

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1. Hunslet Rate Book 1823
2. Mayhall Annals August 1812
3. Leeds City Archives DB/M 139 Map of Holbeck (1786)

in 1829[1] it had 2 prs French stones, 1 pr grey stones, 1 pr shelling stones and a bean splitter, an addition of an extra set of French stones since 1795.[2] It was typical of many village corn mills. The duplication of the 'French' stones was important since these stones were built up from sections of fresh-water quartz and were used for grinding wheat into flour. 'Grey' stones were millstone grits and were used for grinding oats and feeding-stuffs. This dual function of a corn mill is important since it produced not only flour and oatmeal for human consumption but also animal feed for cattle, pigs and, most important in nineteenth century England, horses. Roberts had an 18 h.p. steam engine in his mill[3] but was listed as a seed crusher rather than a flour miller.

As the population of the townships increased, the need for more flour grew also and new corn mills were built to meet the demand.

Leeds was in an unusual position with regard to corn milling. Within the ancient manor of Leeds, except those properties which had formed part of the Knights Templar's manor of Whitkirk,[4] all corn had to be ground at the soke mill, the

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1. <u>LM</u> 26.9.1829
2. <u>LM</u> 6.11.1795
3. Lindley <u>op.cit</u> (1824) T. Roberts, seed crusher
4. Leeds City Archives DB 234 Map showing the various manors n.d.

King's Mills on Swinegate. This restricted the development of milling in the town and eventually in 1838 the Corporation bought the soke mills for £13,000[1] by private Act of Parliament. The soke mill problem was complex since it originated in the medieval structure of the parish of Leeds. The new borough based on Briggate created by Maurice Paynel in 1207 reverted to the de Lacey's in 1248 and to the Duchy of Lancaster, and hence the Crown, in 1311. The old manor around St. Peter's church, together with the township of Holbeck, formed a manor of the Benedictine Priory of Holy Trinity, York, whilst Hunslet was a sokeland of Beeston.[2] Thus Mill Green mill could supply Kirkgate, and Hunslet mills were originally the Beeston soke mills.

New corn mills were established in the 1820s and 30s as follows: Meadow Lane mill (212) circa 1823, Farrar's mill, Low Road, Hunslet (210) 1827, Barleycorn Street mill (9) 1829, Union Mill (1) 1831. All these mills were steam-powered. The Meadow Lane mill belonged to W. Jackson and had a 12 h.p. beam engine. In 1827 it became Horner, Drake & Co. and an extra floor was added which increased the rateable value from £17/10/- by another £10. The Union Mill was built by Jonathan Shackleton of Mill Green mill. On Low Road, the mill was a conversion from Burrow Copley's scribbling mill of 1788, this had become Westley's flax mill,

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1. LCD 1123
2. J. le Patourel (ed.) Documents relating to the Manors and Borough of Leeds 1066 - 1400 Thorseby Soc. XIV (1957)

with oil-gas lighting and a 30 h.p. engine, until 1826 when Westley moved to another flax mill in East Street and it became Farrar's corn mill until 1850. The largest mill was the Union Mill and this continued in use until 1889. In 1844 Shackleton added a corn mill to his maltkiln on Wortley Lane. The kiln was rented until 1822 when he bought it from S. Brown the owner. Shackleton had started at Mill Green in 1809, moved on to the Union mill in 1831 and added the Star Mill in 1844. This eventually traded as the Star Mill Flour Co. until 1890 when the flour milling stopped and malt became once more the main product.
J. Dawson followed Shackleton at Mill Green but his son took over the New Wortley Steam Mill on Barleycorn Street in 1829. The owner of this mill was S. Dawson, a cornmiller/farmer whose Knox Mill in Nidderdale had been turned over to flax. Dawsons were followed at Mill Green by Dyer & Jackson[1] and in turn they were succeeded by Beavers & Wightman.[2]
In 1866 Mill Green passed to the Robinson family, millers, maltsters and clothiers. W. Jackson of Meadow Lane was followed by Horner, Drake & Co. but seems to have kept on working as a miller until he became bankrupt in 1829.[3]
It appears that he joined Dyer at Mill Green and then as corn miller and dyer took over the old Hunslet Soke Mills in 1845 until they closed down in 1850. Wightman moved from Mill Green in 1866 to the Holbeck Steam Mill when his

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1. Baines & Newsome D (1834)
2. Williams D (1845)
3. LM 3.10.1829

predecessor, J. Clough, who took over from Robert's widow in 1850, opened the Globe Flour Mill (32). At Holbeck Steam Mill Wightman was followed by Wright[1]. Meanwhile, at the Globe Mill, Clough had been followed by S. Smith and in 1899 the Globe Steam Flour Mill became Bairstow & Midgley until it was closed in 1900. Over on Meadow Lane Horner, Drake & Co. were followed by J. & W. Pape in 1845 and in turn they were succeeded by Witham & Riley in 1875. The mill was sold to the Leeds Industrial Co-operative Society in 1880 and a Co-op store was built on the site.[2] About 1846 the Perseverance Corn Mill was opened in Ingram Street (43) by T. W. Horsman, and passed to Hannah Smith,[3] possibly the widow of S. Smith of the Globe Flour Mill. In 1914 this mill was used by Culross & Sprotson, printers.

The People's Mill

There remains but one flour mill to discuss, sociologically the most important mill in Leeds, the 'People's Mill' in Marshall Street (36). The economic crisis which lasted intermittently from 1843 until 1847 was reflected in Leeds by the continuous operation of the Public Soup Kitchen,

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1. White D (1875)
2. G. J. Holyoake The Jubilee History of the LICS (Manchester 1897) p 111
3. Kelly D (1906)

which at peak periods distributed 38,400 pints of soup in one week. By 1847 flour was "scarce, dear and bad".[1] It retailed at 4s per stone compared with 1s6d in 1897. On 25th February 1847 a manifesto was published calling for the setting up of a co-operatively owned flour mill:

<u>Holbeck Anti Corn Mill Association</u>

> "We, the workpeople of Messrs Benyon & Co's mill, Holbeck ... having experienced much trouble and sorrow of late ... in consequence of the exorbitant price of flour ... we deem it needful to enter into a combination to raise a subscription ... to be paid by each member weekly ... for the purpose of renting a mill until the funds of the Society shall enable them to erect a mill of their own ... to supply flour, and that only".

In the wording of the notice, 'Anti Corn Mill' meant 'against the millers' and the restriction 'to supply flour' to the members, 'and that only' created problems in the selling of millers' offals and the sale of flour to the general public.

The first Corn Mill meeting took place late in March 1847 and there was great support for the scheme. A committee was set up to organise the movement and although two leaders of the Redemption Society, an Owenite 'co-operative league'[2]

1. G. J. Holyoake <u>op.cit</u>. p.6

2. <u>Ibid</u> p.2

started in Leeds in 1845, were elected, none of the original seven flax-spinners was appointed. The Leeds Flour Mill Society was registered under the Friendly Societies Act on 8th July 1847 and it rented the Britannia Corn Mill on Wellington Street from September 1847. Within three months they ground 1800 qrs. of wheat into flour for sale to the members. The following year the Society negotiated for the flax mill on Marshall Street which formed part of the Round Foundry estate and bought it for £12,216. This mill was five storeys high and had a 30 h.p. Murray engine.

The Flour Mill Society soon ran into difficulties. Their flour was pure and that sold by the Leeds millers was frequently adulterated by the addition of Calcium Sulphate. When flour was 38s per sack it retailed at 2s per stone, but by 'stretching' it with Plaster of Paris it could be sold at 1s 10d per stone. The decision was the choice of selling pure flour at the average price and paying the profits to the members as a dividend or to reduce the price so that the public in general benefitted and possibly the members might lose their dividend. Between October 1847 and July 1851 the Society sold flour at between 1d and 4d below the market price. At first they sold flour at 3d below the market rate and the following week the millers dropped their price by 2d even though in the meantime corn had risen by 2s per quarter. Thus the public at large benefitted from this policy and the members, in addition to cheaper flour, received a small dividend.

The amendment to the Friendly Societies Act in 1852 allowed sales to non-members and trade expanded quickly. In order to meet this increased demand new methods of milling were introduced, one of which was the use of an 'exhaust', a blast of cold air on to the grindstones which permitted higher milling speeds to be attained without damage to the meal through overheating. The patentee, Bovril, established his claim against the Millers' Association and the Leeds Flour Mill Society agreed to pay a royalty of 1/6th of their net profit to use the 'exhaust' until the patent expired in 1870. Trade grew steadily and in 1871 a more powerful compound steam engine was installed. Further alterations were made and extra machinery installed between 1875 and 1877 which included a new 35 h.p. engine and boilers at a cost of £1,400.[1] Together these improvements permitted output to be doubled. In 1881 there was a serious fire in the mill.[2] It was described at the time as being 5 storeys high, 150 ft long and 35 ft wide. In the basement were three boilers and 22 prs of stones. This shows the great size of the People's Mill compared with, for example, Mill Green Mill at the turn of the century.

With the proceeds of the insurance a roller mill was installed in the burnt-out shell. This reflects the technical

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1. City Engineers (Factory Plans) Vol. IIa Flour Mill warehouse, brick and cast iron. Wilson & Bailey, Architects, Leeds. June 1875.
2. LM 11.10.1881.

developments which had taken place in flour milling in the second part of the century. Just as the 'tower' brewery replaced the 'horizontal' one, rollers were replacing grindstones in flour mills.

Next door to the new mill was another corn mill, 'Campfield Roller Mill' (35). This too had been part of the Round Foundry estate and had been used as woollen mill until there was a fire in 1866.[1] After various uses related to wool it became Wilson, Crosby & Co's flour mill. The Leeds Industrial Co-op took over the lease in 1879 and bought the freehold in 1891. Wilson, Crosby & Co. were still in business there in 1889 and the Society let the mill until 1905 before they ran it themselves. Flour milling ceased in 1925.[2] This continuance of milling by the Society reflects the attitude of the directors and members to the virtue of pure flour. Most other town mills had ceased flour milling by the 1880s. The causes of the decline in urban milling were twofold.

Firstly, the growth of urban population generated an increased demand for flour which in turn meant a heavy capital investment in the new roller mills to remain competitive.

Secondly, the technical superiority of the roller mill

1. Mayhall Annals 1866 "Wool extract mill of Messrs Emmanuelson, close to the Co-op Flour Mill and to Marshall's Mills"
2. Information derived from LI.C.S. deeds and senior employees.

was related to the new sources of milling wheats, the prairies of North America, the plains of Australia and the steppes of South Russia. The development of these great corn growing areas in the 1860s based on new railway investment enabled large quantities of corn to be produced at very low prices.[1] These 'durum' (hard) wheats could be ground most effectively in roller mills, whereas the softer English wheats tended to overheat when ground at speed. The new wheats undercut English grain and except in country districts imported wheat replaced local corn as the main source of flour. Even with cheap rail and water transport it was cheaper to establish flour mills at the ports rather than inland and these factors combined towards a decline in urban milling, except in the ports, where it greatly expanded. This decline in inland milling can be seen in the closure of Shackleton's Union Mill in 1888. The membership lists of the Leeds Corn exchange reflects the increase in the number of corn and flour dealers who were mainly Hull or Liverpool based merchants. The decline in urban milling was to some extent masked by the number of smaller mills that kept in business but changed from flour to provender milling.

A facet of economic history which seems to have been neglected

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1. The average price of wheat, in the five worst years of the 1860s was 60s per quarter, in the 1870s the worst five year average was below 50s.(In 1879 it was 43s10d) Prices continued to drop until the 1890s.

is the urban horse. The expansion of the railways killed the stage coach and heavy goods waggon but at the same time the growth of trade led to an increase in the use of horse-drawn transport for short hauls from the nearest railway yard. The bulk of goods arriving at Hunslet Lane Midland Railway depot were delivered within the town by horse-drawn drays. The L.I.C.S. used a hundred horses for milk delivery alone, Tetley's brewery still uses horses within the city centre for delivery. All these horses created an enormous demand for fodder and provender: the smaller mills catered for this increasingly as flour milling became unprofitable for them. It is noteworthy that when the Crown Point Mill, just across the bridge in The Calls, was rebuilt in 1868 by William Turton, the keystone of the main entrance archway bore a horse's head, the sign of a provender mill rather than a flour mill.

CHAPTER 8

FOOD INDUSTRIES

Malting

> "The county of York has long been famous for the growth of barley and its conversion into malt, and has from ancient times supplied a very extensive district besides satisfying local requirements. The large breweries in Leeds, together with the remarkable number of publicans who brew their own ales, have led to the establishment of a very considerable number of maltings in the city ... it is a source of satisfaction to know that the maltsters of Leeds at the present day are as well-equipped and as up-to-date in their methods as any in the Kingdom". Leeds Commercial Year Book 1910 p.80

The conversion of barley into malt for brewing was an important trade in nineteenth century Leeds. Whilst the common brewer was slow to become established in the town the demand for malt grew steadily during the century.[1] The production of malt from barley was done either at the brewery or, more often, at maltkilns in market towns in the main barley producing areas. Matthias refers to the East

1. E.M.Sigsworth, The Brewing Trade During the Industrial Revolution York (1967) Table 1. Bushels of malt brewed in Yorks: 0.54m bushels in 1822; 5.2m bushels in 1877.

Hertfordshire area as the 'oldest and most mature in the country'[1] and the importance of East Herts. in the production of barley and the proximity of the London market were major factors in the location of the industry.[2]

This pattern can be seen in the number of maltings situated in major brewing centres where the coincidence of the right kind of water in a barley producing district has favoured large scale brewing. Leeds owes much of its original importance to its situation as a mart between the dales and the lowland corn growing areas of the Vale of York. Even in pre-railway days the supply of barley was relatively easy. Apart from barley the other main requisite for malting was ample fuel supplies. Historically this fuel was wood and Abraham Darby of Coalbrookdale introduced the use of coke for malting as well as for smelting iron in the early years of the eighteenth century. Maltkilns are of a distinctive construction. At one end is the barley store, next is the cistern where the barley is steeped in water for several days. When the water has been drained from the barleycorn it is moved to the 'couch' and from there spread over the malting floor to germinate. The starch of the grain is changed to maltose by enzyme action to feed the emerging radicle. When the maltster judges that the maltose content is at its maximum the grain is moved to the adjacent kiln where it is dried-off to form malt. For these processes to

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1. P. Matthias, The Brewing Industry in England, 1700-1820 (1959)
2. E.J. Connell 'Hertfordshire Agriculture during the Napoleonic Wars" Hertfordshire Past & Present (1970).

be done most economically the design of the malthouse tends to be a range of long low buildings with the distinctive pyramid of the kiln at one end, protruding above the roof line. Maltings built late in the nineteenth century lack the cowled kiln and were generally multi-stored.

In Hunslet & Holbeck there were numerous kilns.[1] Many maltsters had more than one kiln and it is not possible to ascribe definite ownership or occupancy to every kiln where the Robinson, Walker or Dobson families were concerned. Thus in 1845[2] 23 maltsters were listed and on the 1847 O.S. map 30 kilns are shown. Some were small but those attached to the breweries were larger and more complex. The number of kilns remained the same until the end of the century. As old kilns were closed down, other new kilns replaced them and these were generally much larger. The number of maltsters declined steadily from 1847 until by 1914 there were only ten of them operating 17 kilns.

The Old Brewery on Burton Row had become one of the Dobson's maltings.[3] Sarah Holmes' brewery in Ivory Street had been replaced by Matthewman's maltkilns. The Star Flour Mill (8) bought by J. Shackleton in 1822 had a maltkiln and became a maltings, 'The Star Maltkiln', after 1890. It was bought by the Willow Brewery in 1903 and they operated until 1939 when it was bought by Tetley's and closed down. The Kirkstall

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1. Hunslet Rate Book (1823) listed 16 kilns
2. Williams Directory (1845)
3. City Engineers (Factory Plans) Vol.IIa New Malting, R.Dobson Brewery Moorside July 1875

Brewery (now Whitbreads), started by Benjamin Dawson in 1834, had three maltings in Holbeck.

Joshua Tetley began as a maltster in Armley before becoming a brewer and as a maltster sold malt until 1861. The Crown Point Malting (90) dates from 1781 and was sold with Sykes' Brewery to Tetleys. This was rebuilt in 1866 as a five storey block. Other Tetley kilns were in Chadwick Street, built for Dobson in 1863. Tetleys bought the Old Brewery in Meadow Lane in 1899 for £5,700 from G. Kitchen's trustees (65). Kitchen took the brewery over in 1872 but appears to have let part of it to another well-known malting family, the Robinsons of Mill Green. It was then a large malting 'capable of wetting 197 qrs. of barley with 8 kilns.[1] As a brewery it had started out with a malting capacity of 50 qrs. 'The Meadow Maltings', as the brewery had now become known, was the largest in Leeds. The Walker family were reduced to a single maltkiln in Sydenham Street, Holbeck (6) but William Naylor had three small ones still and had been in business for over half a century. He succeeded T. Skelton of Water Lodge, who also owned several maltings in the Water Lane area of Holbeck. These independent maltsters, like Naylor and Dobson, supplied the brewing publicans chiefly. Dobson was still in business on Moorside in 1960. Like brewing, maltmaking required only a small labour force. In 1851 William Naylor employed 15 men

1. Leeds City Archives: Hepper Valuation Books VB22 B, 1889

at his Derwent Street malthouse (26)[1] and Joshua Tetley, the largest brewer, employed 32 men, some of whom worked in the maltings which formed an integral part of his brewery in Salem Place.[2]

In 1845 Robert Arthington, Ben Nell, William Spong, Joshua Tetley and Haynes & Dalby were brewers as well as maltsters. Harrison & Sons were distillers and wine merchants. J. Dobson was a butcher. James Varley was a wireworker. John Dawson was a cloth dresser & corn miller and Len Foster of Stocks Hill, Holbeck, had weaving sheds, a cloth warehouse and the 'Friendly Inn' on his West End House estate - nearly half the maltsters listed had other interests than malting, possibly because of the seasonal nature of the trade. In the early part of the nineteenth century, malting, like brewing, tended to be a seasonal occupation. For many labourers work in winter in the malthouse alternated with brickmaking, which was mainly a summer job.

It is apparent from the rise in the consumption of malt that the newer kilns built after 1860 were larger and had a much greater output of malt. Hunslet and Holbeck had the skilled maltsters, good supplies of coal, rail & water transport to bring the barley in from the Vale of York, the Trent Valley, the Wolds and beyond. There was an

1. Census Enumeration 1851 HO 107/2317
2. Ibid HO 107/2321

expanding local market for malt. It might be expected that the making of malt should retain an important place in the food and drink industries of Leeds in such favourable circumstances, as was recognised by the writer of the Leeds Commercial Yearbook in 1910.

CHAPTER 9

FOOD INDUSTRIES

Brewing

The public water supply of Leeds was not 'water bright, from the crystal spring' until the 1860s when the Corporation began to bring in supplies from the Washburn Valley north of Otley. Beer remained a major item of most domestic budgets for at least the first half of the nineteenth century. It was true that the sulphur water of the Meadow Lane Spa (on Dewsbury Road, by March Street) had a reputation for brewing a good pot of strong tea but in an area where engineering and foundry work was the main occupation of adult males the sales of beer increased in line with the growth of the population of Leeds south of the River Aire.

By 1800 Leeds, as a town, possessed five common brewers, four of these were operating south of the river.[1] Most beer was brewed by licensed victuallers for retailing from their own premises. Until 1834 there was no distinction made between beer sold for consumption on the premises and that sold to be consumed elsewhere - 'on' and 'off' sales. Brewing was a notoriously unstable occupation. By 1817 there were six brewers in Leeds but only Jaques & Nell, Sykes and Arthington had survived from 1800. Green's Burton

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1. Jaques & Nell, Meadow Lane; Wm. Sykes, Salem Place; R.Arthington, Hunslet Road; J.Green,Burton Row; and across the river, Thomas Appleyard, The Calls.

Row brewery had become John Wood's. This brewery went out of production and Wood became a maltster.[1] Sykes let his brewery to Joshua Tetley, an Armley maltster, in 1823 for £409 and a rent of £170.[2] The development of the brewing industry in Leeds is to a large extent the history of Tetley's brewery. William Singleton's Brunswick Brewery (1830) and Benjamin Dawson's Kirkstall Brewery (1834) are the only other survivors of an industry that at its peak had 29 breweries in production (in the 1890s).[3]

During the early part of the century the common brewer, in Leeds, was distinguished from the publican brewer and the private brewhouse only by the scale of production and sale (nothing less than a barrel). His equipment and premises were similar only, since the scale was larger, the risks were also larger. These risks were associated with the problems of brewery hygiene. The brewing process consisted of grinding malt and then mashing it with boiling water to extract 'wort'. Hops were added and the liquor boiled in a copper to concentrate the sugar solution, to extract the flavour from the hops (bitters) and also the tannin which, by precipitating albumenoids 'clears' the beer, and most of all, sterilised the wort. The liquor was strained through the 'hopback' and cooled as quickly as possible. Before

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1. Baines Directory (1822)
2. J. Tetley & Sons Ltd. Reviewing a Century of Progress 1823-1923 p.6 - also information supplied by Clifford Lackey PRO Allied Breweries.
3. E. M. Sigsworth op.cit Table 4

1800 this was normally done by allowing the liquor to flow over a series of shallow trays arranged like a gently falling staircase round the side of the room. In 1800 the Riley refrigerator was introduced which consisted of a tinned copper vessel with large, horizontally corrugated sides. Cold water passes through the inside and the wort is cooled by running down the outside to a collecting trough beneath - the familiar dairy cooler. The cooled wort then passed into open wooden vats where yeast was added and fermentation took place over a period of 10 - 14 days, depending on the temperature, which needed to be kept stable. The beer was drawn off, more hops added and, after clearing, the beer was racked into casks to mature. In warm weather the brew frequently went sour and turned into vinegar. For this reason brewing was mainly a winter occupation or beer was brewed in small quantities for immediate consumption. No brewery in Leeds before the 1830s was on such a scale as to warrant a steam engine such as Samuel Whitbread had installed at his Chiswell Street brewery before 1800.

Such was the state of brewing in south Leeds in the 1830s. T.G. Jaques was retiring from active life and although listed as a partner in 1840 had sold out to D. W. Nell for £1,350 in 1837.[1] There was a small brewery on Ivory Street, Pottery Field (129)[2] which was started by Sarah Holmes in the 1820s and ran in close connection with an adjacent

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1. LCD 43

2. Baines Directory (1822)

maltkiln as the Kiln Brewery, but by the late 1850s this had ceased production. On Pepper Road the Grove Brewery (210) likewise developed from an established maltings and lasted until about 1875 when the site was redeveloped for housing.[1] Robert Arthington inherited the family brewery in 1827[2] and about the same time a woollen merchant's warehouse & dyeshop in Hunslet Lane became William Spong's Airedale Brewery.[3] which lasted until about 1848 when it was pulled down to make way for extensions to Kitson's Airedale Foundry (140).

All these breweries were small, mainly single, or at the most two storey buildings with associated maltkilns and stabling for the dray horses. Apart from malt, which has already been dealt with as an important local industry, the main need for any brewery was a good supply of coal and water, with an equally accessible market for the brew, since beer in the cask travelled badly by waggon or dray. The advantage of Tetley's site 'opposite Brandling's coal staithe'[4] is clear and the Arthington brewery was also close to the coal depot. The Kiln Brewery was by the Middleton Railway and the Grove Brewery was close to the river and the original Brandling tramway to fetch the coal to the river staithe. The Meadow Lane Brewery and the Airedale

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1. Ivebridge Street, Derbyshire Street
2. LCD 565
3. Hunslet Rate Book (1823)
4. Syke's Invoice (1796) reprinted in <u>Reviewing a Century's Progress</u>

Brewery were a little further from the coal yards but this cannot be considered significant in terms of added product costs. The Moorside Brewery was furthest from the coal from Brandling's pits but it was within half a mile of coal pits in Beeston township. There were few industrial sites in either Hunslet or Holbeck more than a mile from either a pit head or coal staithe. Tetleys and Jaques & Nell had their own deep wells.[1] The water supply to the other breweries is uncertain but all were close to becks, Kiln and Airedale by Dow Beck and Grove close to Balm Beck.

The Yorkshire Square System

In the middle of the nineteenth century important changes took place in brewing technology.[2] These changes were based on a fresh approach to the basic problems of hygiene and temperature control, but already in the Huddersfield district there had been developed the 'stone trough system' (the Yorkshire square). This was attributed to Timothy Bentley of Lockwood Brewery.[3] There is a chance that he knew Dr. Joseph Priestley, the minister of the Mill Hill Unitarian Chapel in Leeds. Priestley lodged in a house

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1. Century's Progress (1893)p.65, 'Wells on the premises afford a never failing supply of excellent water whilst boreholes several hundred feet deep supply cooling water'.
2. E.M. Sigsworth 'Science & the Brewing Industry 1850-1900' ECHR 1968
3. Bentley's Yorks. Breweries Ltd., A Famous Country Brewery, Woodlesford c. 1932 p.9

next to the Meadow Lane brewery in 1767 and showed a keen interest in the gas, Carbon Dioxide, given off in fermentation. He carried out experiments using glazed earthenware troughs for collecting the gas and from contemporary illustrations these seem to be similar to the 'pots' used for smelting glass. It is likely that the local glass and pottery industries assisted Priestley's experiments by providing laboratory apparatus. There is no firm link between Priestley and Lockwood's brewery but there is a remarkable similarity between the principle of the Yorkshire square and his paper to the Royal Society in 1772[1] in which he described the making of 'aerated waters' by impregnating water with carbon dioxide. In the stone square system the open wooden vats were replaced by stone vessels, double decked, a large lower vat under a smaller upper vat with a manhole in the horizontal division. The wort was pumped to fill the lower section and as fermentation proceeded a froth of yeasty wort built up in the upper section. After about 18 hours all the wort in the lower section was pumped into the top section. This produced great activity from the yeast and as the wort ran back the top was sealed off by a filling of frothy yeast. Beer made this way was more effervescent and the gas in the froth protected the brew from contamination. The limit on the size of a square was that imposed by the size and weight of stone slabs available. Bramley Fall Quarries were the main source of

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1. J. Priestley 'Experiments & Observations on different kinds of air', Philosophical Transactions Vol. 62 (1772) p. 216 et seq.

the Elland stone slabs used until the 1890s when Welsh slate was introduced. It was held that slate was easier to clean and less liable to contamination than stone slabs but it would only be a matter of time before bacterial infections developed in the slate.

Stone squares were introduced at the beginning of the nineteenth century and it is possible that the capital investment needed to install the system was a factor in the closure of some of the smaller breweries. Tetleys installed stone squares from 1830 onwards. The original Sykes brewhouse became the 'square room'. The problem of cooling the wort has already been noted as an important factor in delaying contamination and some stone squares were built with double walls to allow cooling water to circulate. In the 1850s Tetleys were left as the only major brewery south of the river. Following a Temperance Meeting, Arthington, who had regularly supplied the ale for refreshments, closed his brewery[1] and the site was sold for the redevelopment of the Midland Railway station. Nell's brewery was in decline and the Airedale Brewery had become part of the Airedale Foundry site. Tetleys began to rebuild the main brewery between 1853 and 1855.[2] There were four coal fired coppers and two steam heated ones feeding the two Riley refrigerators. In 1851 Tetleys employed 32 men out of a total of 223 in

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1. A.M. Chirgwin, <u>Arthington's Millions</u> (1935)

2. Society of the Chemical Industry: Leeds Meeting 1895

the seven breweries in Leeds,[1] but it must be emphasised that brewing was not a labour intensive industry.

Tower Breweries

From the old Syke's brewery a new style of brewery was evolved - the 'tower' type. In this type the malt copper was below a water tank at the top of the tower. Once water had been pumped into the header tank and malt hoisted to the grist mill then gravity moved the liquor on each of the subsequent stages of brewing until the beer was racked-off from the squares into barrels.

Large boilers were needed to produce steam for heating the coppers and for cleaning but the system required only a small steam engine to power the pumps, usually to pump water from the well to the top of the tower.

Most of Tetley's building was done by local firms like Nicholsons who originally had their yard next to Tetleys before they moved to the nearby Prospect Sawmill. In 1874 a new mash tun (No. 5) was cast at Kitsons and the following year an even larger tun was built by Kitsons and Heptons (the Yorkshire Copper & Brass Works) - across the street from the brewery.[2] The wooden hopbacks were replaced by copper ones and the cooling system was extended.

1. Census Enumeration 1851 HO 107/2321
2. City Engineers (Factory Plans) Vol. 9. Extension to Brewhouse. J. Tetley & Son, August 1874.

Tetley bought the freehold from the Syke's estate in 1864. The cellar stone room and the hop store were rebuilt in 1866. Adjacent to the brewery was a maltkiln and on land next to this, bought from the Blayds-Calverley estate, was built a new Crown Point malting in 1867.

The English translation of Pasteur's '<u>Etudes sur la Biere</u>', published in 1879,[1] showed that it was bacteria and 'wild' yeasts that spoiled good beer. It emphasised the need for absolute cleanliness in brewing to prevent infection but did little to directly indicate methods of dealing with unwanted secondary fermentation by wild yeast spores. Although the work was well received in London and Burton it had little impact on Yorkshire brewers. One method used to preserve the brew was to add hops after fermentation and Tetleys have always been generous at this stage. In addition to improving the keeping qualities, hops added flavour and the ability to maintain a distinctive flavour was a major factor in the continued existence of a brewery. Hop oil is a soporific and the effect of this in their bitter enhanced Tetley's reputation considerably. Another factor which aided Tetley's reputation was the use of the original strain of yeast for brewing.

There were social and economic factors which had important effects on the sale of beer in the nineteenth century. The distillation of English grains for spirits was legalised in

1. as '<u>Studies in Fermentation</u>'

1690. Charles II introduced a beer duty which provided a substantial part of the Crown revenues by the early eighteenth century. When the duty on beer was raised there was an increase in gin drinking. The production of spirits rose from 1.23m gallons in 1700 to a peak of 8.2m gallons in 1743.[1]

The Gin Age came to an end after 1751 when drinking debts were no longer recoverable at law, this cut down drinking 'on the slate', and distillers were banned from retailing spirits. At the same time spirit & licence duties were once again raised.[2] A reduction in the duty in 1785 stimulated distilling once again and by 1800 almost 5m gallons were produced.[3] The duty was reduced by a third in 1825 and gin drinking once again increased from an average of 9.75m gallons to 19m gallons annually.[4] Beer was considered as a temperate alternative to spirits so the Beer House Act of 1830 may seem as being inspired by the Temperance movement. This allowed any rate payer to retail beer on payment of a 2 gn. licence fee. Within 7 years there were more beerhouses than inns in Leeds. Leeds publicans tended to brew their own beer but many beerhousekeepers bought their stocks from common brewers. In 1847 half the beer in Leeds was brewed by licensed victuallers,

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1. Customs Library <u>Excise Revenue Accounts 1662 - 1827</u>
2. 24 Geo II c.11
3. Customs Library, op.cit.
4. *Ibid*.

30% by common brewers and 20% by beer houses. The Temperance movement began in Yorkshire, in Bradford, in February 1830 and the Leeds Society was formed in September 1830. Its pledge was:

> "We do voluntarily agree to abstain entirely from the use of distilled spirits, except for medicinal purposes and ... the moderate use of other liquors is not excluded ... " <u>First Report</u> The Leeds Temperance Society, Leeds, 1831.

The rapid increase in the number of beerhouses, especially in working class districts attracted the attention of Temperance workers and in Preston in 1832 the Teetotal Movement began. By 1835 nearly half the members of the Leeds Temperance Society had signed the pledge and the following year the Leeds Society became teetotal.[1] Leaders of the movement in Leeds included the Baines family of the <u>Leeds Mercury</u> and woollen merchants like Jowett and the Claphams. The Society met in the Quaker Meeting House on Water Lane and the Quakers adopted temperance principles in 1834[2] but did not become teetotal until 1850[3] when Robert Arthington closed down his brewery. It will be recalled that many London brewers were Quakers.

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1. Report of the Public Meeting of the Leeds Temperance Society, 1831.

2. Leeds Temperance Society, <u>4th Report</u> 1835.

3. A.M.Chirgwin, <u>op.cit</u>.

The Rev. Jabez Tunnicliffe founded the Band of Hope in Leeds in 1847 and the early meetings were held in a house on the south-east side of Leeds Bridge. The British Workman Public House (the pub with no beer) movement began in Leeds in 1867 and there were four dry houses in Hunslet & Holbeck by 1871. In 1869 the reformers triumphed and beerhouses came under the control of the local bench and the magistrates could refuse new 'on' licences, but could not refuse to renew an existing 'on' licence for a beerhouse if the premises or licensee were satisfactory. This restricted the growth of the number of beerhouses. As the number of beerhouses began to decline brewers were eager to lend to new entrants in support for ties to their brewery. Tetleys were reluctant to extend their interests beyond production and by 1890 had only two tied houses. Indeed, in Leeds as a whole, only 1/3rd of the public houses were tied in 1899.[1]

In the meantime further changes had taken place in drinking habits which were reflected in production methods. The Temperance movement encouraged the more restricted consumption of bottled beer at home in preference to heavy drinking in public houses. Bottled beer was not new and until recently Bass produced a traditional bottled beer which matured, by secondary fermentation, in the bottle. The changes of the late nineteenth century were based on a new style of beer, which was filtered to prevent secondary

1. R.C. on the Operation & Admin. of the Laws relating to the Sale of Intox. Liquor, Final report Pt.IV (1899) XXXV p.73

fermentation and with dissolved Carbon Dioxide to increase the sparkling, clear, appearance. This carbonating was closely linked with the development of the mineral (aerated) water industry and used similar machinery, much of it produced by D. Wickham of Ware, Herts. (1890) which added carbon dioxide under pressure, during the bottling process. Related to these changes were matching developments in the mass-production of glass bottles, which is dealt with in Chapter 13, and the change from earthenware pots and pewter tankards to drinking glasses. The old style beers were 'full bodied' and consequently of cloudy appearance, a factor which reduced sales when poured into glasses. Tetley's first bottling plant was opened in 1892 and the trade grew so rapidly that a new bottling store was built on the site of the old gateway in 1894. The growth of Tetley's brewery is outstanding and was continuous during the last quarter of the century. By 1900 it was the biggest brewery in Yorkshire, employing 400 in the brewery and another 100 in administration and transport. There were at that time less than 840 brewery workers in Leeds employed in 28 breweries.

The development of rail transport after 1830 increased competition from the Burton brewers. The London brewers had agents in Leeds from 1817 onwards, delivering barrels of porter by the Aire & Calder Navigation[1] and local breweries only survived for as long as they could hold on to their

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1. Leeds City Archives: Glover Collection. (A33a) Billhead: 1817 Joseph Heighington - dealer in Barclay Perkins ales.

market. Successful local brewers, like Tetleys, expanded production and eventually went into tied houses to protect their sales. This led to take-overs which gave added outlets and allowed surplus production units to be closed in favour of modern larger scale plant.

To raise the capital for this kind of expansion Tetleys were incorporated in 1897. Expansion at Salem Place continued and by 1913, of the original Sykes' brewery, only the counter and private offices were left. Tetleys was the only tower type brewery built south of the river. The other breweries, all of which went out of production, were of the older horizontal type. Although Tetley's tower dates from the mid-1850s designs for horizontal breweries were published as late as 1865.[1] In Leeds, by 1900 the common brewers, led by Tetleys produced 2/3rds of the beer sold but beer houses and inns still produced the remainder as 'home-brewed'. It is difficult to reconcile the emergence of Tetleys as the largest brewery in Yorkshire with this persistence of home brewing by independent publicans in Leeds, when elsewhere the tied house had become dominant by 1872.[2] Perhaps the answer lies partly in the words of the writer of the Leeds Commercial Yearbook 1920:

> "Rapid strides have been made in the science of brewing during the last twenty five years ... Leeds is also the centre of the brewing trade. The old

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1. Scott Burn, (ed.) Working Designs & Drawings Edinburgh (1865)
2. E.M.Sigsworth, The Brewing Trade during the Industrial Revolution (1967) p.31

> system of home-brewing still prevails to a certain extent, but the ales now brewed in Leeds at its large breweries are held in high esteem, and are supplied to all parts of the Kingdom".

This suggests that breweries like Tetleys had substantial sales outside the borough which more than compensated for the reduced market in Leeds where home brewing maintained such a hold.

CHAPTER 10

FOOD INDUSTRIES

Vinegar Brewing

> "This trade is now one of the most successful of the lesser industries of the city, and is undoubtedly the largest of its kind in the North of England."
>
> Leeds Commercial Year Book 1913 p.61

Reference has already been made to the problems of brewing beer in warm weather, chief of which was the souring of the beer. The vinegar maker depended on this for his supply of malt vinegar. In Leeds the major producer was the Cambrian Vinegar Co. who, after beginning in a cellar in New Briggate, moved in 1868 to a former wool warehouse in Water Lane.[1] The lease of these premises expired and the business was transferred to a newly-built vinegar brewery on Elland Road in 1877 (221). This was described in great detail by the manager, James Brodie,[2] in 1884 and again in 1892. Basically it was a tower brewery with two steam engines and vats of 4000 gallons capacity. Brodie was appointed manager in 1869 to succeed Taylor, who came from the parent company at Pontypridd, and he soon became a partner. About this time a branch was opened in Birmingham and after a time this was sold to a Mr Moore. He renamed it

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1. J. Brodie, <u>'Tis Thirty Years Since</u> (1894) Leeds.
2. <u>LE</u> 31.5.1884 'Peeps into Leeds Industries' <u>Leeds Illustrated</u> (1892). Plans: City Engineers (Factory Plans) Vol.9. Sept. 1874. Ben Woolley, contractor

the Midland Vinegar Co. and went on to make a fortune from H.P. Sauce.

In 1883 the original Welsh site was sold and James Brodie was joined by his brother John following the move to Elland Road. The firm was incorporated as a private limited company in 1898 with the brothers holding nearly half of the shares.

James Brodie commented on the state of the trade in 1894:

> "To begin with, prices of the common qualities of vinegar are little more than half of what they were a quarter of a century ago, whilst an expensive plant has to be kept in the best working order."[1]

The problems of the trade derived from the competition from chemical manufacturers & wholesalers who added caramel colouring to dilute Acetic acid and sold it as malt vinegar. Malt vinegar was made by brewing a malt liquor and fermenting it like beer. The brew was then allowed to percolate through casks full of beech wood shavings. The action of *Mycoderma aceti* oxidised the dilute Ethanol into Acetic acid (about 4%) but retained essential malt esthers which produced the distinctive flavour.

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1. J. Brodie, *op. cit.*

Vinegar breweries were comparatively rare. The economies of scale were such that an efficient brewery like the Cambrian could supply the needs of a large area and, with the Penistone Vinegar Co., at Barnsley, could supply all Yorkshire and beyond.

CHAPTER 11

FOOD INDUSTRIES

Mineral Waters

The late nineteenth century Temperance movement contributed to the development of the aerated, or mineral, water trade. The fashion for spa water, the true mineral water, was not new. Harrogate's mineral springs were discovered by William Slingsby in 1571.[1] Joseph Priestley, whose experiments have already been discussed in connection with the Yorkshire square system of brewing, may be regarded as the inventor of 'soda water', which he felt would cure scurvy,[2] in 1772. There is some indication that Watt and Bramah were interested in aerating & bottling machinery also. It is difficult to separate the bottling of spa water for sale to those unable to visit the spa in person and the manufacture of 'pop'.

In South Leeds mineral water manufacturing cannot be traced before 1889 when there were 6 manufacturers of 'soda water etc.' listed.[3] North of the river Clarkson's Brunswick Soda Water Manufactory claimed its origin in 1853[4] and J. K. Clapham of Briggate, 'Chemist & Soda Water Manufacturer' was even earlier.[5] Of the six listed the most intriguing was the 'Malt-ette Co' of 93 Hunslet Road - surely a precursor

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1. E. Deane Spadacrene Anglica(1626) describes the various wells of Harrogate.
2. J.Priestly,op.cit.p.240
3. Kelly WR (1889)
4. Century's Progress (1893) p.178
5. Leeds City Archives A33a Billhead 4.11.1839. The link between chemists and aerated waters lasted until after 1920. Reynolds & Branson, of Briggate, advertised aerated waters as well as scientific instruments & fine chemicals at this date.

of the present day malted milk drinks. Four of these firms became established soft drink and mineral water makers and in all cases they adapted existing premises to their needs. Harston & Co. at 9 Bowman Lane, absorbed G. Barrett, 11 Bowman Lane, and lasted until after 1918. C.B. Inman, Progress Mineral Water Works (165) was followed by his sons, R.H. and W.E. Inman in 1906 (Kelly) and in 1914 they were taken over by E.P. Shaw & Co. Ltd. from 68 Victoria Road. Shaws also had premises on Mariners Street, Dewsbury Road, but these seem to have been only a warehouse or depot. Hanby Bros. began in Water Lane and moved to Torbay Street under the railway arches[1]. Their first premises were part of the Midland Junction Foundry development onto the Springfield Mill site (24) and were recently used as a depot by Watney, Mann & Co. the London brewers. Len Foster of Stocks Hill, Holbeck, died in 1853[2] and the Thomas Malthouse (19) was let to J. H. Robinson of Millgreen. After several changes of ownership it was bought by B. Chapman for £3,025 in 1899. He refurbished the premises and, in addition to a loading dock, spelt out 'Chapman's Table Water Works' in white brick on the gable end of the lean-to. Chapman's were still in business in 1960.

Following the closure of Smith, Beacock & Tannet in 1894 the 'Round Foundry' (Victoria Foundry) was split amongst a variety of users. One of these was William Oxley, mineral

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1. Kelly 1906
2. LCD 4871

water manufacturer, who gave his address as Foundry Street, Water Lane, that is to say it was the S.W. corner of the Victoria Foundry, built in 1862. There were never more than half a dozen mineral water makers in the district. Capital investment was not high and because of the low value in relation to bulk, transport & distribution costs were important in determining the distance over which mineral waters might be profitably moved. These firms catered essentially for a local market smaller even than the brewers, and growth was not feasible until the advent of cheap motor transport permitted sales over any distance.

The development of the trade was linked with developments in the mass-production of glass bottles and suitable stoppers for carbonated drinks. In this respect the firms noted had the benefit of the bottle-making plants in Hunslet for most of their needs, and potteries, such as Robinsons in Jack Lane (141) to provide screw-top stoneware jars for ginger beer.

POTTERIES

> "Leeds has been, moreover, noted since 1770 for the manufacture of pottery, old Leeds ware being much sought after by connoisseurs. The high standard has not, however, been maintained; but the establishment and rapid development of the terra-cotta and faience works in the city have given this branch of the industry an extraordinary impetus".
>
> Leeds Commercial Year Book 1910 p.37

In outlining the general development of industry before 1800 the importance of the Leeds Old Pottery (128) was noted. It was the largest single enterprise in Hunslet and under the direction of Hartley was producing large quantities of 'Leeds Creamware' based on bought-in china clay and flints.[1] Some of the other local potters were quick to follow suit; Petty & Rainforth moved from Leathley Lane, almost next to the Leeds Pottery, to another pottery started a few years earlier. Pettys also produced a creamware but there is little known of their style or designs since there are no known surviving pieces. It is very likely some unmarked examples of Leeds Creamware are, in fact, from Petty's Pottery and not from the Old Pottery.

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1. "Visited china works at Leeds. White chinaware sells well locally and on the Continent. Wedgewood does not sell well on the Continent". February 1815. J.G. May, Prussian Factory Commissioner (quoted in W.D. Henderson, op.cit.)

Pettys had a good reputation and exported their wares to Brazil amongst other places.[1] Another pottery which established itself in the better end of the trade was Thomas Cartledge's, later the Victoria Pottery (110). Both of these potteries were tiny compared with the Old Pottery. Petty had a 12 h.p. engine in 1848[2] and it seems that the Victoria Pottery lacked any kind of steam power. It was rated at 6 gns. when the Leeds Pottery was rated at £166,[3] which included a 36 h.p. Murray engine.

The success of these potteries stimulated competition and in the space of a dozen years five new potteries were opened. Two were on Jack Lane between the Leeds Pottery and Hunslet township, and two were close to the Victoria Pottery. These potteries seemed to have concentrated on domestic stoneware and 'common earthenware'. The remaining pottery, Marsdens, was on the north side of Hunslet Moor and was associated with Jabez Woolley who was an important brickmaker with several brick-kilns in the Farnley district to the west of the Elland turnpike.

There are two standard works on the Leeds Old Pottery[4] which deal mainly with the artistic side of the pottery. The

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1. J.R. & F. Kidson Leeds Old Pottery (1893) p.111
2. Holbeck SV Minutes (1848)
3. Hunslet Rate Book (1823)
4. Kidson op.cit. and D.Towner The Leeds Pottery (1963)

first crisis of the Old Pottery was in the 1820s when the business went bankrupt for the first time. It was re-opened in 1825 by Samuel Wainwright, who had been a partner since 1783, but there was little innovation in design. Sales of existing designs continued but there was a decline in the quality of the goods produced. Wainwright sold out to S. & J. Chappell in 1840 but in 1842 they mortgaged the pottery for £17,000.[1] In 1847 the pottery was taken over by Warburton & Britton. Britton was the active partner and he arranged a succession of mortgages, with Warburton in 1863 for £4,000 and then in 1868 for a total of £17,000 mostly with the Middleton Estates. Britton went bankrupt in 1878 and for practical purposes it was the end of the famous pottery, or almost, since one of the senior staff, George Raikes Senior took the 'Creamware' moulds away with him and in the early years of the present century his family set up an electric kiln on Balm Road (187) producing 'Creamware' from the original moulds.[2]

The other potteries followed the 'normal' pattern of nineteenth century industrial organisation; fluidity of management, changes of ownership, changes of site. Sam Brown lasted some fifteen years and his successor Marsden lasted ten years before that pottery closed down and in due course became a housing site, Bedford Row. Joseph Allison was followed by his son John but in 1840 their pottery

1. LCD 3246, Summary of mortgages, Leeds Old Pottery.
2. Information supplied by G. Gilbert, Curator, Temple Newsam House Museum, and George Senior's son.

was taken over by the adjacent Jack Lane (Hunslet) Pottery (141) which was opened in 1814 by William Taylor. Taylor made 'common earthenware' and stone ware, and the pottery was extended in the middle 1820s.[1] This pottery was next to the Bower glass works and close to the chemical works, so there was an immediate market for stoneware jars and retorts on the one hand, and for 'pots' for the glasshouses on the other. William was followed by his sons in 1845 and they continued in business until about 1880. By that time they had taken over Allisons and had an interest in the Union Pottery, Leathley Road (131). About 1870 they bought the Hunslet Hall Pottery (174), which after 1844 was not in continuous production, and eventually closed it down and it was to be sold for housing by 1890.

The situation can only be reasonably explained by the assumption that the various potteries were operated by a loose cartel of potters, the Taylors, Mills and the Russells. Mills was involved with John Hepworth at Leathley Road before it became Dawson & Chappell. Chappell took over the Leeds Pottery with financial help from Dawson, amongst others. Meanwhile Mills had concentrated his interests at the Victoria Pottery and at Hunslet Hall. Taylors bought the Leeds Pottery when Britton went bankrupt in 1878. Because of all this, little is known of the activity of the Leathley Road Pottery. It was second in size to the neighbouring

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1. Hunslet Rate Book (1823) Pottery with 2 kilns.
(1826) new kiln, (1827) new slip house.

Leeds Old Pottery, with its five kilns, but it seems that much of its output was sold under the names of the other potteries with which it was associated for most of the time. After J. Taylor closed it down in 1890 it was immediately re-opened as the Leeds Art Pottery and then it became the Stafford Pottery of the Leeds Fireclay Co. By 1908 it was recorded as disused and it is most likely that it had become a storage depot for the Leeds Fireclay Co. with the great advantage of its site next to the goods depot.

The 'blackware' pottery of William Russell was in Meadow Lane by 1807.[1] In value it ranked next to the Old Pottery but was slightly smaller in size than Leathley Road. This suggests that its output was of a somewhat higher quality. Russells remained in business until about 1890 when the area was built over as Shand Street etc. Russells took over the Lane End Pottery, which was started by J. Clarke in 1817,[2] from 1834 until 1860 when it passed to Sykes & Dickinson. It remained in the latter family until the turn of the century, when it became a builder's yard for a few years until it was re-opened by the Crossleys from Hunslet Hall Pottery.[3]

Of the later potteries little needs to be said. They were single kilns like the Holbeck Moor Pottery which opened in 1853 and closed down in 1912 by which time it was listed as

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1. Wilson D (1807) Kidson, op.cit. p.113
2. Baines D (1817)
3. City Engineers (Factory Plans) Vol.9. New Workshops: Dickinson & Sykes, Lane End Pottery. September 1874

'W. Green, Holbeck Pottery, garden pots'.[1] Only one other site worthy of mention remains; the Jack Lane New Pottery (141) begun by Jesse Platts in 1839 between Allisons and the newly opened Hunslet Engine Co's works on Jack Lane. This soon became Robinsons and remained in production until about 1918. The main product seems to have been glazed earthenware bottles and jars. These found a ready market with the local aerated water manufacturers for ginger beer and with the chemical manufacturers, as well as the vinegar works on Elland Road. Recently one of Robinson's stoneware two gallon jars was discovered in a cider mill in France.

With poor roads there was a need for local potteries producing a range of domestic pottery. The sites in Hunslet and Holbeck lay on the clay outcrop and all were close to good supplies of coal. The introduction of 'creamware' reduced the need for local clay but the rise of the Leeds Pottery in the first two decades of the nineteenth century was closely linked with the Middleton Railway which passed through the site. At its zenith the pottery took nine waggon loads of coal each day for the kilns. The decline of the Leeds Pottery was basically due to poor management in the specialised field of creamware production where its direct competitors were notable potteries like Wedgewood, Rockingham and Doulton etc. The other, smaller, potteries continued for as long as they could meet the local needs

1. Robinson D (1910/11)

for domestic earthenware in competition with other potteries. In most cases the sites were limited and their clay grounds were used up. Improvements, first in water transport, and then the railways weakened their local monopoly of the market so that it was only at the lower end of the trade, stoneware jars and garden pots, that they could remain competitive. For these products the value in relation to bulk was extremely low and, due to their fragile nature, transport cost could only be borne over very short distances. The majority of potteries were out of business and were redeveloped as building sites by 1890. By 1914 only Holbeck Lane End, Jack Lane New, and Balm Road Electric Potteries were still at work. Only the last named was modern in its operation, the others were the traditional beehive coal-fired kilns. Most of the potteries produced bricks as a side line and it seems that Robinsons pottery began originally as a brick works. Certainly in 1800 Ard Walker bought firebricks from the Leeds Pottery.[1] The major brickworks were to the west of Elland Road and across the river at Burmantofts. Apart from bricks they developed important lines of sanitary ware from glazed fireclay, which was found in association with the 'Better Bed' coal and the faience or terra-cotta, plain or glazed, produced at the Burmantofts works.

The best known Leeds pottery was the Old Pottery and at

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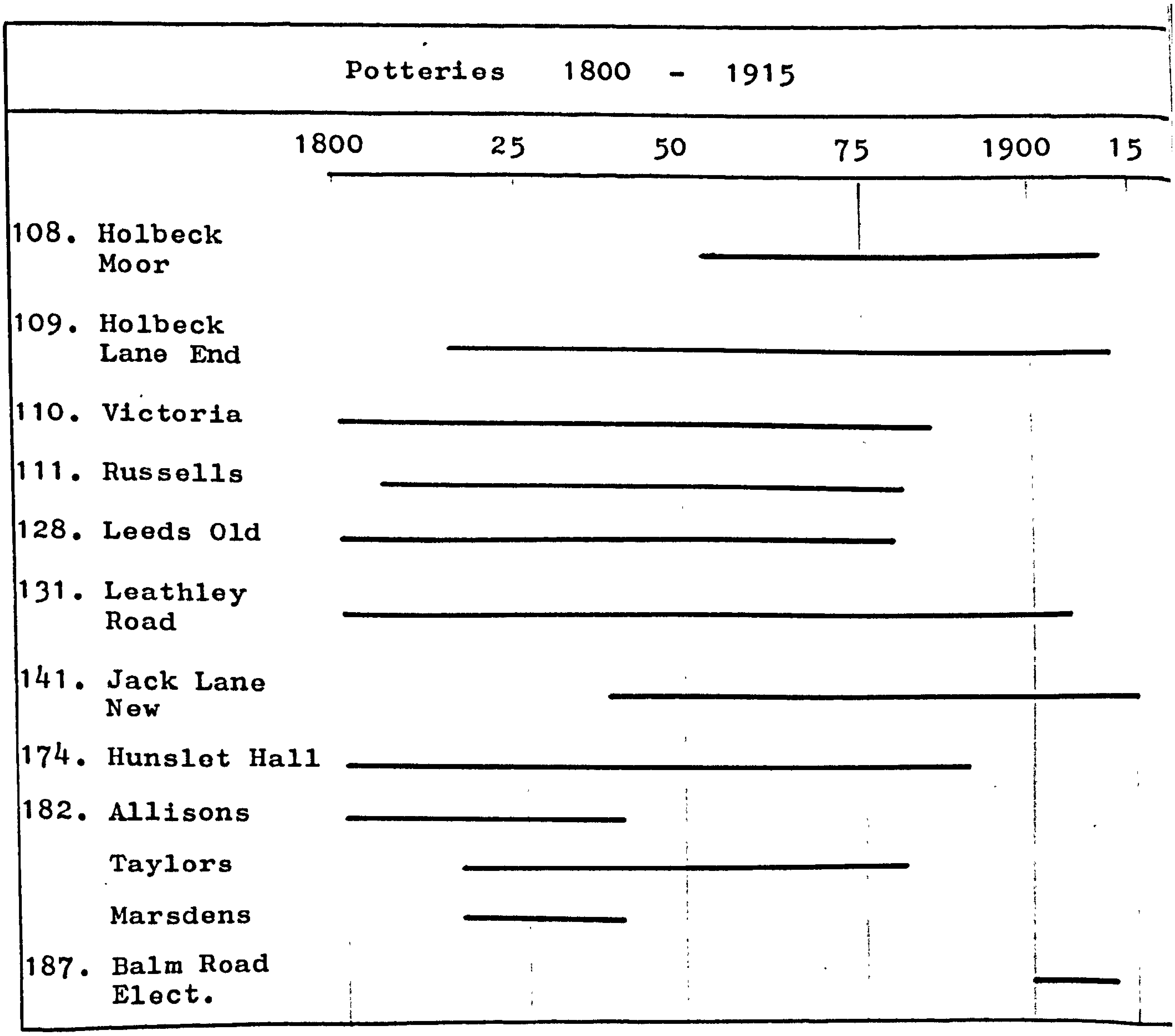
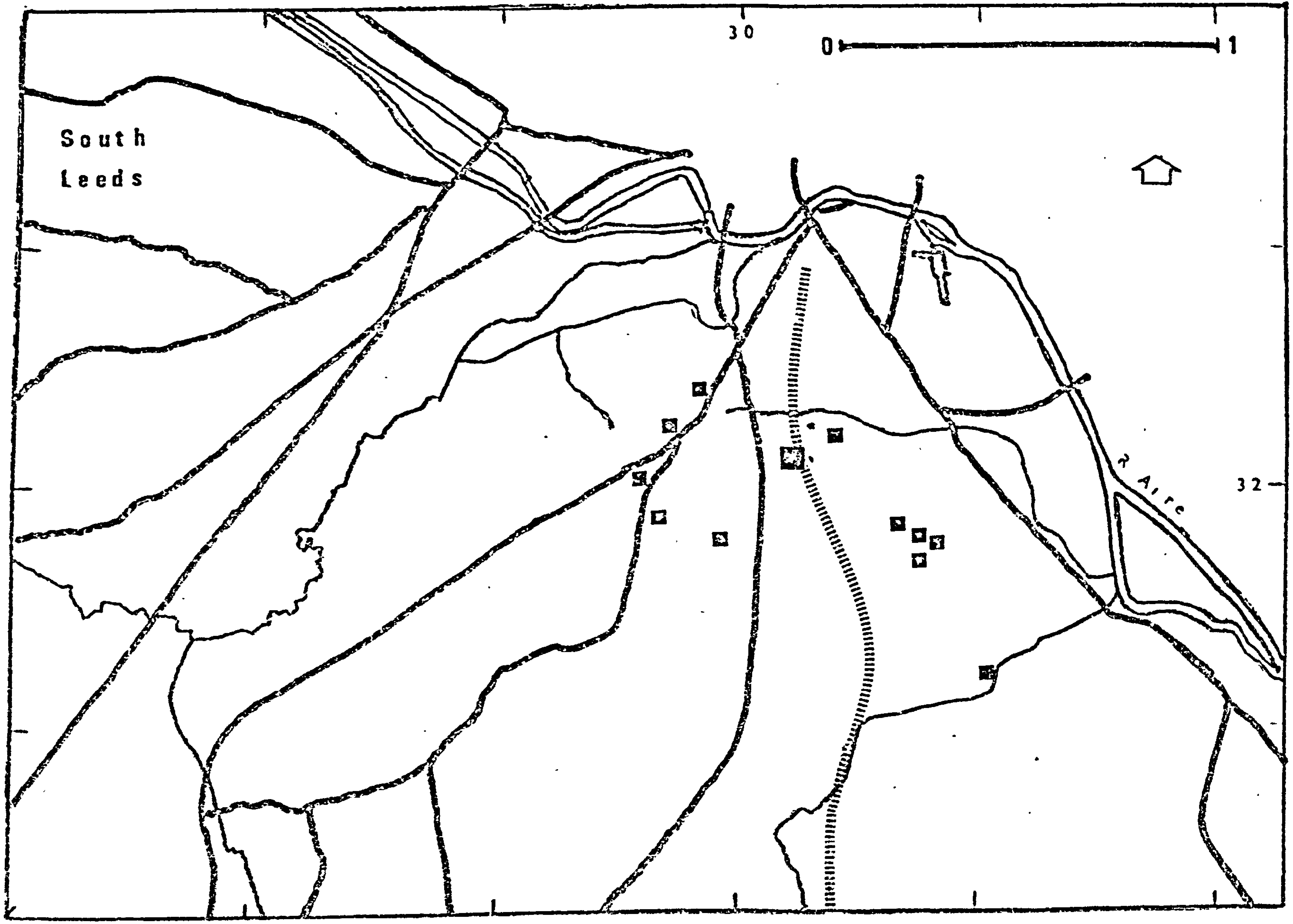
1. Leeds City Archives DB23 (1800) Sept. 1. 1000 fire bricks from Pottery, £4.3.4.

its close it had 4 biscuit kilns, 7 glazing kilns, a hardening & enamelling kiln, a brick kiln, steam mill, grinding mill and a flint mill. The saggar house and brick kiln were mainly used to produce materials needed for the operation of the pottery itself. It was a notable works and many maps before 1850 showed a drawing of the great pottery in the margin, even though it was 'off the map' itself.

Table 12.1





POTTERIES

CHAPTER 13

GLASS WORKS

"The glass bottle industry has been carried on here for about a hundred years".

LCYB 1913 p.60

The manufacture of glass in Yorkshire has a long history. The industry was founded in Elizabethan times by Hugenot refugees who settled in England after 1560. The remains of a Flemish type glass house dating from this period were excavated in Rosedale in 1969. In 1696 there were three glasshouses in the south of the county, one near Ferrybridge and two near Barnsley.[1] The glasshouse built by William Fenny at Catcliffe, Sheffield, in 1740 still stands and has been preserved by the Sheffield City Museums. The details of this are identical to that depicted by Diderot in 1763[2] as an 'English' glasshouse and the style did not change until the later part of the nineteenth century when the Siemens regenerative furnace was introduced.

William Fenny's brother, Joshua, leased a glasshouse at Rothwell Haigh in 1726[3] but this became a pottery in 1773.[4] In Leeds itself J. Fenton had the 'Engine Glasshouse'[5] and

1. John Houghton, Letters for the Development of Trade & Husbandry(1696).List of glasshouses in England & Wales: 15.5.1696.
2. D.Diderot:Dictionnaire et Encyclopedie (1763)Paris Vol.X. Verrerie Angloise Pl III
3. Rothwell Parish Registers.
4. LM 13.4.1773.
5. LM 21.3.1738.

and was still listed in 1790 (British Universal Directory). The site of this glasshouse was almost certainly by Pitfall Street on the north bank of the River Aire, the 'engine' being that of the waterworks.

In 1814 Joshua Bower established a glassworks in Hunslet (185) to make Crown & Window Glass. Next door John Bower built a Flint & Bottle Glassworks in 1816 and they had no competition until 1846. The works expanded, Joshua added a warehouse and John a new calcining furnace, a 3 h.p. steam engine and converted a warehouse into a glasshouse.[1] By 1831 (Fowler map) there were 4 Crown glass furnaces and 3 Flint glass furnaces. In 1839 Robert Kilner and two other employees left Hunslet and set up on their own at Dewsbury. This became the home of the 'Kilner' jar still widely used for fruit bottling.

Crown Glass

The techniques of making Crown glass were clearly illustrated by Diderot[2] and the methods had not changed by the mid-nineteenth century but with the repeal of the Excise duty on glass and of window tax in 1851, hand-made crown glass could not be produced in the quantities required. The main source of window glass was from cylinders which were split open and rolled out flat, without the 'bullseye' that was

1. Hunslet Rate Book 1826.
2. Diderot, op.cit. Vol.X. Verrerie en Bois, grand verrerie. Pls II XVI

the centre of a piece of crown glass. By 1846 Joshua Bower had taken over the flint glass works and renamed it the 'Crown Glass & Bottle Works', his original site being developed for housing in the 1860s, a period of rapid development in housing in Hunslet.

The main product of the flint glass works had been hand blown bottles and alembics, the glass retorts used in the manufacture of chemicals on a small scale.[1] This indicates the close relationship between glassmaking in Leeds and the chemical industry. Not only did Joshua Bower own the Hunslet Chemical Works, specialising in the manufacture of Sulphuric Acid, Copperas and Epsom Salts, but John Bower was listed a 'maker of bottles, soda and Hydrochloric Acid'. Large scale methods of chemical manufacture replaced the early batch methods and so the glassworks concentrated on bottles of all types and sizes, and carboys for the transport and storage of acids. This was the pattern of the development of the glass industry in Hunslet, in the second part of the nineteenth century. Most glasshouses made bottles rather than sheet or plate glass, and at this time bottles were still hand-made by blowing molten glass into moulds.

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1. Leeds City Archives, A33a Letterhead, J. Bower, 10.11.1820 shows glassblowers making alembics. Letterhead of 11.2.1829 shows the glassworks with alembics stacked outside the glasshouses.

Apart from skilled labour the raw materials needed for glass making were sand (silica), soda or potash as a flux, lime and coal, as the fuel, in quantity.[1] As well as the fuel to melt the mixture of sand etc. (frit) coal was also needed to fire the kiln which was used for baking the 'pots', the crucibles in which the frit was melted. Thus the choice of site for a glassworks needed to be related to the source of the raw materials, to the fuel and to a supply of clay for 'pots'. Jack Lane met all these needs. Sand and lime came by river, coal to Hunslet Moor coal staithe by the Middleton Railway and the glassworks was next to Allison's pottery. The availability of coal, clay and skilled glassblowers were important factors in the location of subsequent glassworks in Hunslet rather than other parts of Leeds, as were the river and the railway for delivering the finished products to the users.

The second site to be developed as a glassworks was on Balm Road, by the railway bridge, hence the name, 'The North Midland Glassworks' (188). This was in 1846 and the owners were Roberts, Scott & Taylor. By 1853 there were two more glassworks. The 'Belle Vue Glassworks' in Old Mill Lane (205), formerly James Aspin's glue house, was started

1. "Crown glass materials consist of kelp, barilla, pot-ash, Lynn sand, cullet, etc. and require from 24 to 30 hours to found and melt them. Plate glass is made from barilla, salt-petre, Lynn sand etc. Flint glass is made from salt-petre, red lead Lynn sand, arsenic etc. Common bottle glass is made from kelp. hard sopers, ashes, lime, wood ashes, cullet and coarse sea or river sand".
A. Nesbit & W. Little 'Practical Gauging' (York 1926) pp 482-3

by Taylor and Nicholson. Booth & Co. built a glasshouse on Pepper Road (212). Scott left the North Midland Glassworks and set up on his own in 1859 at the Hunslet Glassworks, South Accommodation Road (155). The other glassworks in Hunslet were the Albert Glassworks (162) of Joshua Taylor[1] and the Belinda Glassworks (202) which was bought by Wood before he moved to the Balm Road works in 1863.

The Bowers' glassworks passed to William Brooke, 'Jossie' Bower's grandson, who modernised the works considerably and as William Brooke Ltd. only went out of business in 1932.[2] Brooke installed 5 Siemens furnaces and employed 200 in 1888.[3] The growth and development of the trade by this date can be seen from the description of the Hunslet Glassworks given by A. Alexander in 1883.[4] At that date they had been using a Siemens continuous-melt gas furnace of 45 tons capacity for about 8 years. These furnaces were developed by F. Siemens of Dresden in 1872 because the regenerative furnace developed by Sir William Siemens in 1856, and heated by producer gas from 1861, produced such high temperatures that the covered fireclay pots, in which the frit was melted, were soon burnt away. At the Hunslet Glassworks the furnace consumed 40 tons of coal to produce 9,000 cu.ft. of gas. In terms of bottles this was 78,000 in a five day week. Apart from the Hunslet works, Alexander

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1. Jones D (1863)
2. LCD 19138
3. YI (1888) p.174
4. LE 17.3.1883, 'Peeps into Leeds Industries'

also had a smaller works at Newcastle-on-Tyne. In Leeds he employed 200 men, the same as William Brooke, but their output was greater since they had a more up-to-date plant with a bigger furnace.

Nicholson & Booth had become Armitage & Robinson by 1866. Their glassworks was next to Blackith's Chemical Works and one of Blackith's men, Peter Gilston, opened a glass bottle works on Upper Carr Place in 1868 and built another, larger, works on Moor Road in 1884 (212) where he also employed 200 men. Armitage left Robinson and took over the Belle Vue Works in 1891 where he stayed until 1906. Wm. Brooke expanded into the Albert Works in the 1890s but by the turn of the century it had become the Clarence Glassworks of Lax & Shaw, who are still in business as bottle makers but now occupy an extended Hunslet Glassworks.

Mechanical Bottle-making

Apart from the Siemens continuous furnace the main developments were in the mechanisation of bottle making.

The first stage in the mechanisation of bottle blowing was the re-introduction of open moulds. These left the neck enclosed whilst the size control was in the hands of the glass blower. Closed moulds gave uniform size but the final blowing needed great physical effort. Cahuc, of Doriguies, France, introduced a revolving mould in 1878 and at about the same time the use of compressed air for blowing was developed at the Baccarat works (famous for its paper-weights). The first major development, in 1866, was Arnall & Ashley's 'plank machine' in which a movable mould was fixed to a plank in an inverted position. A gob of molten glass was forced down into the neck of the mould by a piston and then a jet of compressed air was admitted at the neck to 'blow' the glass hollow. The length of the bottle was controlled by lifting the piston. This machine was not a commercial success but it was improved in 1887 and 1889 by the use of two moulds. The first formed the neck of the bottle, which was inverted manually, whereupon the second mould closed round the glass and the bottle was blown by compressed air.

In 1882 Philip Arbogast of Pittsburgh devised a machine to feed gobs of molten glass into a neck mould. The combination of the ideas enabled the manufacture of bottles to become even more mechanised and Ashley had ten three-headed rotary machines producing over 2000 bottles daily at his Castleford works by 1892. This was only a quarter of Alexander & Co's output in 1883[1] and it appears that Hunslet glassworks were amongst the largest in Yorkshire at least. The final steps towards completely mechanical bottle-making did not take place until 1904. Michael Owens in America had spent six years and a large fortune on producing a six-armed machine which was used with a glass

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1. LE 17.3.1883 'Peeps into Leeds Industries'.

furnace equipped with a revolving tank. Homer Brooke introduced an automatic feeder for molten glass and further developments were made by Karl Peiler of the Massachusset Institute of Technology.[1]

The Hunslet glass makers were quick to adopt the new methods and were advertising their specialities in the various types of patent stoppers which were replacing the traditional corks.

Alexanders made 'Codd's Patent Stoppers', the type used for lemonade bottles with a glass marble in the neck as the stopper, and a pointed base which meant the bottle had to be stored on its side. 'Cohen's Patent Stopper' was used until recently for sterilised milk bottles. A porcelain stopper with a rubber washer was held in place by a springy wire loop system, pressure on the loop locked the stopper in place and a flick upwards lifted the stopper clear of the neck for pouring. 'Valet's Patent Stopper' was made of wood and rubber, it was a screw top type and Alexander's were the 'only makers in the north of England'.[2]

In the early 1880s the Hunslet Glassworks, Bower's and the Hunslet Carr Glassworks each employed 200 men and the other four works probably employed 6-700 also, making a total

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1. E. Venis, 'Glass Manufacture', <u>The Chartered Mechanical Engineer</u> (Sept. 1966) and information supplied by Johnson, Radley & Co.
2. <u>LE</u> 17.3.1883.

direct labour force of 1200 workers in Hunslet. In 1910 there were thirty glass bottle makers in the area south of Leeds employing 5000 directly. Wages were high, averaging £2 weekly and the output of bottles was estimated to be at least £1.5m in value.[1]

The development of the industry as outlined above is confirmed by the Leeds Commercial Year Book, (1910), p.78:

> "Bottles are also made largely by machines in this district; this is a new development, but it is making rapid strides and opens up new possibilities for bottle users, as many kinds of bottle which it was impossible to make by hand may be made by various machines, e.g. vacuum, fruit or jam jars."

This last reference is undoubtedly to the Kilner jar made at Dewsbury and by E. Breffitt & Co. at Castleford. There were many bottle makers in the district but after the closure of the Crown Glass Works there was no production locally of window or plate glass. It would be wrong to ascribe the rapid growth of bottle-making in Hunslet entirely to the increased demand for mineral waters and bottled beer but they were major factors. Output ranged from soda-glass phials for medicines to 15 gallon carboys for chemicals and included sauce bottles and jam jars in large quantities.

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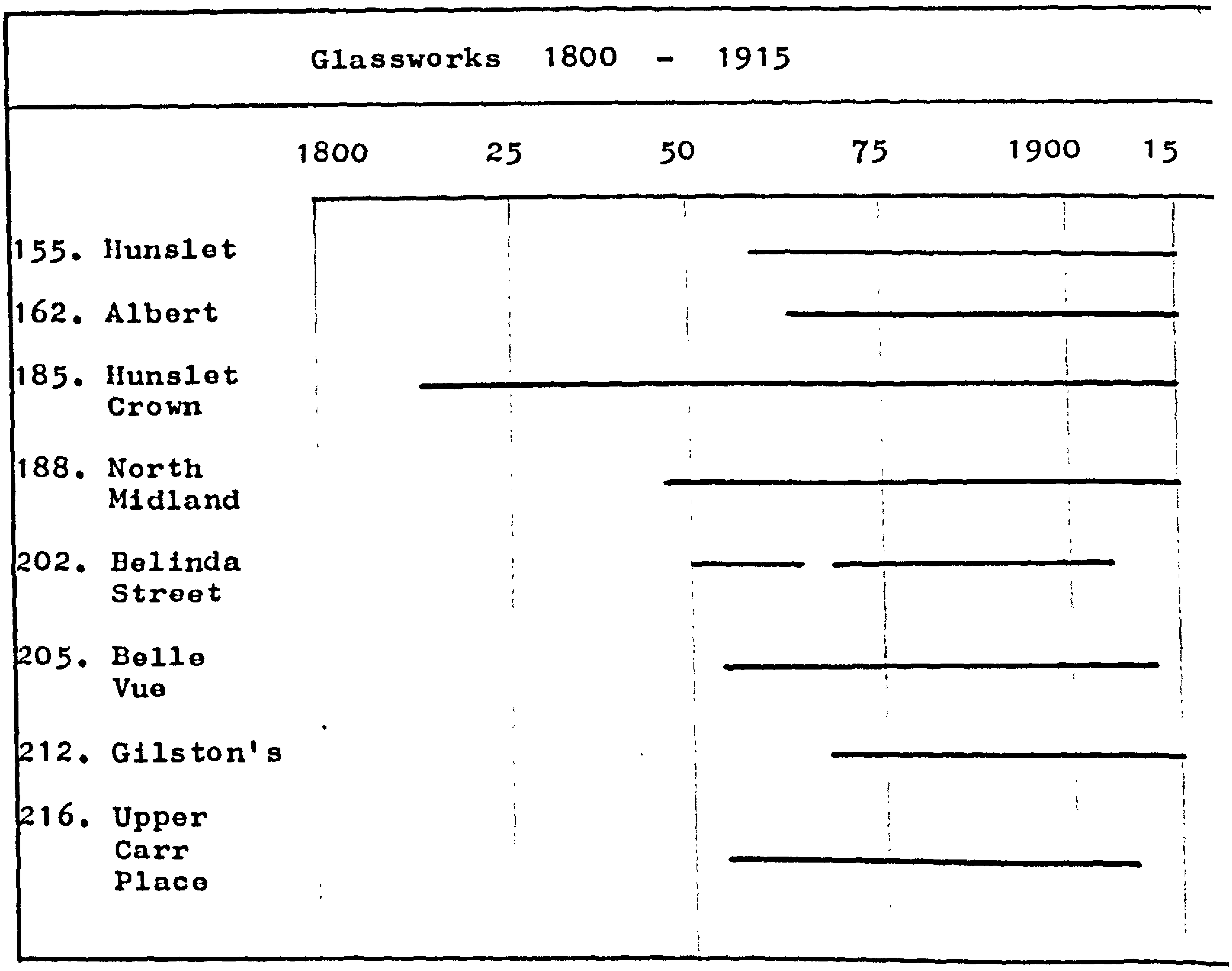
1. LCYB (1910) p.78

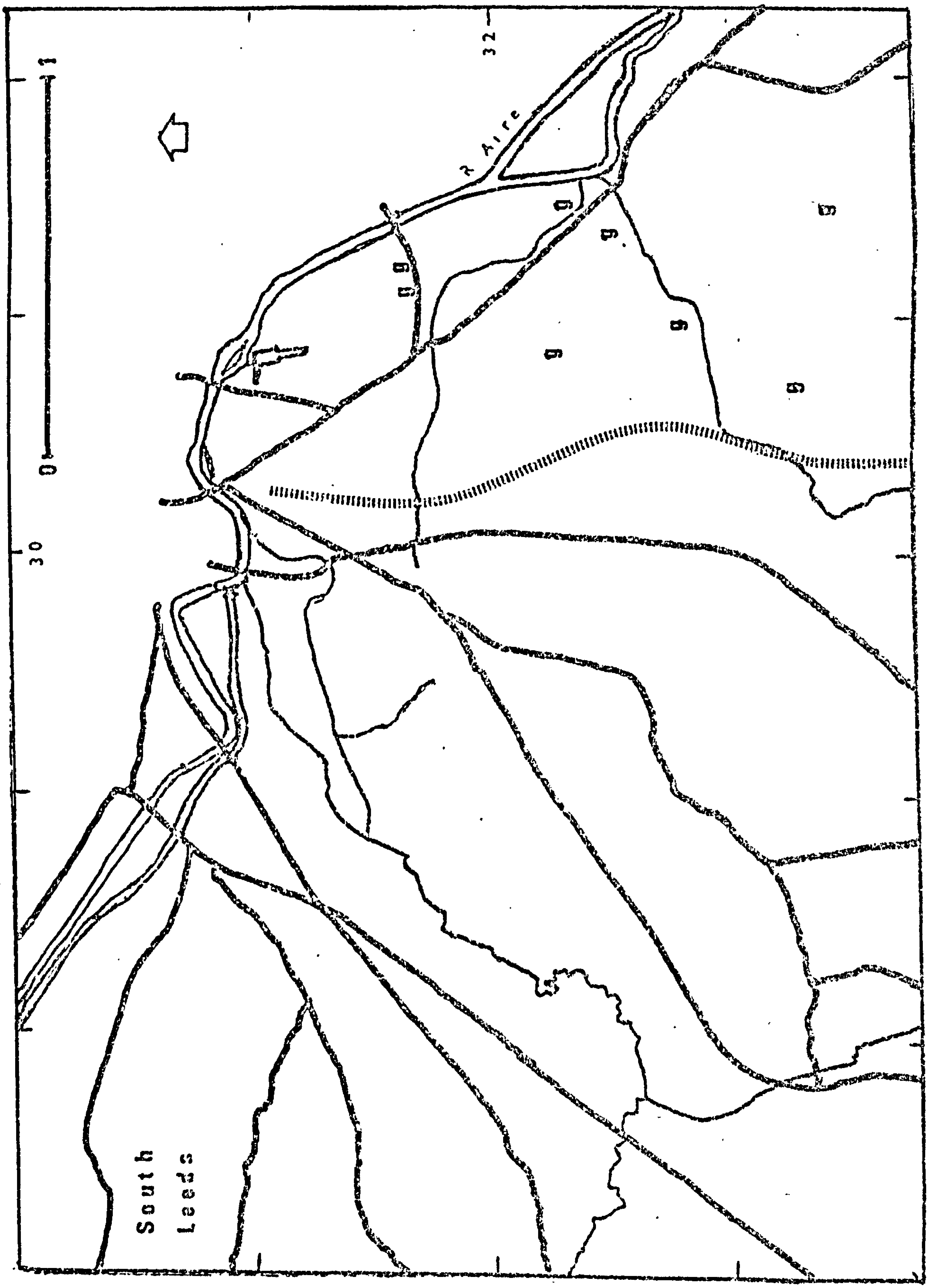
The factors influencing the location of the industry in Hunslet have already been noted: there were ample supplies of raw materials especially coal, and by the middle of the century a well-established supply of skilled glass workers. The subsequent growth of a strong local market for glass bottles and containers of various kinds stimulated production to the stage where Hunslet-made bottles were being exported to most of the colonies as well as selling widely throughout the home market.

The control of glass works changed perhaps less often than seems typical in other industries. The main firms were relatively stable, Bower's lasted over a century and Scott, Wood and Taylor were long established but moved about considerably. A late-comer was Peter Gilston but he established himself and became a local councillor as well as a prosperous bottle manufacturer.

Table 13.1


Glassworks 1800 - 1915
1800
25
50
75
1900
15
155. Hunslet
162. Albert
185. Hunslet Crown
188. North Midland
202. Belinda Street
205. Belle Vue
212. Gilston's
216. Upper Carr Place

SHEET NUMBER 16



GLASS WORKS

CHAPTER 14

CHEMICAL MANUFACTURE

The chemical industry in Leeds is still of considerable stature. Basically it derives from the needs of the woollen industry for dyestuffs and of the glass making industry in the early nineteenth century. Most of the dyes for wool were organic; woad, supplanted by indigo, madder, saffron and a wide variety of tropical dyewoods such as logwood, camwood, brasil wood (after which the country was named), myrobolan, fustic, etc. These woods were prepared by 'chipping' for woollen-dyeing and 'rasping' for worsted-dyeing. Specialist firms of dyeware grinders developed to meet the needs of this sector of the industry, firms like Bucktrouts on Goodman Street and Bulmer, Crouchley & Co. Oakwood Chemical Works, on the site of Marshall's second flax mill on Water Lane. The name of the latter indicates the breadth of the concept of the chemical industry, and Bucktrouts were also seed crushers which indicates the oil merchants' involvement with chemicals through soap-making.

Apart from the 'straight' organic dyestuffs there were others like Cudbear made by treating dried lichens with ammonia. This is reflected in the number of 'Cudbear Manufacturers' listed in the directories and the number of 'Cudbear Houses' shown on the early nineteenth century maps. Copperas (Iron II Sulphate) was used with tannin extracts to provide a fast black dye and there were several 'Copperas Works' also shown on these maps.

The dye trade needed other chemicals: alum and Epsom salts were used as mordants to fix the dyes in the early part of the century and after 1840 Bichromate of Potash (Potassium Dichromate) was also used.[1] In addition Sulphuric acid, Hydrochloric acid, soda, chloride of lime and Sulphur were in demand for bleaching. At the beginning of the nineteenth century the main demand for chemicals was for Sulphuric acid, soda (Sodium Carbonate), copperas (Iron II Sulphate), Epsom salts (Magnesium Sulphate) and alum. Alum was made in the North Riding from the alum shales found near Whitby. Peter Gilston, the Glasgow-born glass-maker who began his career at Blackith's Chemical Works, was the son of the manager of the Whitby Alum Works,[2] illustrated by D. Walker in his Yorkshire Costumes.

Sulphuric Acid

The earliest references to chemical manufacture are in the Hunslet Rate Book 1791[3] in which J. Bower & Co. were assessed £10 for a 'still house' and T. Fenton & Co. £20 for a 'distill house'. These were Sulphuric acid works. Bower was on Jack Lane (192) and Fenton on Woodhouse Hill (216). The cost of transporting a corrosive liquid like Sulphuric acid was so high that it was uneconomic to move it more than fifty miles. The method of production in the distill houses is not clear but the small size of the premises

1. Chas. Kober, Leeds, British Patent 8415 of 1840.
2. LE 14.6.1884 'Local Celebrities'.
3. Leeds City Archives LO/HU/4 and RE 125064 (1791)

suggests that it was most likely to have been Ward & White's system patented in 1749.[1] Large glass globes were suspended with the neck horizontal and a gallon of hot water was poured in. A pottery ladle, with a stopper, was filled with Sulphur and saltpetre, ignited and placed in the glass globe. The fumes filled the vessel and dissolved in the hot water. After several charges had been burnt the liquid would be about 50% acid and it was removed and the water boiled off before distillation to yield 'Brown Oil of Vitriol'; this produced acid at about 4d/lb. In 1746 Dr. Roebuck of Birmingham introduced the 'Lead Chamber process' with lead lined chambers, initially of six feet cubed. Soon these were built on a larger scale and it may be assumed that they were in use in Leeds in the early years of the nineteenth century. The 'alembics' made at Bower's glassworks were used for distilling the chamber acid into the stronger Oil of Vitriol.

It has been stated that in 1820 there were 24 vitriol makers in England producing a total of 3000 tons of acid annually.[2] The only Leeds firm mentioned was Bower & Son, who by then leased the Fenton distill house as well as their own works on Jack Lane. By 1823 there were two more vitriol manufacturers in Hunslet. John Jubb and Thomas Scarth, both with small works on Woodhouse Hill near to Fentons. Jubb leased his works from Fenton, Scarth, a Leeds woollen merchant and

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1. British Patent 644 of 1749
2. J. Mactear, Proceedings, Glasgow Phil. Soc. xiii (188) p 409

dyer, leased his from W. Bilton. As well as making Sulphuric acid Jubb made 'aqua fortis' (Nitric acid) by the distillation of a mixture of saltpetre and Sulphuric acid. By 1826 there were 8 vitriol works in Leeds, half of them in Hunslet. This number increased to a maximum in 1853 and then declined so that by 1890 there were only 5 Sulphuric acid makers still in business.[1] Bower's works passed into other hands and closed down soon after 1860. Jubbs became F. Blackith in the 1850s and went out of use in 1870. Jubb seems to have been on the fringe of the industry still, since he became a lead ash maker and later took over part of the Bower Chemical Works where, as the Vulcan Foundry, the Jubbs became specialists in type metals. The smaller vitriol houses went out of production by 1840. They were unable to develop in size to remain competitive with the major producers with large investments of capital to modernise production methods. A major use of the acid was for making soda and bleach. Large plants were built at St. Rollox, Glasgow, Liverpool, St. Helens and on the Tyne. In 1838 Muspratt of Liverpool and John Tennant of Glasgow bought a Sicilian sulphur mine to ensure their supplies of the essential raw material. There was a sharp reaction by the King of Naples and an export duty was put on Sulphur, £4 per ton.[2] Gun-boat diplomacy followed but this only resulted in the granting of an export monopoly to Taix et Cie. of Marseille. This led to a doubling of the price of sulphur which did not help

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1. W.G.Rimmer, Leeds Journal xxiv (1958) p.5 et seq.
2. LM 22.12.1839.

small producers like those in Hunslet to keep in business. Intensive work was carried out to modify the furnaces so that Iron Pyrites could be used instead of Sulphur and the monopoly was effectively broken by 1842, but by then the smaller works had closed down. Copper Pyrites was used as a source material which yielded Sulphuric acid and copper also;[1] this process was adopted by Nicholsons at the Church Street works. In order to conserve supplies of saltpetre two further developments were introduced. Gay-Lussac's tower[2] recovered the Nitrous oxides, which were returned to the system in the Glover tower[3] which was placed between the pyrites burners and the lead chambers. This led to a saving of some 4% in nitre, such towers were in general use by 1870 and smaller, unmodified plants went out of use.

Soda

Most of the chemical works were described as being worked by 'manufacturing chemists' and Bower, like others, produced Copperas, Epsom salts and soda. Soda was an essential material for hard soap and soda-lime/Crown, glass. The major source of supply was Spanish 'barilla' (12-20% Sodium Carbonate) or kelp (5-8% Sodium Carbonate). Since the Spanish were continually raising the price of barilla, efforts were always being made to discover alternative sources of

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1. Tharsis Sulphur & Copper Co. 1866
2. Gay-Lussac, St. Gobain Chemical Works, 1827.
3. John Glover, Felling Chemical Co. 1859.

soda. In 1789 Nicholas Le Blanc devised a process which was used for most of the next hundred years. Salt was heated with Sulphuric acid and this produced Hydrogen Chloride gas and saltcake (Sodium Sulphate). The saltcake was burnt with a mixture of lime and coal to produce 'black ash' a crude mixture of Sodium Carbonate and Calcium Sulphide. The Le Blanc process was first used in England at Walton-on-Tyne in 1814 and then at St. Rollox in 1818, but the high price of salt prevented its widespread adoption. This took place after 1825 when the Excise duty was removed and the price of salt fell. Bower made soda for the glass works possibly from 1810[1] and until 1825 it was almost certainly made from kelp ash.

Copperas and Epsom Salts

Copperas and Epsom salts were linked chemicals. There were at least three copperas works in Hunslet by 1820. Bower began this side of his trade in 1814 and leased another works on Hunslet Carr which became S. Warburtons about 1836. Robert Carr had a works from 1823 until 1850.[2]

Copperas was produced by leaving iron pyrites in heaps to weather for up to five years. Fresh material was added to the beds and the liquor drained into a tank in the works. Weathering oxidised the Iron II Sulphide into Iron II

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1. W.G. Rimmer, op. cit.
2. Hunslet Rate Book 1823.

Sulphate. It was crystallised out by evaporating the liquor and collecting the green crystals on twigs. Copperas was used for the only true black dye before synthetics became available: woollen cloth was boiled with a tannin extract (usually from Alleppo galls) and then soaked in copperas solution. It was greatly in demand for uniform cloths, particularly railway liveries.

Epsom salts were made by heating copperas fiercely to yield strong Sulphuric acid which was reacted with Magnesian limestone to give Epsom salts (Magnesium Sulphate). The residue from the copperas was Iron III Oxide, Venetian Red, a paint pigment and a starting point for the manufacture of Prussian Blue. All this extended the links between chemical manufacturers and dyers. As a maker of vitriol Bower had Sulphuric Acid available for Epsom salt making but it was normally made with copperas as the starting point because of the residue produced. Mangesian limestone was no problem in Leeds since it outcrops roughly on the line of the Great North Road from near Pontefract to Wetherby.

Cudbear

The trio of chemicals in demand and made in Hunslet in the first half of the nineteenth century was vitriol, copperas and cudbear. The cudbear makers were the forerunners of the present chemical industry. The first cudbear works was John Marshall's. He came to Leeds from Norwich in

1820[1] and set up the Providence Works on the site of C.W. & F. Brown's cloth finishing mill (94). His main products included Cudbear and Archil, so that, when the streets off Crown Point Road were made up in 1862 they included Cudbear Street at the front and Orchella Place at the side of the works.

Cudbear, a corruption of Cuthbert, was discovered by the brothers George and Cuthbert Gordon of Glasgow in 1758. Lichens were macerated with an ammonical liquor and then treated with lime to produce a dye which, like Litmus, could range from pink to blue according to the mordant used. Originally the ammonia was 'stale' (urine) but by the time Marshall set up his business in Leeds the gas works was providing a more reliable source. Archil was very similar to cudbear in that it, too, was made from a sea-shore lichen treated in the same way. This lichen was known to the Greeks and Romans as <u>fucus</u>.[2] Other cudbear makers included John Carr, who had a cudbear house as well as a corn mill, on Hunslet Carr in 1823. The Carr family were possibly the most active in the field of chemical manufacture: apart from a copperas works already noted they started the Low Holland Chemical Works on Low Road (206) in 1826 and the Hunslet Chemical Works on Chapel Street by 1839. At the same time Samuel & Joshua Carr took over Storey & Walker's chemical works on Dewsbury Road which had been opened five

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1. Baines <u>Directory</u> 1834
2. <u>Fucus</u> i.e. seaweed: but the seaweeds of the Fucus family are not related, being brown rather than red algae.

years previously (121). On the death of John Carr the Low Holland works was taken over by Bowers and the Hunslet works by John Carr Nicholson. This latter continued to flourish until after 1914 and eventually became part of the Laporte group, which was started in Castleford about 1860 making bleaching powder. The Low Holland works became a ropeworks in the 1890s. The other Carrs' Highfield works remained in the family until 1889 when it became the Canning Street Oil Works. Marshall continued at the Providence Works and incorporated Clemons & Carbet in 1900 and then in 1910 became part of the Yorkshire Dyeware group. This amalgamation brought in Bedford & Wood of the Hunslet Chemical Works, Chadwick Street. James Bedford started his works about 1854 and the family made important contributions to the chemical industry. James gave a paper on 'Colorific Lichens' to the British Association's Leeds Meeting[1] and his son, C. S. Bedford, developed a process for oxidising linseed oil for linoleum-making in 1886 and produced 'Patent Fustin' the following year.[2]

Charcoal Products

In the late 1830s Bower's copperas house became S. Warburton's works. Warburton was a woollen spinner[3] and the works included a small charcoal mill.[4] By 1866 Warburtons had another

1. British Association Report (1858) p.45
2. Society of the Chemical Industry, Leeds Meeting, Report (1957) p.25
3. Parsons CD (1830)
4. Rivers Commission (1871) p.110 'We produce pyroligneous acid and charcoal'

chemical works at Worksop, Notts. In 1900 it became H. F. Warburton, charcoal manufacturers & chemists, with offices on Balm Road.

Charcoal was an important chemical raw material. It was produced by the destructive distillation of wood in iron retorts to yield pyroligneous acid, an impure Acetic acid, which was used in the manufacture of acetate mordants for dyeing.

Discovered in 1796, from 1834 until 1901 Carbon Disulphide was manufactured by passing the fumes from burning Sulphur over red hot charcoal in a cast iron vessel. It was used as a solvent for extracting oils for soap making.

The lay-out of a chemical works later in the century is illustrated by a valuation made in 1897[1] for Hirst, Brooke & Hirst of their Airedale Chemical Works off South Accommodation Road (161). There were 2 soda houses, a still house, a retort house and, for charcoal, there was a store shed, an open building containing charcoal grinders and a charcoal mill. There was also a colour house. The engine power was not stated but the boiler chimney was 132 ft. high and 9 ft. square at the base.

Whereas the Bowers had used the Le Blanc process for making soda for the Crown Glass Works, in 1872 the Solvay process

1. Leeds City Archives. Hepper Valuation Book 186 p.141.

was introduced into England by Louis Mond at Northwich.[1] The Solvay process used brine saturated with ammonia and then Carbon Dioxide. Initially this formed Ammonium Bicarbonate which reacted with the Sodium Chloride to precipitate Sodium Bicarbonate. By adding lime to the heated solution remaining, ammonia was given off for further use.

The chemical works were not great employers of labour: the Airedale Works employed 14 men, the Victoria Chemical Works, which was predominantly a sawmill, employed 31 and three other Hunslet firms, Tunstalls, Jubb and Warburtons together employed 27.[2]

Coal-tar Chemicals

As the importance of textile finishing declined in Leeds after 1870 different types of chemical works were built to cater for other needs. One of these was on Holmes Street, behind the gas works. The use of ammonia from the gas works has already been mentioned in connection with cudbear manufacture and for the Solvay process above, but a whole range of coal tar derivatives were being developed. Dyson, Brotherton & Co. were originally a Wakefield firm making Sulphate of Ammonia. They bought Illingworth's Holme Street works about 1889 and built a new works on the site in

1. L. Mond, J. Soc. Chem. Ind. (1931) p.143.
2. Rivers Commission (1867) pp 201-204.

1897.[1] In time Dyson, Brotherton & Co. became Brotherton & Co. with imposing headquarters on Westgate, now the Police Headquarters. Their products included Ammonium Carbonate, Ammonia liquor, bleaches and a host of coal tar derivatives, Benzol, Toluol, Xylol, Naphtha, Carbolic acid, Creosols, Anthracene, tar, pitch, fuel oils and disinfectants. Their slogan "The Brotherton Bridge links Coal Tar and Dyes"[2] indicates clearly the new pattern of the chemical industry in Leeds.

Nicholson made copper and Sulphuric acid from copper pyrites as well as ammonia. The Yorkshire Dyeware & Chemical Co. represented the dyestuff makers facing up to German competition and the growing importance of chemicals in the making of leather. Their range of products covered both wool dyeing extracts and tanning extracts. Most of these were old-established dyes, archil and cudbear, logwood and camwood, but there were new dyes like Airedale Yellow. Although Perkins discovered coal-tar dyes in 1856 the Germans had captured the synthetic dyestuff market by the turn of the century and so perhaps it was natural that tanning chemicals had become increasingly important in Leeds, a major centre of leather production. The tanning extracts included many of the dyewoods, e.g. myrobolan and sumac, but also chromates were used for the newer tanning methods developed

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1. Leeds City Archives, Hepper Valuation Book 251 p.223.
2. LCYB (1920) p.82

in the 1860s. These technical changes are dealt with under Tanneries (chapter 18).

The chemical industry in South Leeds restricted itself mainly to those products needed for textiles, glass and leather manufacture. They were in Leeds because of its importance as a centre for the manufacture of these goods. The importance of Sulphuric acid making continued for over a century. Leeds D.O.V. (Double Oil of Vitriol) had a high reputation but latterly Nicholson was the only major local producer and the copper pyrites used provided copper from the spent ore. Arising from this Nicholsons also developed as copper smelters using the higher copper ores. Apart from meeting local needs the coal-tar distillers had important continental markets.[1] The need to locate Sulphuric acid making near the users has already been noted and Hunslet in particular was well placed for coal supplies and for importing raw material by the river and canals and then the railway. It was not by chance that Bower's chemical works was so close to his glass works which used his soda. Apart from the use of coal as a fuel it was a base for gas making and the subsequent coal-tar by-products and ammonical liquors. What better site could Brothertons have chosen than next to the Meadow Lane gas works?

Before the passing of the Alkali Works Act in 1862[2] the

1. LCYB (1910) p.73
2. 26.27 Vic. cap. 124

Le Blanc process of making soda released Hydrochloric acid gas (Hydrogen Chloride) into the air. To disperse these noxious fumes chemical works built tall chimneys. Similarly, the manufacture of vitriol produced irritant fumes and so the early vitriol works were built on the edge of the township of Hunslet, or well away from it up on Woodhouse Hill. Cudbear manufacture was less noisome and so could be carried on close to the staithes for ease of delivery of dried lichen and lime, the nearest supply of lime being at Fairburn and Brotherton, both of which were adjacent to the Aire & Calder Navigation.

The Germans dominated the synthetic dyestuff market and so dyestuff makers such as Marshall and Bedford turned to the production of liquors or extracts from the dyewoods instead of the direct use of chippings or raspings. Considerable developments took place in the use of extracts for textile and leather dyeing after 1885:

> "The use of extracts had become general ... because it avoided the discharge of spent dyewoods into the streams".[1]

Spent dyewoods were notorious pollutants.[2] Because of their greater solubility extracts made for more consistent dyeing. Tannin extracts could be sold on their tannin content as shown by analysis. The dyes were not new but merely presented

1. LCYB (1910) p.74
2. Rivers Commission (1867) Vol. I p. xxiii

in a more convenient form for the dyer and enabled a superior standard of dyeing to be achieved.

Apart from the bona-fide manufacturing chemists already mentioned there were a number of other concerns involved in the trade. They were variously listed as 'drysalters, druggists, wholesale or manufacturing chemists'. Few were truly manufacturers of chemicals but were blenders, mixers and mainly wholesalers of chemicals, drugs and dyestuffs. The site of Marshall's second mill (27) became the Oakwood Chemical Works of Bulmer, Crouchley & Co., 'indigo merchants'. Marshall's fireproof-warehouse, built in 1806 (28) became Barracloughs' Mill. Barraclough & Co. were wholesale druggists, chemists and drysalters. Next door was the Daisy Co. Ltd., makers of headache powders. Part of the maltkiln site at Mill Green (6) became in 1889 the works of Preston & Cooper, manufacturing chemists; by the turn of the century they were trading as 'The Sydenham Fruit Preserving Co.' but by 1914 were once more 'chemists', this time as W. Preston, drysalters.[1] At the Meadow Lane end of Beeston Road there was a chemical works which was started in the 1860s by Stewart and Brooksbank, manufacturing chemists, this became W. Clark's and in 1878 it was Laycock & Waterhouse. This firm became A. Laycock & Co. and moved to the Stansfield Chemical Works on Kirkstall Road in 1880.

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1. LCD 15436

Table 14.1

Examples of the use of chemicals & dyestuffs
(from Rivers Commission (1871) Vol.III: Evidence)

A.	Dye 150 tons	Use 12 tons logwood
B.	Make 160,000lbs of cloth	Use 100,000lbs dyewares
C.	Bleach 800-1,000 tons	Use bleaching powder 90 tons, soda ash 80 tons, vitriol 20 tons
D.	Dyers 300,000 pieces dyed 40,000 pieces stoved	Use aquafortis 37,000lbs, double aquafortis 25,000lbs, alum 95,000lbs, ammonia 181,000lbs, vitriol 125,000lbs, prussiate 7,000lbs, soda ash 21,000lbs, spirits of salts 68,000lbs, salt cake 160,000lbs, sugar of lead 1,200lbs, picric acid 532lbs, oxalic acid 262lbs, nitrate of soda 13,776lbs.
E.	Dyers	
	6,500 stones of wool	
	300,000yds of cloth	21,200lbs indigo, 6 tons alkali
	200,000lbs of cloth	20 tons indigo, cochineal and lac
F.	Tanners	
	300 tons leather	lime 50 tons
G.	Tanners	
	25½ tons leather	lime 9½ tons
H.	Tanners	
	88 tons leather	lime 12 tons
I.	Dyers	
	3,000 tons cloth	300,000lbs dyewares: bichromate of potash, sulphate of iron, sulphate of copper, nitrate of iron, sulphuric acid, pyroligneous acid
J.	Tanners	
	350 tons leather	lime 78 tons
K.	Linen mfg.	soda ash 50 tons
L.	Mfg. Chemist	Use and produce: salt 100 tons, indigo 20 tons, vitriol 30 tons, copperas 30 tons, ammonia 40 tons, lime 60 tons Produce: refined indigo 10,000lbs, extract of indigo 150 tons, cudbear 120tons orchil liquor 100 tons, soap 100tons

Table 14.2

Chemical Manufacture in the mid-nineteenth century

COPPERAS Iron Pyrites FeS_2

atmospheric oxidation & hydrolosis

Copperas $FeSO_4$

Tannin = heated - 29-35% oil of vitriol H_2SO_4

black dye ink

Venetian red (red iron oxide)

prussiate of potash

Prussian blue

alum shales + magnesian limestone +

alum

Epsom salts $MgSO_4$

(mordants)

ALKALI Sulphur + Nitre + Air + Steam

Salt + Sulphuric acid $NaCl+H_2SO_4-HCl+NaHSO_4$

HCl

Limestone + Coal + Saltcake(Sodium sulphate Na_2SO_4)

Black ash

Soda

Alkali waste

WOOD

turpentine — resin — lampblack

potash

tan bark

tar — WOOD — charcoal — gunpowder

oxalic acid

pyroligneous acid

wood spirit acetone vinegar acetate mordants

ANIMAL PRODUCTS

Livestock — lanolin

tallow — soap

candles

blood offal

bones — bone ash

Prussian blue

hides

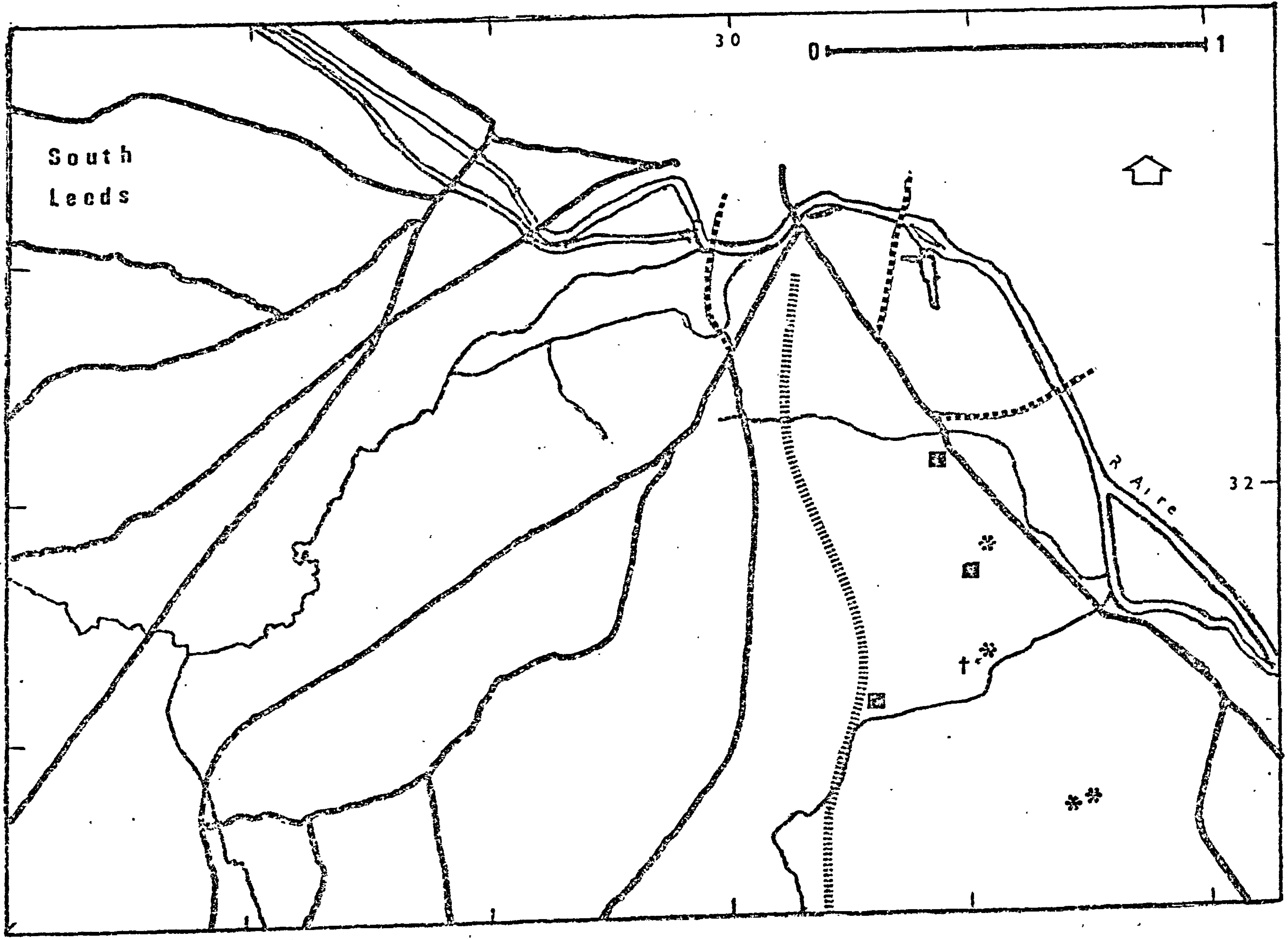
ammonia

bone black gelatin glue

tan bark

manure

superphosphate



* Vitriol Works
⊠ Copperas Works
† Cudbear Works

CHEMICAL WORKS :: 1823
Based on Hunslet Rate Book

CHAPTER 15

PAPER MAKING

> "RAGS make paper, PAPER makes money, MONEY makes banks, BANKS make loans, LOANS make beggars, BEGGARS make rags".
>
> (Anon.)

The making of paper as a substitute for parchment was established in Italy by the late thirteenth century and spread to England much later, John Tate had a paper mill in Hertford by 1494 and supplied paper to Caxton and Wynkin de Worde: this is the first recorded paper mill in the country and was in a converted corn mill. By the eighteenth century France produced the finest paper and it was at the end of the century when developments began there. Paper is made from cellulose fibres. The two main processes are firstly the separation of the fibres mechanically and freeing them from non-cellulose matter and, secondly, the sieving of the pulped fibres from the water as a thin sheet on a wire mesh. In the eighteenth century linen, hemp or cotton rags were the main source of cellulose, in the mid-nineteenth century esparto grass came into use, and then the now universal wood-pulp. The rags were picked over, soaked for three to four weeks with lime, cut up and then beaten to a pulp in a series of hammer mills.

The main requirements for paper making were ample supplies of rags, enormous quantities of water for the making of the pulp and for either water power or the boilers, fuel for heating the vats, the size boiler, the sizing kettle and the engine when used. In addition the labour force required skilled paper-makers and couchers and plenty of very cheap labour for rag picking and cutting. The earliest record of paper-making in Hunslet is from 1788[1] when Rogers had a steam engine in his paper mill. The site is not certain and it was not listed in the Rate Book and map of 1791[2] but in 1823 an empty paper mill was noted[3] on Woodhouse Hill close to the vitriol works, a maltkiln and, significantly, two lime houses. The same Rate Book included John Hirst as having a paper mill 'unfinished' (208). This was on the site of one of Coupland's cotton mills on Low Road, which was described in the bankruptcy sale as a scribbling and fulling mill. Hirst was first recorded in Water Lane in 1822 (Baines). The demise of Rogers' business may be related to the introduction of the power driven endless web onto which the pulp was poured by a small bucket wheel. This effectively ended the making of paper by hand.[4] The use of Fourdriner's machine began to spread so that by 1817 there were thirteen machines in use by other paper makers[5] in England. Leeds did not develop as a major paper making centre but Hirst developed a substantial business in the manufacture of brown paper and wallpapers. The early

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1. J. Goodchild collection. Hunslet Rate Book 1788.
2. Leeds City Archives LO/HU/4
3. Leeds City Archives LO/HU/5
4. Nicholas-Louis Robert, Frendh patent 1798, introduced to England by Henry & Sealy Fourdrinier in 1802.
5. W.Branch Johnson, Industrial Archaeology of Hertfordshire (1970)p.58

years of his mill were not without problems. Whilst still in the building stage a gale damaged the chimney[1] and a little later one of his women workers was injured 'by an unfenced machine'.[2] By 1824 there were two paper mills in Leeds. North of the river was J. Foster with a 10 h.p. engine and in Hunslet was Hirst with a 34 h.p. Balcarras engine, the only one by this Lancashire maker recorded by Lindley. Hirst's paper was coarser than the 'thin paper' used for stationery and printing, but this permitted the use of waste paper and esparto grass, as well as rags, for pulping. Wallpapers became popular in the early nineteenth century as substitutes for wall hangings and panelling. The finest early wallpapers were imported, often from China, to suit the current fashion in decor. John Hirst was succeeded by his widow Delia.[3] The business became Hastings & Mellor and was bought by T. Bracken for £2000 in 1871. In 1867 the paper mill employed 20 workers and 120 h.p. Mellor obtained his water supplies from the river and from his own wells.

> "I use yearly rags, 1300 tons; esparto, 20 tons; lime, 120 tons; soda ash, 25 tons; bleaching powder, 50 tons; alum, 80 tons; and vitriol, 50 tons. The whole of the waste liquid produced by my mills flows directly into the river. I do not recover the soda from the waste esparto liquor. I manufacture yearly 950 tons of packing and wrapping paper".[4]

1. Mayhall Annals 3.12.1823
2. LM 17.10.1829
3. Baines & Newsome D (1839)
4. Rivers Commission (1871) p.110

White (1875) still listed Mellor as the owner and Waddington was also a partner in the business. This is interesting because cardboard box making, with colour printed designs, became important towards the end of the century, with John Waddingtons as one of the leaders of the trade. Bracken & Co. continued to operate the mill until after 1914.

In the meantime John Neill had bought Hindes & Dereham's worsted mill on Dock Street in 1825.[1] and turned it into a wallpaper and packing paper mill, which lasted until 1890. Neill employed 28 men and 80 h.p.

> "Use yearly, rags 600 tons, soda ash 5 tons, bleaching powder 24 tons, alum 30 tons, lime 20 tons, antichlor* 5 cwts. Make yearly, brown paper, 200 tons and grocer's paper, 200 tons."[2]

There are several comments to be made on the small and specialised paper making trade of Hunslet. The demand for cheap wallpaper was stimulated by the expansion of house building in the West Riding generally in the second part of the nineteenth century. The wrapping paper business arose from the demands of the cloth finishers, who used paper interleaves in the hot pressing of cloth as well as for packing the finished pieces. The introduction of paper

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1. LM 4.1.1825 "For sale, former worsted mill".
2. Rivers Commission (1871) p.105
   * Antichlor = Calcium Thiosulphate, a by-product of the Le Blanc process of soda making.

bag making in the middle of the century gave a further stimulus to the brown paper trade. Originally the bags were made by hand but the process was mechanised by 1880. By 1910 the numbers employed in this trade had risen to 800, a tripling in workers in thirty years. At the same time each machine used produced ten times as many bags as a handworker had made.[1] On the evidence of Neill and Mellor[2] it needed 5 cwts. of chemicals, 16 cwts. of coal and 10,000 gallons of water to make a ton of paper.

South Leeds had excellent supplies of water from the River Aire, which provided the enormous quantities needed, most of which was returned, albeit heavily polluted. In addition there were chemical works, flax works and, with the rise of the shoddy trade, rag warehouses which sorted the rags required for the shoddy makers as well as the paper makers. There were good supplies of cheap coal and a ready market for the finished products.

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1. <u>LCYB</u> (1910) p.77
2. <u>Rivers Commission</u> (1871) p.105 & p.110

CHAPTER 16

PRINTING

> "The printing trade in Leeds is entitled to rank as one of the leading industries of the city. Its development during the last half century has been most remarkable and it can now be claimed that it has gained for the city the distinction of being the second greatest centre of the trade".[1]

Printing is essentially an urban trade, introduced into England in the fifteenth century by William Caxton. Craftsman printers established themselves in most towns and Leeds was no exception.

The '<u>Leeds Mercury</u>' was started in 1718 and the '<u>Leeds Intelligencer</u>' in 1754 and there were other printers who carried out general jobbing work with hand-set type on manual powered presses.

> "Fifty years ago the Leeds printers could almost be numbered on the ten fingers of the hands, now there are about two hundred printing works in the city".[2]

Amongst the reasons for the expansion of the trade were the

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1. <u>LCYB</u> (1910) p.75
2. <u>ibid</u>.

mechanisation of the printing press on the one hand and the increasing demand for consumer goods in the latter part of the nineteenth century. Between 1870 and 1880 real income per capita in the U.K. rose by 10%: between 1880 and 1890 by 40%, and in the next decade by a further 12%.[1] The age of mass consumption had arrived and with it a need for catalogues, posters and packaging. Leeds printers specialised in this type of work, colour lithography of the highest quality for posters, books, and later, cartons and tins. It is possible that these specialities developed in Leeds as a spin-off from the rise of the engineering industry, particularly in Hunslet, but for printing presses Otley in the 1860s had given rise to four firms specialising in power driven presses of the horizontal 'Wharfedale' type.

Within the terms of reference of this survey only powered presses are considered and this reduces the number of printers to a few relatively large firms. Most of these were more than letterpress printers: they made use of the application of the power driven press to 'chromo-lithography', introduced in 1852 and the more economical grained-zinc litho plates which replaced the stones in the 1870s.[2] The first

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1. Based on A.L.Bowley, Wages and Income since 1860 (1937)pp6,30
2. Lithography was a relatively new technique developed at the end of the eighteenth century in Prague. With heavy slabs of limestone the application of power to litho-printing was most welcome and the replacement of the stone slabs by zinc plates further reduced the effort and power required and so higher speeds became possible.

of these major printing concerns was Alf Cookes at Crown Point (134). Cooke began as a newsagent, stationer and printer at 68 Hunslet Road in 1866 and built his first printing works opposite the Black Bull Inn in 1872. Later in the year there was a fire and the present works were built to hold 18 litho presses powered by a 30 h.p. engine. By each press there was a bay in the outer wall of the building to provide a paper store.[1] After another fire in 1894 the works were extended in the original style, said to be derived from the design of the Brighton Aquarium. Power and light were supplied by two generators driven by engines totalling 400 h.p. This represents over a tenfold increase in power used and shows that each press now had its own electric motor and was not driven by belting from a power shaft system.[2]

The kind of work in which Cooke specialised was coloured almanacs, which were widely used for advertising purposes. He was a real character, a paternalistic employer and a dynamic personality. When the works was on fire in 1894 he was away at Scarborough so he ordered a special train to bring him back to Leeds as soon as possible. He set up fish stalls on a vacant lot by the works to sell fish cheaply to his employees and others, but when his manager and chief clerk asked for a share of the profits they were dismissed immediately. The manager, Bill Pickersgill, founded

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1. LE 29.3.1884,'Peeps into Leeds Industry'(Crown Point Printing Works).
2. A.J.Turner,Crown Point Story, 1866-1966(1966) Leeds

Chorley & Pickersgill, 'The Electric Press' Cookridge Street, and Charlie Lightowler, the chief clerk, set up on his own in a former flax mill on Joseph Street (189) as a specialist litho printer on tin boxes. Alf Cooke died in 1902 and his sons set up a limited private company. In 1912 single and two-colour offset presses were installed. Friedrich Koenig had adapted the hand printing press for steam power in 1810 and introduced the cylinder press in the following year. Almost a century later the German printing machine makers, Koenig und Bauer supplied offset litho machines to Cookes. In offset litho, the original positive plate, mounted on a cylinder, is inked and in rotating transfers the image to a second cylinder as a negative. As this cylinder rotates it transfers the ink to the paper as a positive image. If the machine is fitted with two sets of cylinders the sheet of paper may be printed with three colours in one run (e.g. blue, yellow and blue + yellow = green). With these presses and large litho presses capable of printing quality colour work up to 60" x 40" the firm developed an extensive trade in calendars, children's picture books, chocolate boxes and biscuit tins. These early colour litho tinplate containers are now much sought after by collectors.

The next big printing firm to start business was E.J.Arnold & Son, who came to Leeds from Devon in 1870 and built their Butterly Street Printing Works (135) on the site of a malthouse round about 1900.[1] They specialised in stationery,

1. British Printer vol.77 p.84 1963 "Arnolds of Leeds - 100 years of school printing"

ruled exercise books and then textbooks and from this extended to provide a very wide range of 'scholastic requirements' such as pens, ink, rulers, slates, blackboards & easels etc. The move from Barnstaple to Leeds in 1870 was a wise one since the Forster Education Act of that year led to the election of school boards who began to build elementary schools in every town in the country. In Leeds alone places were provided for 15,000 pupils by 1890, so there was opened up a new and expanding market which Arnolds still continue to serve.

After 1900 the number of 'power' printers in Hunslet and Holbeck increased. Jowett & Sowry began as stationers in Albion Street, a shop they still occupy, but in 1910 they opened the 'Electric Printing Works' in part of the Balm Road flax mill (214) to produce letterpress and colour printing work, mainly catalogues and calendars. In Water Lane, Knight & Foster built a printing works (25) and are still in business as manufacturing stationers.[1] Culston & Sprotson set up business the following year in a corn mill on Ingram Street (43) but moved their offices over the river to Saville Street in 1910. Two other general printers to set up at this time were H. Dawson, in Hope Mills, Water Lane (41) and Nutt & Co. in Potterdale Mills (124). Both continued in business for many years but certainly Nutt & Co. now at Armley, have not developed to the size or importance of the businesses already noted.

1. Kellys D (1906)

The firm of John Waddington began in 1906 at 38 Great Wilson Street (59) as jobbing printers, but was soon heavily in debt. The manager took over and salvaged the business. Because of personal connections with the theatre Waddingtons obtained the contract to print programmes and posters for the 'Grand Theatre' in Leeds. This was soon extended to other theatres and in response to the technical challenge playing cards were printed successfully.

Like Cookes, Waddingtons have since developed as colour printers specialising in packaging and games like 'Monopoly'.[1]

Two other specialist printers deserve mention since they were started in 1890, Arnott & Halliday, in the old Marshall Mill (29) and an off-shoot, Bean & Halliday, ten years later in Holbeck Mills (15). They printed 'photographic mounts, Christmas cards and calendars'.[2] The first firm became Arnott & Co. and the second now trades as C.H. Halliday & Co.

Even the smaller firms seemed to have been inclined to colour work. One such was G. O. Batty,('The People's Colour Printer') who trained with another Cooke and set up on his own in 1883 at 27 Meadow Road.[3]

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1. Information supplied by employees of John Waddington
2. <u>LCYB</u> (1920) p.178
3. <u>Century's Progress</u> (1893)

As an industry printing south of the river began in the 1860s, with Alf Cooke & Son and numbered a dozen large firms by 1910 with almost as many again jobbing printers. Cooke built on the grand scale on a vacant site but the others took over existing premises that had outlasted their original use, parts of redundant mills, flax mills chiefly (Dawson, Lightowler, Arnott, Jowett & Sowry); woollen mills (Nutt & Co.) (Halliday, Waddington) and a flour mill (Culross & Sprotson). All offered plenty of floor space on the lowest floor level, since the weight of printing presses demand high load-bearing floors. Ancillary machinery for collating, binding, stitching and box-making could be operated on upper floors since the loading was smaller. All these printers specialised in lithography and used electric power. The kind of work they produced included catalogues, calendars, printed tins and boxes, items increasingly in demand in a society where advertising and packaging were helping to stimulate mass consumption of branded goods.

Reasons for the location of the trade in south Leeds are difficult to ascertain. Cooke found a vacant site due to the re-development of the Midland Railway station on Hunslet Lane and Arnold took over a malting standing in its own grounds. The others moved into low rent accommodation in the numerous surplus mill premises. Printing was a well-paid male prerogative but there were many less skilled jobs for women and girls as machine minders, in binding and collating etc. so that printing offered employment to the women of engineering families in the area. Apart from this, whilst Otley was an important centre for the manufacture of printing presses, there were three printing machine makers, a printing ink maker and a printers' furnisher all established before 1900. In addition there was a firm of packaging machine makers which started in Dewsbury Road, but it is possible that this was in response to the needs of the existing printers for box making machinery. If a concern the size of Alf Cooke & Son encouraged the development of supporting industry, then the existence of these ancillary trades in turn encouraged other printers to set up their works in this part of Leeds.

CHAPTER 17

SOAP, OIL AND GREASE WORKS

> "Leeds is now one of the chief seats of household soap manufacture ... in connection with the local industry an oil-crushing mill is being put down in the neighbourhood".[1]

The most important soap works in Leeds was Joseph Watson's on Whitehall Road, across the river from Holbeck, and now part of the Eilda-Gibbs division of Unilever. The industry has a long history in the manufacture of textile soap for the woollen industry. Related to this was the recovery of wool-grease, the production of various oils for lubricating the wool during spinning and weaving, for mordants in dyeing wool and, later, as the engineering industry developed, the production of grease and lubricating oils for machinery of all types. Despite the introduction of coal-gas as an illuminant by Murdock about 1800 there continued a demand for lamp oils and tallow candles which were only slowly ousted by paraffin and paraffin wax candles in the latter half of the century.

When raw wool is washed, 'brown grease' is extracted from the washings. This can be worked up into brown cloth oil, lanolin, and pitch, by steam distillation. Woollen

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1. LCYB (1910) p.73

manufacturers commonly used up to a quarter of the final weight of the cloth in olive and rape oil for dressing their yarns before weaving. Olive oil and Gallipoli oil (rancid olive oil) were imported from the Mediterranean but rape (colza) oil was produced by local seed-crushers. Apart from its use as a wool lubricant, colza oil was widely used for lamps. The best lamp oil, used by the railway companies, was 'train oil' from whale blubber.[1] W. K. Westley used train oil to make gas for his flax mill on Low Road, Hunslet, since it gave a clearer light without sulphur fumes.[2]

Colza oil was obtained by crushing rape seed. Rape is a close relation of the turnip and is grown still for sheep feed, to plough in as green manure or for the oil seeds. The earliest oil mills used horse, wind or water power to turn edge rollers of stone around a central post set in a circular trough. Examples of this type of mill are still in use in the Middle East with ox, camel or donkeys providing the power.

Linseed oil was difficult to extract by roller crushers and so stamp mills were used for the first stage of oil extraction and the oily mass was packed in hemp sacks for pressing by means of great wedges. These were hammered

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1. In the first half of the century Whitby was still an important whaling port.
2. W. Brown, "Information Regarding Flax Spinning in Leeds" (1821) Copy Leeds City Library

in place by more stamp mills. The residual oil cakes found a good market amongst the many sheep and dairy farmers in the area.

One of the oldest established oil seed crushers in Leeds was J. & J. Armistead, who had their mill at Water Hall by 1798 (39).[1] Apart from seed crushing they were mustard manufacturers, mustard milling being between oil and corn milling in technical terms. By 1807[2] they were also brush makers. Business prospered, the mill was extended several times and these developments are illustrated in billheads of 1811 and 1842.[3] In 1824 the mill was powered by a 20 h.p. Murray engine. By 1853 Armisteads had added to their activities candle making.[4] The candles were tallow dips, made by the repeated dipping of wicks into molten tallow, or the more costly moulded tallow candles. Armisteads went out of business in 1887 and the works was taken over by James Grisdale & Son, formerly Dauber & Grisdale, oil & tallow merchants of 1 Dewsbury Road (61). With the introduction of paraffin wax Grisdales made 'Yorkshire' and 'Sun' brand wax candles as well as the ordinary 'dips'.[5] They were followed at

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1. Morris D (1798)
2. Wilson D (1807)
3. Leeds City Archives, A33d 8.12.1811 and 2.8.1842.
4. Whites D (1853) "No person residing out of the limits of the Head Office of Excise, who is not assessed ... to Poor Rate where he resides, can make candles."
   Nesbitt & Little op.cit. p 489
5. Century's Progress 1893 p.166. The profit on candles was ½d per gross - information supplied by Miss Grisdale.

Dewsbury Road by T. H. Newsome, oil & tallow merchants, and 'Newsome's Greaseworks' was identified as an oil extraction works on the 1908 O.S. map, but by that time it was mainly used as a warehouse, their main business being based on their Canning Street Oil Works (121).

Next in seniority in the Leeds oil trade, and still a prosperous firm, was the Joy family. The business was started by the brothers Edward & William Joy: their father, David Joy, had developed the extraction of colza and linseed oils in 1798. They opened their Crown Point Oil mill in 1807, moved to the larger Thwaite Mills downstream from Hunslet on the River Aire[1] and in 1840 the partnership was dissolved. William set up on Bowman Lane before moving to a larger mill at Hull. Edward bought a warehouse from George Goodman, a prominent woollen merchant, turned it into the 'Filtrate Oil Works' (75) and set up in business as E. Joy & Son. A valuation in 1889[2] shows that the works consisted of three blocks of buildings with stables etc. The upper storeys were stores for 480 tons of oil seeds, there were two cake warehouses, two oil-seed crushing mills, offices, oil store, boiler house and, rather curiously, a 40 h.p. Carret-Marshall horizontal engine worked at 80 h.p. Some

1. Leeds City Libraries LQC 725.4SM66 also Brit. Trans. Archives, York. Aire & Calder Navigation Co.Accounts 1823. AC 1.9

2. Leeds City Archives, Hepper Valuation Book 229,1899

of the original copper boiling kettles were still in use until recently.[1] The influence of David Joy's work is seen in the development of the business from producers of lamp oil and reclaimers of wool grease to specialist lubricant producers. One of their earliest customers was George Stephenson who used Joy's grease for his 'Rocket' locomotive.

Robson & Bucktrout, seed crushers, Larchfield Works (150) started business before 1863 (Jones) but in 1867 were returned as 'ware grinders'[2] and in 1871 produced 800 tons of dyewood valued at £4750.[3] The relationship between seed crushing and dyeware grinding is not clear except that 'Turkey red oil' was used as a mordant in wool dyeing. The best Turkey red oil was prepared from low grade castor oil reacted overnight with Sulphuric acid and then neutralised with either ammonia or soda. Similar products were made from colza, olive and cotton seed oils, and it is possible that the firm progressed from seed crushing to ware grinding via the preparation of Turkey red oil.

T. H. Newsome began his business in Tenter Lane in 1878 and moved to Canning Street (121) and Dewsbury Road in 1887. This warehouse was sold to a boot maker in 1910 but the

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1. Oral evidence of Joy workers, also A.O.Joy, '_Five generations of the name of Joy_' (Leeds 1948)
2. _Rivers Commission_ (1867) p.201
3. _ibid_. (1871) p.104

firm carried on in business at its Canning Street works. Many of these later oil dealers had no seed crushing interests. After 1870 this type of business became increasingly concentrated at the main ports where the various oil seeds were landed. The movement of William Joy in 1840 to Hull is an example of this development. Increasing use was being made of Carbon Disulphide and petroleum ether as extraction solvents and the Leeds firms that developed towards the end of the century were wool grease refiners and merchants. This change of emphasis in the trade can be seen in T. Batt & Co's list of products:

> "Stettin, Dantzig & Amsterdam Colza Oil, double refined cotton oil, fish oils, linseed oil, Gallipoli oil, Loco grease, Corfe grease, Shumac, Gambier, Best Tallow, etc."[1]

Most of the items on the list were imported and included tanning materials also. This firm began as Andrew Bros. on Armley Road in 1851, but as T. Batt & Co. built the Whitehall Grease Works (10) in 1892, and carried on trade until after 1920. Benjamin R. Vickers & Sons began business on Boar Lane[2] and took over part of the Airedale Chemical Works site (161) by 1889 for their oil and grease works. In 1906 they shared the site with Fox & Atkinson,

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1. Century's Progress (1893) p.166
2. White (1875)

oil cake manufacturers,[1] and by 1914 they were the sole users. Vickers still specialise in oils for spinning, leather dressing and soap making as well as a patent solvent to remove oil & grease stains. The stables, wool washing warehouse and leather warehouse of the Bowman Lane Dyeworks became the 'Clarence Oil Works' of D. W. McCarthy Ltd. in 1900. McCarthy seems to have been predominantly a merchant with a warehouse on the Aire & Calder Dock in Dock Street[2]. The site was next to Medley's Yard. Medley followed the Joy brothers at Crown Point Oil Mill immediately across Crown Point Bridge, and the yard was used for storage. Close to this was Simpson's Fold Mill, a flax mill which was shared by W. Lynd, oil manufacturer, from about 1848. By 1875 (White) W. E. Kenworthy had joined Lynd and the flax mill became Bowman Lane Oil Mills. Kenworthy was an oil extractor who began business in 1842 and moved to a bigger building in Fleece Lane in 1853. Lynd introduced soap making but it is most likely that this was industrial soap for scouring woollen cloth.

Soap was made by boiling together a fat and an alkali. Woolgrease and tallow were widely used. The best hard tallow went into candles and the soft waste was used for soap, as was train oil, fish oils and the third pressing of olive oil.[3] The alkali was potash for soft soap and

1. Kelly (1906)   2. White WR (1866)

3. "Hard soap is made of leys and tallow; and is most commonly boiled twice.
White soft soap is composed of leys and tallow.
Green soft soap is composed of leys, tallow and fish oil,
Ball soap of leys and fine oils,
Yellow soap of common resin boiled up with tallow"
A. Nesbit and W. Little op.cit p.469

soda for hard soap. This demand for soda was met by the Le Blanc process and, by adding a calculated amount of lime to the carbonate, caustic soda was produced which was more effective for saponification. Soap was separated out by the addition of salt and the residual liquor contained salt, excess alkali and glycerol. The recovery of glycerol was encouraged by the discovery of nitroglycerin in 1846 and Nobel's development of this into the relatively safer dynamite in 1871.

As a dealer in hides & skins Joseph Watson started by supplying tallow to soap and candle makers. He started his soap works in 1848 and although the site is north of the river mention must be made of his chief chemist from 1887, Dr. Julius Lemkowitsh, an expert on oils & fats, who was the first to separate pure glycerol from soap lye. Besides 'Nubolic', an antiseptic toilet soap, Watson's were renowned for their scouring powder "Watson's Matchless Cleanser" The development of Watsons reflects the importance of Leeds as a centre of meat supply for a large population. The slaughterhouses provided butchers' meat, fell wool, sheepskins and material for the tallow boilers and glue makers. Glue was used to size the warp, tallow was used for soap and candles, as was wool grease. The supply of sheepskins was a factor in the establishment of the South Market for leather in the 1820s.

The soap, oil and grease trade of South Leeds was a direct development of the needs of the woollen industry locally.

Raw wool provided wool grease, the sheep also yielded tallow. Spinning needed a lubricating oil and scouring the finished cloth needed soap. Raw materials reached Leeds mainly by water from the Vale of York or from Hull for imported oils. To refine the oils and for soap boiling, cheap supplies of coal for heating and for raising steam were available in Huhslet and Holbeck.

The chief trend in the nineteenth century was the movement of oil-seed milling to the ports. Allied to this was the growing need for lubricants for machinery of all kinds and the replacement of colza and train oils by paraffin as an illuminant in the 1860s. This was followed by a gradual change to mineral oil based lubricants able to withstand the higher temperatures of high-speed bearings. The oil refiners of Leeds seem to have specialised in oils derived from wool or tallow (symbolised in Benjamin Vickers logo of a Merino sheep) for dressing textile fibres and leather, and in grease based lubricants, particularly for underwater bearings. These special lubricants were successfully exported from the end of the nineteenth century.

CHAPTER 18

LEATHER TRADES

> "From very remote times Leeds has been recognised as a leading market for ... leather".[1]

The making of leather is one of the oldest crafts known. There are three basic methods of preserving a raw skin and turning it into leather: Chamoysing, in which oil or fat is used as the preservative; Tawing, which uses salt and alum; and Tanning, which uses tannin derived from a wide range of vegetable matter. When a skin has been turned into leather it needs dressing, i.e. finishing, to make it flexible. One method, used for sole leather, was to hammer the damp leather. For shoe uppers and harness leather, the normal method was currying, i.e. dressing with grease. Finally 'Morocco' leather was prepared from sheep or goat skins which were dyed red on the outer surface with <u>Kermococcus vermilio</u>, the dried bodies of an insect parasitic on the Kermes oak, before tawing. A variation on this 'Morocco' process was 'Spanish' leather or 'cordovan' (after Cordoba) from which was derived the medieval name for a shoemaker, a cordwainer. All of these methods were practised in Hunslet in the nineteenth century, and tanning and chamoysing had been carried on for much longer.

Chamoysing is probably the oldest method and the primitive technique was to rub grease into the prepared skin. This

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1. <u>LCYB</u> (1910) p 69

was modified into a method in which the skins, of sheep mainly, were impregnated with oil and then heaped to permit oxidation to take place. When this was completed the surplus oil was squeezed out and the chamois leather dressed by rubbing it smooth and pliable with a circular bladed knife, using chalk as a lubricant. The oiling of the prepared skins, 'fleshes', was normally carried out in fulling stocks and there is a reference to a 'tanning mill' at Kirkstall Abbey in the time of Edward I,[1] and stocks for chamoysing were illustrated in Diderot's Encyclopedie (Paris 1763). Cod liver oil was the main oil used for this process and was obtained from the many oil merchants in Leeds who stocked it as either 'fish oil' or 'Newfoundland oil'. The liquid squeezed out in the press was known as 'sod oil' and found a ready market with curriers for dressing coach leathers and harness.

The development of tanning in the Leeds district in the middle ages may be regarded as mainly a response to favourable geographic factors. Leeds was a market town at an interface of pastoral and arable economies. To the west were the sheep farms of the Dales and to the east lay the Vale of York, but between Leeds and Tadcaster was the ancient oak-dominated Forest of Elmet growing on the Magnesian Limestone outcrops. Thus the essential supplies

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1. PRO Ancient Extents: 386 (1)

for tanning were all readily available, sheepskins, lime and oak bark, with an emphasis on light leathers from sheepskins rather than on heavy sole leathers from ox hides.[1]

The raw hides and skins were scraped clean on the flesh side, the 'fleshings' being sold to glue & size makers. Sheepskins came from the fellmonger who stripped them of wool first, and cow and calf skins came directly from slaughterhouses. The skins were soaked in a series of limepits, being moved progressively from the oldest and weakest to the newest and strongest. This process loosened the hairs on the outer side and these were scraped away for sale for carpet making, cheap blankets for workhouses, and manure. The actual tanning process followed: tan pits full of layers of skins and bark were used in a similar manner to the lime pits, the skin began in the oldest bark and ended up leaving the new bark as leather. Tanneries were heavy users of water in the various processes and the effluent was generally returned in an untreated state to the nearest water course. Apart from lime, phosphates were needed in small amounts for tanning and, just as the woollen mills used 'stale' urine as a source of ammonia, so tanners used pigeon, poultry and dog dung. It was a tradition that tanners kept mastiffs,

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1. c.f. Northampton in relation to the Forest of Rockingham, the oolitic limestones and the grazing districts of the East Midlands.

who also acted as guard dogs.

With putrescent raw hides as a starting point of the trade it is little wonder that tanneries were noisome places ill suited to even working class residential areas:

> "the odours call no sweet fancies about spices of Araby."[1]

The oldest tanneries in Hunslet were J. Addiman's on Hunslet Carr (213)[2] and S. Inghams on Woodhouse Hill (216)[3], both in relatively rural spots away from existing houses. By 1817 John Coultate, tanner, and T. Hawkesworth, currier, shared the former Whitechapel, which was built in 1758 as the first Congregational chapel in Leeds (73).[4] This was at the junction of Meadow and Hunslet Lanes, close to Leeds Bridge. It was a very small tannery, with only six tan pits, so it would not have been too offensive to the neighbourhood. The other two tanneries were much larger with 45-50 tan pits and as many lime pits within a court yard of dressing and store sheds. They were extensive rather than intensive, lay by becks for their water supply and were within half a mile of Hunslet staithe and the main road to Pontefract from Leeds. Lime was easily obtained by boat from Fairburn or Brotherton and Ingham's

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1. LE 3.3.1883 'Peeps into Leeds Industry' W.Paul,Oak Tannery.
2. Baines D (1817)
3. Baines D (1822)
4. E. Parsons, op.cit. p.31 (1834) "In 1755 Mr. Edwards ... began to build ... the place in which he preached was the Old White Chapel ... now entirely abandoned as a place of worship."

tannery was next to a 'limehouse'. Because of its favourable location Leeds had more than the average number of tanners for a town its size and in consequence developed a leather market with leather fairs held on the third Wednesday in January, April and October. A further five fairs were added in 1833 to meet the growing needs of the trade and these fairs were held on the first Wednesday of March, June, September and December.[1] These fairs were held next to Whitechapel Yard at the South Market, which was built by a private company in 1826 as a general market for 'transpontine Leeds'. It was soon very clear that in this context it was a total failure and towards the end of 1827 it had become the main leather market with £100,000 worth of leather changing hands.[2] The following year the turnover was 200 tons, by 1832 it had risen to 300 tons then to 400 tons the following year. The sales of leather at the South Market in 1840 exceeded 500 tons and it was established as the main provincial leather mart, a pre-eminence which lasted until the 1880s.

The main trade at the South Market was in light leathers used for shoe uppers, book binding, saddlery, coach upholstery, furniture, gloves and slippers, with special leathers for belting, carding rollers and other uses in textile machinery.

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1. E. Parsons, <u>History of Leeds</u> (1834) p.252
2. <u>LI</u> 18.10.1827, Returns of leather sales were regularly published after this.

The growth of local tanneries was related to the availability of suitable sites with ample water supplies, with good access to supplies of hides and tan bark, both of which had relatively low value in respect to their bulk.[1] Oak bark, with a 10% tannin content, could not bear heavy transport costs and as the demand for leather increased alternative tannage was sought.

At the beginning of the nineteenth century the average tannery was small and employed fewer than half a dozen men. It served a local market, used local raw materials and involved a relatively massive investment of capital in stocks of raw hides, oak bark and finished leather awaiting sale. The actual tanning process took up to 15 months and so turnover was slow. W. G. Rimmer has shown that the demand for leather rose at an annual rate of 3% after 1815 so that consumption had doubled by 1850. At the same time the supply of native hides increased by 1½% annually and after 1820 imported hides made up the shortfall in supply from home sources at a rate which increased by 6% annually until by 1840 they outnumbered home produced hides.[2] The consequences of

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1. LCYB (1910)p.70. "Up to seventy years ago the tanning trade of the district was confined to old fashioned and out of the way tan yards and dependent on local supplies of hides and tan bark".
2. W.G. Rimmer, 'The Leeds Leather Industry in the 19th Century' Thoresby Soc. xivi (1960) pp 119-168

this growth in demand was to strengthen the position of Leeds as a centre of production of light leathers. In 1817 there were eight tanners in Leeds, one of whom was in Hunslet. By 1830 there were 14 and of this total six were on Meanwood Beck. The future pattern of tannery location was becoming clear, with the Meanwood Beck and the north bank of the River Aire upstream from the town being the most favoured sites, with ample supplies of water and still undeveloped. Only one new tannery was built in Hunslet before the middle of the century. This was J. Wilson's 'Spanish Leather Works' (136). The business began in Mabgate in 1825 and moved to a newly built tannery on Leathley Lane in 1834. It was the first provincial tannery to make 'Spanish leather', fancy coloured leather from sheepskin, dyed before tanning. This speciality proved to be profitable and as Wilson, Walker & Co. the business moved to a new and larger tannery at Sheepscar in 1857 and the Hunslet works were closed down in 1863, the site becoming part of an engineering works. The capital investment involved in such a project may be noted from the issued capital of Wilson, Walker & Co. of £400,000 when they became a limited company in 1893.

In the first half of the century the trade became more intensive. The first innovation was the use of hot liquors for tanning instead of tan bark.[1] This halved the time

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1. S.C. <u>State of the Leather Trade</u> (1816) Vol. VI p.95

needed and so reduced capital investment in stocks in tanning but required the installation of coal-fired coppers to make the extract from the bark. Once again the importance of good supplies of cheap coal in Leeds proved an asset. The newer tanneries by the river had no supply problems but the poor transport up the Meanwood valley limited development in a northerly direction, and encouraged new tanneries on good sites in Beeston, Bramley and Wortley, south of the township and near to coal pits.

In the late 1820s mixed tannage began to supplant the now limited supplies of oak bark for light leathers, the trade in which Leeds was pre-eminent. This involved the use of sumac, valonia, gambier, myrobelans and divi-divi, vegetable tanning materials, leaves, barks and berries from the Mediterranean and Far East. These contained up to 50% tannin and so were much more concentrated than oak bark. At Hunslet Carr, Addiman was followed by Harrison in 1833[1] and in turn T. W. Appleyard took over the tannery. He employed 110 men and produced 350 tons of leather from 400 tons of hides. To do this he used 78 tons of lime for 'depilation' (the hair was subequently sold for £10) and for his mixed tannage used 168 tons of bark, valonia and sumac. The original 50 tan pits had been increased to 200.[2] This compares with the comments

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1. LM 19.1.1833 "Tanyard to let, 50 pits"

2. Rivers Commission (1871) Part II p.110. Evidence of T. W. Appleyard.

made in 1913 on the minimum scale of investment in a tannery of £35,000 for plant and buildings with 120 men employed to produce 1200 hides weekly with 5000 in the tan pits, or in store as dried rawhides.[1] Appleyard was therefore one of the big four or five in Leeds. The first two in size were Richard Nickols at Joppa Tannery (300 men) and Wilson, Walker & Co. at Sheepscar (250 men).[2] The degree of specialisation in the 1860s was also clear. At Joppa, Nickols tanned 70 tons of light leathers with 20 tons of mixed tannage but at his Bramley tannery 25 tons of sole leather was produced using bark only.[3] As already mentioned, Wilsons specialised in 'Spanish leathers'. The newer tanneries, such as that which had replaced the Hunslet Spanish Leather Works, were covered so that the tan pits were protected from the weather and more steam power was used for machinery. Splitting machinery was highly developed, polishing machines were widely used and hydraulic presses were used to squeeze the 'sod oil' from chamois leather. Most of this machinery was made in Leeds by engineering firms who found in the concentration of tanneries a ready market for their specialities.

The import of hides developed rapidly. Initially they were salted rawhides imported in barrels from Europe and brought by river from Hull, but after 1830 the sun

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1. <u>Leather Trades Review</u> 21.5.1913
2. <u>Rivers Commission</u> (1867) Evidence of A.M.Fowler, Borough Surveyor, pp 194-201
3. <u>Ibid</u>. Evidence of R. Nickols, Part II p 202 et seq.

dried skins of African and Indian cattle became increasingly important as a supply for the Leeds trade and these 'East India Kips' were brought by rail from the docks. Appleyard used only dried hides at Hunslet to make upper leathers. The peak of production in Leeds was in the early 1870s. Nickols asserted that Leeds was the largest tanning district in England and that 2.75m hides & skins were processed annually, mainly East India Kips from Calcutta and Bombay.[1] After 1873 tanned kips began to be imported and these were in direct competition with the output of the Leeds district tanneries. To make matters worse the opening up of the prairies following the ending of the American Civil War led to the growth of the Chicago stockyards with an enormous output of hides which were tanned with Hemlock bark (55% tannin). Thus export markets for leather were declining, the American tanners were more efficient than their English counterparts, European states were raising tariff barriers and from India tanned hides competed in the British market also. The Leeds trade began to decline and Appleyards went out of business in 1890. Coultate closed down in c. 1865 and Hawkesworth followed in 1900. Ingham moved from Hunslet to another new tannery at Armley in 1839 and so by the end of the nineteenth century the only producer of leather south of the river was Alderman John Atha's Belinda Leatherworks (207) where chamois leather was made from 1863 until 1907.

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1. Ibid. p.204

Atha's works eventually comprised an extensive three storey block with ancillary buildings used as offices, stores, warehouses and packing shops, all on a site of 1500 square yards.[1] The original works had been a glasshouse but in 1884 a new three storey block was added on the existing site.[2] Apart from the speciality of the house, 'velvet chamois' leathers Atha also sold the 'sod oil' to curriers for leather dressing. This is an example of a specialist firm prospering against a general trend towards decline.

W. G. Rimmer[3] asserts that the main factor in the decline of the Leeds trade was the attitude of management, elderly gentlemen who resisted innovation and so were unable to compete successfully with more progressive organisations elsewhere. This attitude seems somewhat strange when it is recalled that one of the earliest departments of the Yorkshire College was devoted to the needs of the leather industries. Under H. R. Procter it had become a leading research institution by the turn of the century and had been founded with the support of the Skinners' Company and the Leeds tanners.

Despite the technical expertise available most of the Leeds tanners clung to mixed tannage using tannin extracts and ignored the new chrome tannage introduced

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1. Leeds City Archives, Hepper Valuation Book 186 p.3. Valuation for a mortgage (1884).
2. <u>Century's Progress</u> (1893) p.173
3. Rimmer, <u>op.cit</u>. p.164

by Augustus Schultz in 1884. The use of chrome salts, instead of vegetable tannins, and aldehydes, especially formalin (Formaldehyde) reduced tanning time from two to three months to as many days. This gave a much faster turn over of stocks and thus capital went farther. For the same output of leather less capital investment was needed, or with the same capital, a greater output could be achieved.

Only one Leeds firm took up the chromate method before 1905, this was W. & H. Miers who began business in 1892 at the Phoenix Leather Works on Meanwood Road and then moved out to a new tannery, the Embo Works, at Beeston as the new trade prospered. The Miors predecessors at Meanwood Road were Carr & Gill who started there in 1883 and moved to Hunslet Road in 1885[1] to smaller premises. They took over J. W. Beadle's Elmtree Works[2] and renamed it the Phoenix Works. By 1906 the business had become T. A. Hall & Co., leather factors.[3] Thus from tanning in Meanwood Road, Carr & Gill had moved over to factoring and ceased to manufacture. Other leather merchants who became established in Hunslet included the Conyers. The Conyers family had begun as curriers on Kirkstall Road and moved into factoring and the new trade

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1. W.H. Miers, <u>Century's Progress</u> (1893) p.175. Carr & Gill <u>YI</u> (1888)p.144
2. Jones <u>D</u> (1863)
3. Kelly <u>D</u> (1906)

of mass-production boot making. At their Boar Lane works they employed 400 men to produce 4000 pairs of boots each week. From 1889 until 1911 they used 110 Hunslet Lane (72) for the storage of leather and finished boots.

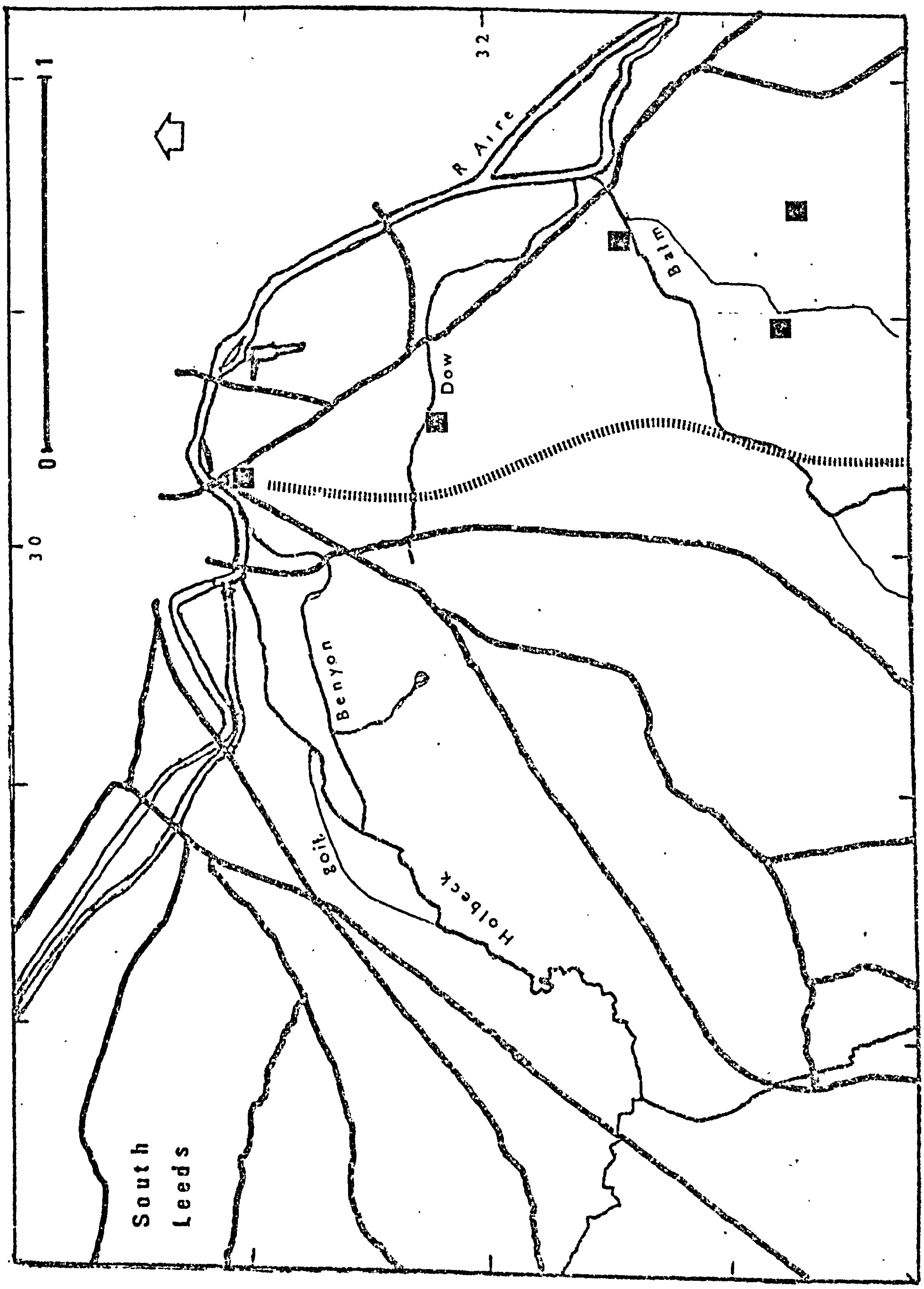
Boot and Shoe Making

The wholesale manufacture of shoes and boots did not develop until after 1858 when Stead & Simpson began to mass produce boots at their Meanwood works. The application of power to boot-making followed the introduction of the sewing machine and leather cutting machinery developed from cloth cutting band-knives which had been introduced into the multiple-tailoring trade of Leeds. The final development was the introduction of closing-machines about 1900: previously there had been a great deal of hand work done at home by out-workers, the successors to the craftsmen bootmakers. In 1834 there were 23 shoemakers in Hunslet and 10 in Holbeck but they were craftsmen rather than manufacturers.[1] The mass-production of boots and the shoe and boot factories developed alongside the newer tanneries on Kirkstall Road and Meanwood rather than south of the river. These factories soon established themselves as specialist producers of working boots, heavily dressed with grease to make them waterproof. Leicester and Northampton specialised in shoes of a more fashionable and expensive style. Consequently, when heavy greased boots went out

1. Baines and Newsome D (1834)

of favour amongst working men, the Leeds manufacturers were so heavily committed to their speciality that they lost the new market for lighter men's footwear. The boot-making industry of Leeds was only saved from complete collapse by the outbreak of the Great War and substantial orders for Army boots. It seems strange that Leeds developed as a major centre for the tanning of light leathers using mixed tannage to such an extent that it would not accept chrome tannage until it was too late to save most of the tanners from bankruptcy, and to specialise in heavy boot-making rather than shoes. Perhaps it was an excess of Yorkshire caution to commit everything to meeting the needs of the working man for heavy boots in the last quarter of the nineteenth century. The fashion footwear side, which used the light, dyed upper leather Leeds produced so well, was perhaps too speculative for the Leeds merchants, just as they left the making of fancy worsteds to the Bradford men and concentrated on less fashion-conscious woollen cloths.

The new tanneries built in the middle of the century and later, often with associated boot factories, were geared to a faster output than the older and more extensive tanneries. They needed far more water than was available in Hunslet and Holbeck at the time. Coultate's tiny works adjoined the Benyon Beck, Appleyard tapped a Balm Beck feeder and Ingham, on Woodhouse Hill relied on a very small stream feeding the Balm Beck, so small that it no doubt influenced his decision to move to Armley in 1839 to a site with a superior water supply. Wilson chose a good site for his Spanish Leather Works when he moved from Mabgate in 1825 to Leathley Lane, with Dow Beck to supply the water he needed, but Dow Beck was not large enough to supply his needs by the late 1850s, and so he moved to Meanwood. Meanwood Beck was bigger than any of the becks on the south side of the river except Low (Hol) Beck whose lower reaches were already developed as industrial sites as far as Mill Green. Above Mill Green it was wash-land, liable to flood, and only recently reclaimed for building land. Further up still was Millshaw and there were suitable tannery sites to be found, upstream from Walker Bros. woollen mills.



TANNERIES

CHAPTER 19

GLUE & SIZE WORKS

Since the raw material of the glue maker was largely the scrapings and trimmings from the tanners' raw hides it is appropriate to deal with the trade at this stage. There were two glue works in South Leeds, apart from those operated by tanners themselves. Both were by Low Road, Hunslet and were originally owned by James Aspin. In the 1807 Poll Book he was entered as a glue maker and the close relationship with tanning is shown by the preceding entry for 'G. Aspin, skinner'.

If the object of the tanner was to stabilise the collagen in skin to convert it into leather, then the gluemaker's aim was to dissolve out the collagen with boiling water and then by evaporation produce cakes of 'hide glue', gelatine. This was used by joiners and cabinet makers for furniture building and in a diluted form, as 'glue size', it was used by paper makers to give 'body' to their output and by making it less absorbent it became suitable for stationery. The main use for size in the Leeds district was in the preparation of warp yarn before it was wound on the loom beam.

The larger glue works was on Hunslet Road (197) and the smaller one close by on Old Mill Lane (205). James Aspin was followed by John Wilson in 1833,[1] possibly the same Wilson who moved from Mabgate to the Spanish Leather Works in 1834. Many tanners boiled glue from their 'fleshings' on the spot, so if Wilson was building a new tannery it is possible that he wanted a separate glue works until his new works was fully operational. By 1840 the Hunslet Road works had been taken over by Joshua Bower Jnr. The Bowers' main interests were in the glass & chemical works, but they also operated coal pits and farmed the Wakefield Turnpike, of which Hunslet Road formed part. Bower ran the works until the late 1880s and employed 60 men in 1867.[2] There are no references found to this works after 1875 and the site was developed for housing as Balcome Grove, Balcome Place etc. This works must have been of some importance in view of the number employed, which compares favourably with many tanneries and woollen mills.

The glue works on Old Mill Lane became the Belle Vue Glass Works by 1840.[3]

As the tanneries in Hunslet closed down and with a change from heavy woollen clothmaking to the increased use of

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1. LM 16.3.1833 Glue works, late owner J. Aspin 343 sq.yds Sale/Let.
2. Rivers Commission (1867) p.201 188.
3. LCD 19138

shoddy locally there was a decrease in the supply of raw material and in the demand for glue size. Shoddy, reclaimed woollen fibres, was so weak that it was used for weft yarn mainly and instead of a sized woollen warp, cotton warps were used to provide extra strength in the fabric.

Both works were located by the Dow Beck and this ensured a good supply of water for boiling pans. Coal for heating was readily at hand at a low price: like the salt-boilers of Tynemouth and South Shields, glue boilers used small coal and slack for fuel. Being to the east of the main road and the township of Hunslet the prevailing winds would carry away the smells, across the river.

Glue making is an example of the development of a trade based on by-products. So long as there were enough tanneries in the township their existence was justified as separate units but when the tanneries departed to more suitable sites then the raw materials had to be carted from the tanneries springing up on Kirkstall Road and at Sheepscar. This increased the cost and made an independent glue works hardly viable and so, in turn, they were closed down and their sites put to more profitable use.

CHAPTER 20

FACTORS AFFECTING INDUSTRIAL LOCATION

A large number of factors determine where an industry is located. The costs of production often vary with the location of a firm, in particular the costs of transport. There is therefore an economic and an uneconomic distribution of industry. Some of the major factors determining the "territorial division of labour" include:

i. Geographical determinants, in particular mineral deposits, e.g. clay, coal and iron.

ii. Proximity to raw materials, this is particularly important where the weight of the raw materials is more than the weight of the end product, e.g. iron ore + coal (coke) + limestone outweighs the pig iron produced.

iii. Nearness to markets, bulky materials are expensive to transport so manufacture tends to be near the market.

iv. Proximity to suitable labour.

v. Proximity to power supplies, particularly coal and water.

vi. Complementary industry, either the supply of materials partly made up, e.g. yarn for weaving, dressing mills to finish cloth, or industries based on by-product utilisation.

vii. Historical accident, many industries are strictly 'foot-loose' and have developed in a particular place merely because the entrepreneur happened to live there. Unless there are strong economic reasons favouring other locations competitors are often attracted to the original location.

viii. Obsolescence of existing industry, creating favourable conditions for a new industry, e.g. existing labour force, communications, possibly redundant factory buildings.

Most of these factors have been dealt with already in so far as they affect particular industries in different ways, but there are some general influences which made 'Transpontine Leeds' eminently attractive to industry of all kinds. Even before 1800 the main base for industrial development in the area was steam power. The contributory factors favourable to the location of steam powered industry include low cost supplies of boiler fuel and an adequate water supply for the boilers and for other industrial processes. In both these respects the area was well endowed. There was plenty of level land on which to build, and nowhere was more than half a mile from a coal depot, either the pits at Beeston and Wortley, the small pits in Hunslet itself or the main suppliers, the Brandling's Middleton Colliery, delivering to Hunslet Moor and Casson Close, and the Fenton's Rothwell Haigh pits delivering to Hunslet staithe and the Aire & Calder docks below Leeds Bridge, on the south side of the river. The statutory obligation of the Middleton Railway to provide certain amounts of coal at specified prices effectively formed a ceiling price which gave local industry an immense advantage. The beam engines of the early nineteenth century were relatively inefficient and consumed not only large amounts of fuel but equally large amounts of boiler water. This emphasises the advantages of Hunslet and Holbeck as industrial sites since there were numerous small becks which could provide the essential supplies of water, as well as the River Aire itself.[1]

Water Supplies

In Holbeck the main supply came from the Hol (Low) Beck and its associated water courses. The tail goit of Mill Green Mill rejoined the main beck at Holbeck Lane. At this point there was a weir to divert water into the Benyon Beck, which flowed from Sheepfoot Bridge to the

1. A. & C.N. 1.9 Minutes & Accts. 8.12.1836 notes a charge of 2 gns. to G. Goodman to draw engine water from Hunslet Pool.

River Aire just above Leeds Bridge. This small beck supplied the later Marshall Mills, the Co-op Flour Mill, formerly a flax mill, Benyon's flax mill and the numerous engineering works facing on to Victoria Road from the east. Three more mills drew on it between Wilson Street and Water Lane. The dam at Sheepfoot Bridge was the outlet of another stream which began in a pond on Holbeck Moor, where there were two woollen mills.

Hunslet had the Dow and Balm Becks, lesser streams than the Holbeck but of vital importance as determinants of factory location. Dow Beck began near Meadow Lane and flowed eastward to the Dow Bridge, on Hunslet Lane, it turned across the Larchfield estate and then meandered near to the main road before joining the river by the old Soke Mill. In this short distance it served the Potterdale Mill, Union Foundry, Railway Foundry, Leeds Iron Works, Leeds Pottery, the Spanish Leatherworks, Dawbridge Mill (later the Airedale Foundry), the Airedale Brewery, the Larchfield estate, which later included iron and engineering works as well as Pym Nevins woollen mill and dyehouse, and the maltkiln and glue works on Hunslet Lane. The fall of this beck was so slight that it never provided water power and it is clear that the increasing demand on the limited water which was available was a factor leading to the closure of the Spanish Leather Works in favour of a new site on the Meanwood Beck, which the City Engineer's Department estimates had at least six times the flow of water. The Balm Beck had one or two small feeders including the Carr Beck and the flow was enough to power Ard Walker's cotton mill, it also supplied a chemical works, a flax mill, a glass works and a woollen mill before entering the River Aire.

Capital investment was needed to utilise these precious supplies of water and heavy users built reservoirs to accumulate stores of water during the night and on Sundays when the engines were not at work. Ard Walker paid out £67 in wages to have a well sunk and the mill dam cleaned out in 1801.[1] This cleaning would increase the capacity by the removal of accumulated silt which in time tended to fill in a mill pond. Walker's mill still retained the water wheel but by 1795 an engine had been installed[2] and when the new mill was built this was replaced by a 30 h.p. Murray engine.[3] Marshall built reservoirs in 1816-19 on 7 acres of land bought with this in mind over ten years earlier for £5,000.[4] Benyon built a reservoir

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1. Leeds City Archives DB23. Ard Walker Accounts 1800-1801.
2. Sun CS 10/646372 (1795).
3. Leeds City Archives DB23. Ard Walker Accounts 1800.
4. W. Brown, op.cit. (1821)

   "Boreholes are now used for water, some go down 300 feet ... A 4½ inch borehole serves a 20 h.p. engine ... cooling ponds or reservoirs are not very common. Marshall has two of an acre each, three feet deep".

in the 1830s, as did Maclea & March of the Union Foundry and John Day at his Leeds Iron Works. When Dickens & Barraclough built the Hope Mill in 1839 they included a reservoir as part of the original planning. The Leeds Pottery had a small reservoir, but Kitson's Airedale Foundry relied on the Dow Beck until 1845, as did the Union Foundry across Hunslet Lane. St. Helen's Mills, on Whitehouse Street, included a reservoir in 1845 but later, in the 1880s when it became a dyeworks, boreholes were sunk to meet the increased need for process water[1]. The breweries generally preferred to use well water since it was harder than water from the becks and so more suited for brewing beer.

The method of abstracting water was ingenious. A conduit was made to the nearest beck and water drawn into a sump to be pumped to the boilers as needed. The conveyance of part of the Larchfield estate in 1836 from Mary Goodman to Robert Wood, machine maker, refers specifically to his right to lay a pipe from the conduit at Pym Nevins' Mill to his new Larchfield Foundry.[2]

Perhaps the most imposing evidence of the importance of these water courses is the return submitted to the Rivers Commission in 1867 by A. M. Fowler, the borough surveyor.[3]

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1. YI (1888) p.123
2. LCD 18098
3. Rivers Commission (1867) Q.6213 pp 194-201

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Although the purpose of the enquiry was into river pollution it is clear that all these manufacturers had some sort of access to the river or the becks.

Further evidence by individual manufacturers indicated the quantity and source of water they used. John Bucktrout, ware grinder, Goodman Street, obtained his boiler water from the River Aire.[1] Alex Patterson, flax spinner, Trafalgar Mill, obtained water jointly from the river and the waterworks company.[2] John Wilkinson, felt carpet and cloth maker, Airedale and St. Helen's Mills, used the river, wells, boreholes and the water company, to the tune of 26m gallons annually. Benjamin Mellor's paper mill by the river at Low Road drew from the river and from wells. Samuel Warburton, chemical manufacturer, drew water from Hunslet Carr Beck (i.e. Balm Beck) and further upstream Thomas Appleyard's tannery had a small reservoir fed by streams from Woodhouse Hill, and a well.

The biggest manufactory south of the river was Marshall's flax mills. By the time of the report his first two mills, north of Water Lane, had been demolished but the remaining mills drew water from the River Aire* (750m gallons),

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1. _Ibid_. Part II p.104
2. _Ibid_. Part II p.110 etseq.

* The Marshall mills were south of the Holbeck, and the Benyon Beck ran between Mill E and the Temple Mill. To have drawn on the Aire would have meant sinking a conduit under the Holbeck and the canal to a depth of at least 25 feet.

the frontages on the east side of Victoria Road, the Benyon Beck, culverted, was still accessible. On the banks of the Low Beck, by Holbeck Mills, are intakes with protective gratings.

Site Access

So far the emphasis has been on the relationship of industrial sites to the water supplies available, but access to a site was also important. Initially the old Leeds Bridge was the only crossing point of the river in the town. From Bridge End, Hunslet Lane led to Hunslet, Wakefield and Pontefract, and Meadow Lane to Beeston. Water Lane led to Holbeck and Wortley. The development of turnpikes and then new bridges opened up new factory sites as well as catering for the increased flow of traffic generated by industrial development. In terms of the opening up of new factory sites most of the turnpikes to the south west were built in the 1740s. Although these new roads provided direct routes to the major woollen producing districts they originally terminated in Wortley and the only route into Leeds was along Holbeck Lane, Water Lane and over Leeds Bridge. It was not until Wellington Bridge (1818) and Monk Bridge (1827) were built that the traffic pressure on the final mile was reduced. Once again this emphasises the importance of the siting of the Holbeck group of mills,[1] with direct access to the

1. Holbeck Mill 1792, New Mill 1817, Low Hall Mill 1827, Union Mill 1817.

main traffic artery to the south-west, and to the water of the Holbeck. Similarly Marshall's site lay on this route only nearer the town and the river wharves. The Dewsbury turnpike was opened in 1825 and opened up the western part of the level land between Jack Lane and Hunslet Lane. It immediately improved access to the Leeds Pottery and provided sites for the Potterdale woollen mill, Maclea & March's Union Foundry and Sugden's Sun Foundry. From Hunslet Lane a turnpike road and suspension bridge leading to the northern bank of the river was opened in 1829.[1] The planning of this route suggests that its main purpose was to take coal from the Casson Close staithe of the Middleton Railway to the mills on Far Bank and to bring finished goods to the Aire & Calder dock, avoiding Leeds Bridge and the congestion of The Calls.

The development of the Aire & Calder Navigation Company's docks below Leeds Bridge was important in redeveloping the Simpson's Fold area and providing more factory sites. The changes shown from Cossin's Plan of Leeds, 1725, and the Giles plan of 1815 show that first of all merchants, and then manufacturers, had invaded the gardens and tenter garths to the east of Bridge End, off Bowman Lane. From 1818 onwards the Aire & Calder Navigation Company developed a dock complex - Waterloo Street and Dock Street date

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1. Hunslet-Leeds Turnpike Act 9 Geo IV c 67 1828. G. Leather, engineer.

from this period.[1]

The 1830s were a most important period for road and bridge building in the South Ward. In 1837 the footbridge at the end of Neville Street was replaced by the Victoria Bridge, and Victoria Road was built to join Meadow Lane and Dewsbury Road, with Great Wilson Street running across to Hunslet Lane. This formed a triangle through which the Benyon Beck flowed.[2] Mills which opened on to the new roads included Dodgson & Mann's (59) and J. Young's dressing mill on Smithson Place (58) had improved access on to Wilson Street. Several small engineering works were opened off Victoria Road also. The making of the road and bridge cut through the Camp Hall linen & buckram works (41, 49, 57), involved a partial demolition of Charles Dransfield's buckram house (57)[3] and permitted the building of Water Lane Mills (41) for E. Briggs, flax dresser. At the end of the decade Crown Point Bridge was built[4] to a design of George Leather & Sons for £8750. The south abutments cut through Chadwick's Bowman Lane Dyeworks and Crown Point Road provided sites for important industrial developments. Immediately down stream the Aire & Calder

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1. ACN 1.9 Minutes & Accounts, Engineers Reports, 1818, 1823, 1825. Aire & Calder Navigation Act.1 Geo IV c.39 lists property involved.
2. Victoria Bridge Act, 6 Wm IV c.39 1836. G. Leather, engineer, Bridge cost £8000, roadworks £1300.
3. LCD 18422, 18411.
4. Crown Point Bridge Act, 3 Vict. c.26 1840

Navigation Company built the 'New Dock' on land bought from Chadwick.[1] This was later developed as a timber dock which in turn gave rise to the saw mills on Black Bull Street, New Dock Road and Chadwick Street. The bridge and dock were built by James Bray of Bradford and were the reason for him building his New Dock Foundry (96) in 1838. Meanwhile George Hudson had brought the North Midland Railway to Hunslet in 1839 and Crown Point Road and Bridge may be regarded as the logical development of the traffic flow into the manufacturing district to the east of the township, The importance of this railway has already been stressed and it served all industries south of the Leeds Bridge extremely well. Goodman Street, off Hunslet Lane, was laid out in 1835 and provided access to the new Hunslet and Victoria Mill (172, 168)[2]. Ten years later Aire Street was cut through to provide better traffic flows between Leeds Bridge and Hunslet Lane:

> "The main road out of Leeds southwardly is Hunslet Lane. It is now a busy thoroughfare: twenty years ago it was so crowded as to be incapable of accommodating its traffic, so that the new street had to be opened,

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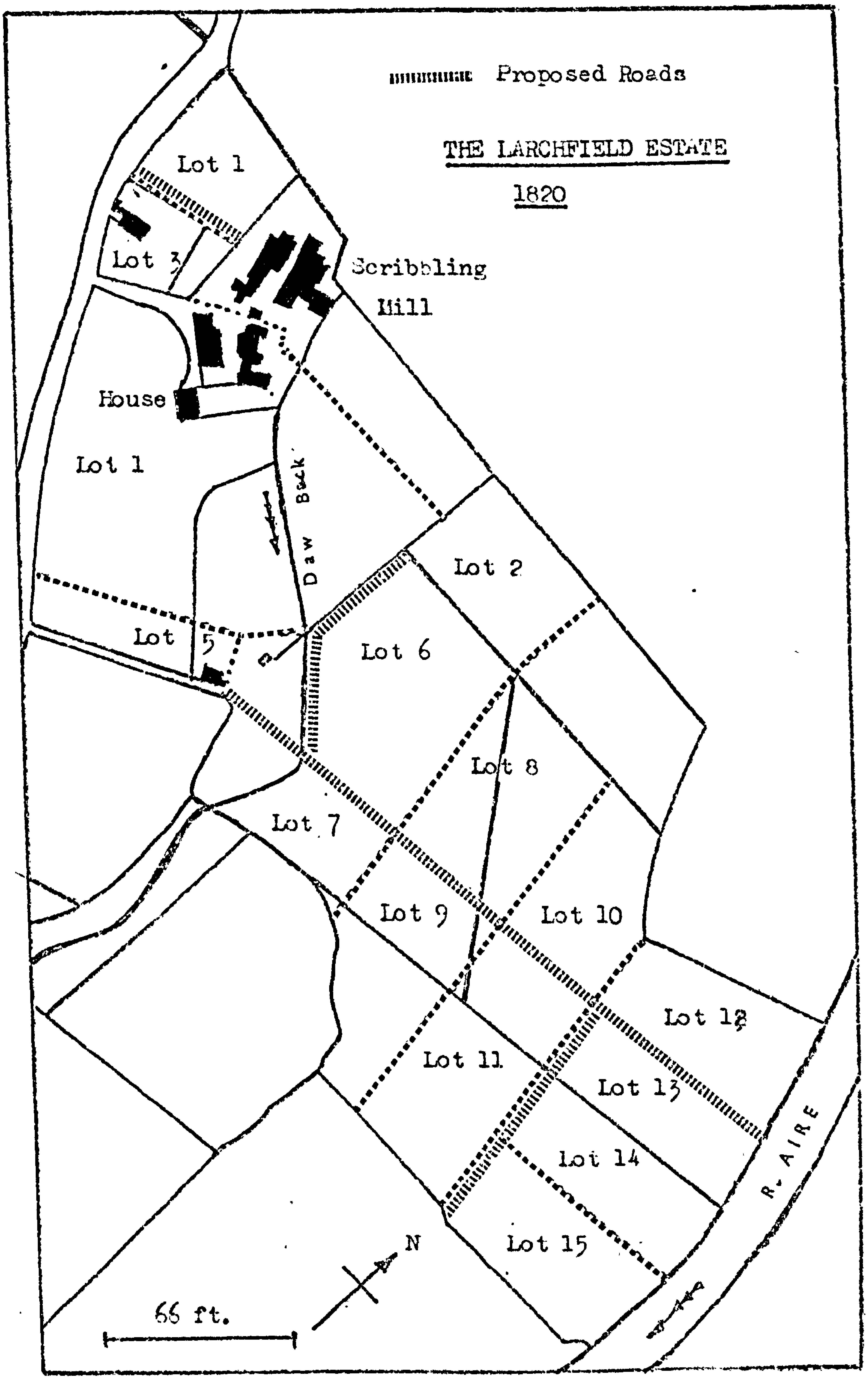
1. ACN 1.9 Engineers' Reports 29.1.1840.
2. University of Nottingham, Denison Mss. Sale Plans of the Larchfield Estate (1820) show proposals for Goodman Street and a dozen sites for industrial development "There is a regular supply of hard and soft water upon every part".

Sheet 19


Proposed Roads
THE LARCHFIELD ESTATE
1820
Lot 1
Lot 3
Scribbling
Mill
House
Lot 1
Daw Beck
Lot 2
Lot 5
Lot 6
Lot 8
Lot 7
Lot 9
Lot 10
Lot 12
Lot 11
Lot 13
Lot 14
Lot 15
R. AIRE
N
66 ft.

> and the old lane thereby considerably relieved. Thirty years ago, at the eastward continuation beyond the bend of the lane at Great Wilson Street, grass grew on the sides of the roadway ... From the bend of the road we approach the old Midland Railway station, now a goods depot."[1]

By 1850 the pattern of new roads, railways and dock area was established ready for progressive in-fill as new works and housing developments were built. The flow of traffic from Leeds was considerably eased by these new bridges but until the late 1860s these were toll-bridges for all except pedestrians.[2] The Leeds & Bradford Railway Company opened its Wellington Station in 1846 but in terms of freight, Hunslet remained the main depot.

During the remainder of the century there was sporadic street widening to ease congestion, for example, Jack Lane was widened in 1892 when the frontage of Jubb's Vulcan Foundry was set back 9 feet (193).[3] When Arthington closed down his brewery (81) the site was eventually redeveloped by the Midland Railway and their new goods depot was built by Nicholson at a cost of £17,000 in 1888. At about the

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1. Jackson's Guide to Leeds 1889, p.23
2. Leeds Bridge rebuilt in 1873.
   'Union' Suspension Bridge rebuilt in 1898.
   Monk Bridge rebuilt in 1886.
   Wellington Bridge widened in 1873,
3. LCD 582.

same time the Aire & Calder New Dock was extended to deal with the increase in timber traffic from Hull and Goole.

By the outbreak of the Great War in 1914 South Leeds had access to rail, road and water transport to supply its industries with raw materials and to carry their products to all parts of the world:

> "Six of the most important railway systems of England serve the city."[1]

The North Eastern Railway had goods depots at Marsh Lane, Wellington Street and, with the Great Northern Railway, Hunslet East (this was in fact across the river below the Hunslet Suspension Bridge). The London & North Western Railway had goods yards at Whitehall Road and Copley Hill, on the western side of South Leeds. The Midland Railway had its chief depot at Hunslet Lane and additional yards at Balm Road and New Pepper Road, serving Hunslet engineering firms with private sidings also. The Lancashire & Yorkshire Railway shared the L. & N.W.R. facilities. The ports served by these lines ranged from the Tyne down the east coast by Boston and Lynn to Harwich. The London Docks were well served and to the west routes ran to Bristol, Liverpool, Manchester and Glasgow, with the G.N.R. offering a through service to Southampton. From these ports the manufacturers of the district had access by sea to their world-wide markets, and supplies of raw materials.

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1. LCYB 1920 p.52

The development of the Aire & Calder docks has already been noted in so far as it affected sites in the central area, but the decision to locate these developments on the south bank instead of adjacent to the existing warehouses off Call Lane added to the other advantages of the south shore since it avoided the congestion of Leeds Bridge and, later, the toll-bridges which added marginally to transport costs from Hunslet and Holbeck into the town centre.

The Aire and Calder Navigation

In management terms the Aire & Calder Navigation Company was very progressive and continued to improve its facilities in the face of railway competition.[1] The development of the port of Goole by the company from 1822 onwards was part of the long term improvement in the flow of goods by water to and from the West Riding. In time, following the rebuilding of locks and dredging, barges carrying up to 200 tons were able to reach Leeds from Goole and Hull. The introduction of 'Tom Puddings', a chain of dumb barges linked to a prime mover as one articulated unit, by W. H. Bartholomew, gave the company considerable advantage in the carriage of coal from West Riding collieries to Leeds, and once again the location of heavy engineering and other industry in Hunslet benefitted by the existence of the New

1. The Aire & Calder remained independent until nationalisation in 1948.

Dock coal wharves, which were as convenient as the railway yards for the final horse-drawn or steam wagon delivery to the boiler house. If the Aire & Calder Navigation Co. was initially slightly dominated by Wakefield interests then the Leeds & Liverpool Canal Co. was Bradford orientated, so that is hardly surprising that it was Leeds merchants seeking to break monopolistic freight charges who supported the Leeds to Selby Railway.

The Leeds-Liverpool Canal

The Leeds-Liverpool Canal had less effect on industrial development.[1] It was not completed until October 1816 and since its locks were 70 ft long, 16 ft wide and 5 ft deep, it could not be compared with the Aire & Calder where, by the end of the nineteenth century all locks were over 200 ft long, 18 ft wide and at least 8 ft deep. The Leeds-Liverpool Canal offered an alternative route to the Aire & Calder, Calder & Hebble, Hebble & Rochdale Canals to Manchester and Liverpool. Its importance was not perhaps so much to Leeds as to upper Airedale and Lancashire. Since the canal was cut from both ends and reached Holm Bridge, 33½ miles from Leeds, when the initial finance was exhausted its benefits were rather to the dalesmen as far as Skipton. For them the difficulties of transporting heavy goods from Leeds, and corn from the Vale of York, were

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1. It was under railway control after 1853 vide J. H. Clapham Econ. History of Modern Britain Vol.II p.199

overcome. In this sense it extended the hinterland of the merchants and manufacturers of Hunslet & Holbeck. Other gains to Leeds included better supplies of lime for building and industry (though the Fairburn and Brotherton quarries provided very substantial amounts by the Aire & Calder system), hides and sheepskins for the tanneries, dairy produce and building stone. The majority of stone and slate dealers were located between the canal and the river at Water Lane, where there was a boat yard and dry-dock. There was also income derived from the transhipment of goods from the one canal system to the other, since the larger boats plying the Aire & Calder could not pass the Leeds-Liverpool Canal lock. It is significant that the warehouse of the Leeds-Liverpool Canal Company still stands as it was first built in 1790 whilst the original Aire & Calder warehouse was rebuilt in 1825 and the old materials re-used to build six additional warehouses on the Dock Street development.[1] At the same time the New Dock at Crown Point was planned but work did not start until 1840 and the dock was extended in the 1880s. It is clear that the Aire & Calder was far more important than the Leeds-Liverpool system to industry in South Leeds.

Hunslet and Holbeck had excellent transport facilities available and this encouraged continued industrial development. In contrast the Meanwood valley, north of the town, lacked so

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1. ACN 1.9. Engineers' Reports 1827.

many of the advantages possessed by South Leeds that there was little industrial development beyond Buslingthorpe Lane, where the sides of the valley close in steeply to severely limit sites. In addition access there was limited to the road, there being no convenient rail or water transport, as there was south of the river.

Public Transport and Housing

In an age when most workers walked to their place of employment, back-to-back housing development in the area matched the needs of industry. Elsewhere there is evidence from early textile mills that manufacturers in rural areas had to provide apprentice houses and cottages for their workers, but there was little of this in Hunslet or Holbeck. A few of the older works had houses for their key workers and management, the Leeds Pottery for example,[1] but in answer to a question on housing provision, Benyon 'rented a few houses to workers'[2] and over at Burley Mill, between the town and Kirkstall, T. W. Stansfield had 70 cottages for a labour force of 610.[3] The 'company house' was practically unknown. Insurance records often included cottages as well as industrial premises. Generally these were noted as tenanted. This suggests that they were regarded as income producing

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1. Leeds City Archives. Hunslet Rate Book (1791)(404-6) Hartley, Green & Co. "Pottery,warehouses,workshops,windmill, yard, workmen's houses."
2. Factories Inquiry Vo.II C.1 (1834) 28. Benyon & Co.
3. Ibid. 39. T.W. Stansfield.

investments rather than tied houses for employees. The number of such cottages never runs to double figures, so that if they were originally part of the complex it was to provide service accommodation for a few essential staff such as the boiler men and engineer.

Even for the speculative builders of back-to-back houses there were distinct advantages in the area: local brick-yards, timber yards, stone & slate wharves and, as potteries and brickyards closed down after 1860, their clay pits were filled-in to provide more building sites. The bulk of speculative building took place after 1860 and matched the expansion of the engineering industry. It seems to have been mainly the work of small under-capitalised developers who bought a piece of land and built a block of eight back-to-back houses which were sold to finance the next block. This meant development of a site was spasmodic and uncoordinated, reflecting every change in interest rates, earnings and employment levels.[1]

Although most workers may be regarded as having lived within walking distance of their job, the development of cheap public transport was of some importance. For the lower middle class there was a horse-bus service from Hunslet into Leeds from 1839, followed by horse-trams in 1872. In the 1880s steam trams, made by Greens of the Smithfield Foundry

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1. M.W. Beresford. 'Prosperity Street and Others' <u>Leeds & Its Region</u>. edit. Beresford & Jones 1967 p.186 et seq. illustrates the 'stop-go' building of Prosperity Street between 1874 and 1901.

in North Street, were introduced and additional routes were established along Dewsbury Road. The private company which operated these services was bought out by the Corporation in 1894 and by 1902 all the routes were served by electric trams using the overhead single-wire catenary system with earth return via the rails. The Corporation introduced early morning services and workmen's cheap return tickets: the 1d stage was increased to two miles, and this meant that for twopence a day almost every industrial site in Hunslet was accessible to workers living in the housing developments at Beeston: after 1910 Morley and Rothwell were also within a tram ride of Hunslet.[1]

Table 20.1

Tram Routes in 1914
City Square .. Monk Bridge .. Gelderd Road (Mill Green)
Corn Exchange .. Morley via Elland Road, branch to Domestic Street
Corn Exchange .. Wakefield via Hunslet Road, branch to Balm Road
City Square .. Dewsbury via Dewsbury Road
Corn Exchange .. Beeston via Meadow Lane

Apart from enlarging the labour pool for industry in Hunslet and Holbeck the tram provided an escape route for

1. Oral evidence: Arnold Stone, Deputy General Manager, Leeds City Transport

those who wished to work in the bustling and more respectable world of commerce and shops in the city centre.

Labour supply

One of the problems facing any industrialist seeking to establish a new venture is the labour supply in a total family situation. When the early textile mills were built in remote rural districts they needed a large child labour force so that apprentice houses were built to accommodate these 'workhouse apprentices' brought in from London and other large towns.[1] When Arkwright developed his mills at Cromford he established a complete community and the houses had attics to allow workers' families to board additional young workers. He provided employment for the men on the estate farms and as waggoners in order to maintain family units in full employment. It has been said, perhaps not too seriously, that the labour needs of the early factory masters were ideally met by a widow with a large family of girls who could work in the mill. In the flax trade it has been noted that hand-hackling continued to employ men and boys for a generation after machinery became available since it helped to provide work for the family unit. The growth of opportunities of alternative employment in engineering for men and boys meant that by the middle of the nineteenth century there

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1. B. Jennings, ed. A History of Nidderdale, Huddersfield (1967) p.240. West End Mill.

was a wide range of jobs for all the family, engineering and the railways for the men, and textiles for the women, initially the poorly paid flax dressing, but later increasingly in the clothing factories. The tram into Leeds provided an outlet to the more highly regarded white-collar jobs and, in the last decades of the century, to the technical schools on Woodhouse Street where industrial advancement could be enhanced by evening study. In helping to increase labour mobility the tramways helped to keep wages steady, in the same way that the railway helped to prevent local famines developing, and so stabilised prices to some degree.

The street directories of the early years of this century gave the occupation of the householder and it is clear that they tended to live close to their work. From St. Matthew's Church, Holbeck, to Jack Lane, the Ninevehs, the streets were the homes of railway workers based on the Holbeck Sheds of the Midland Railway, engine drivers, firemen, cleaners and workshop engineers. In the centre of Hunslet, between Jack Lane and Church Street, the householders tended to be chemical, glass and engineering workers with a few transport workers, railwaymen and tram drivers, as well as the lower spectrum of public service employees, postmen, dustmen, etc. Since only the householders' occupation was given it can only be surmised that the women and girls worked in the local clothing works or travelled into Leeds to work in shops and, increasingly, in offices.

Hunslet & Holbeck were enriched by the variety of industry carried out. No single trade dominated the area, even though engineering was the largest single employer it was so diverse that it needed a general slump to affect the area really badly. The mixture of trades provided work for entire families and this encouraged workers to settle there. In turn the ample reserves of labour, much of it highly skilled, encouraged more industry to enter the area and enrich the mix.

Contrast this situation with that of some of the mining villages to the south of Leeds, where apart from agriculture there were jobs for men in the pits - and very little else, or with Saltaire where the model town was essentially dependent on the prosperity of Salt's mill. In Hunslet & Holbeck there was a variety of work for men and women, boys and girls.

Employment opportunities had changed greatly during the course of the nineteenth century. Before 1800 both townships had been dominated by the domestic woollen industry, and then the flax trade, which led to Holbeck being described as:

> "one of the most crowded, most filthy and most unhealthy villages in the county."[1]

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1. E. Parsons <u>History of Leeds</u> 1834 Vol. I p. 177

By 1889 the situation had changed:

> "Transpontine Leeds is industrial ... The two ancient suburbs are Hunslet and Holbeck, now one vastness of toiling humanity. A century ago both were remote from the mother-town; they are now an almost indistinguishable portion of her growth."[1]

The change in the locality was almost complete by the 1870s. The engraving of 'A Bird's Eye View of Leeds' (c.1873) looks to the north with the Leeds Pottery in the foreground, so that most of industrial Hunslet and Holbeck are clearly shown. Contrast this with the insurance policy for the Leeds Pottery of 1788 which included "ricks & stacks" in the field, common and Pottery yard.[2] There is a tradition that when the Archduke Alexander visited Leeds in 1815 he stayed with Pym Nevins at Larchfield House and they shot snipe in the meadows between Larchfield Mill and the river, as well as breakfasting on trout caught in Hunslet Pool.

Population Growth

It will be clear that if the closes and flatts of farm land in Holbeck and Hunslet were completely engulfed in housing during the second half of the nineteenth century, then the population must have increased tremendously in that time.

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1. Jackson Guide to Leeds 1889 p.23

2. Sun CS/343/530638 (1788) Total insured value: £5,400

Between 1801 and 1831 the population of the West Riding increased from 56,282 to 976,350.[1] At that time the population of Leeds parish was 123,393 of whom 12,004 lived in Hunslet, 11,210 lived in Holbeck and 6,548 lived in the South Division, a total of 29,563 inhabitants of "Transpontine Leeds". By 1851 the population had trebled from 1801 and it doubled again by 1901.

Most of these "immigrant" workers were attracted by the industrial developments, the job opportunities offering a completely different life style to that which they had been accustomed. A ~~random~~ sample of the 1851 Census Enumeration Return[2] for the area shows that a majority of householders were born in the immediate district and that less than 10% were from outside Yorkshire. The manager of the Leeds Co-operative Flour Mill, William Beswick, came from Beeston, Norfolk; and James Kilburn, the son of Richard Kilburn, millwright & fulling stock maker, had a son born in St. Petersburg, an indication of his time spent setting up textile machinery in Russia.

In the second half of the century there were less pleasing aspects of immigration. The decline of the flax industry emphasised its low ranking in employment preference due to the poor working conditions and low wages paid to the flax spinners. Similarly, the existence of two paper mills and

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1. Census Returns 1831. 11 Geo IV c.30 p.827
2. Census Enumeration Returns (1851) HO 107/2317

   Streets around Holbeck Moor.

the growth of the shoddy trade led to the development of rag-picking shops. Their owners often adopted the euphemism of 'waste dealer' so that it is difficult to distinguish between Parker Bros., Airedale Works (149) who changed from flax to mungo spinning and then to waste dealing as well, and the owner of the rag warehouse on Dewsbury Road (61) which was demolished in 1866 following a boiler explosion.[1]

Rag picking drew on the clothing factories for supplies of clippings and the workers were chiefly Irish women separated from their spouses. In line with the traditional tales of the pig moving out when the Irish man came to sleep in its sty, it was said:

> "Dirty as the work is, it would be affectation for the Irish to object to it very strongly on that ground."[2]

As in so many cities, Irish immigrants came in a steady stream after the Potato Famine of 1847, but to judge from the number and siting of Roman Catholic churches and Irish Clubs, in Hunslet and Holbeck the Irish were in a minority. Part of the increase in the labour force was due to an increase in the survival rate as living standards improved, the balance was due to migration, mostly from

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1. Mayhall Annals 27.3.1866 'Boiler explosion at Frogland Mungo Mills ... twenty injured.'
2. C. Collet 'Women's work in Leeds' Economic Journal i. (1893) pp 460 - 73

within a ten mile radius of Leeds.

Initially the entrepreneur group tended to live 'over the shop'. Most of the woollen merchants had their various finishing shops adjacent to their houses. Pym Nevins lived at Larchfield House and Matthew Murray lived close to the Round Foundry, at Springfield House. Marshall perhaps established the trend to live away from the works and, as their trade prospered, more and more manufacturers moved to substantial terrace houses in what has now become the University precinct; Mount Preston, Lydden Terrace, Blenheim Terrace and Sunny Bank. Others moved to villas at Headingly, Chapeltown and Roundhay. John Taylor Wordsworth, senior partner in the Midland Junction Foundry (23) retired to Leicester, whilst E. Brown Wilson, of the Hunslet Railway Foundry (137) gave his residence as Westminster.[1]

Even south of Leeds Bridge there were still some good addresses before 1860, where the smaller capitalists had their terrace houses. Thomas Hogg, of Holbeck New Mill (14) retired to Cross Hill, Beeston, but Hogg's Field was still open land and between it and Sweet Street there was a select development of Greenmount Place, Terrace & Street by the Bowling Green, off Jack Lane. Here lived James Bradley, bolt & screw maker, employer of 29 men: Benjamin

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1. White CD (1853)

Mann, clothier, of Airedale Mills, Kirkstall Road; Joseph Jackson, cornmiller; James Warburton from Louth, with a worsted mill in Beeston; James Brown, employing 110 men at his saw mill on Water Lane; Luke Pool from Driffield, owner of the Lion Screw Works (38). Others lived nearby and some still lived very close to their works. John Taylor, John Whitehead and John Pollard, the active partners of Taylor, Wordsworth & Co., all lived on Silver Street, near to the works.[1] A common practice was for the managing partner to live close to the works whilst the others lived elsewhere in Leeds. J. Telford lived on Dewsbury Road and W. Marshall lived on Hunslet Road, whilst W. E. Carrett lived on Rockingham Street, off Woodhouse Lane, all of the Sun Foundry, Dewsbury Road (125). This decision was often influenced by the business having several production units in different places, an example of this being Titley, Tatham & Walker, flax spinners, owning Water Hall Mill (40), Springfield Mill and another mill on School Close. A. Titley lived in the Manor House, Headingley, R. Townley lived on Springfield Mount and T. Walker lived at Water Hall. G. Tatham lived on Springfield Mount but he was also involved with Wilson, Walker & Co. who at this time had the Spanish Leather Works Leathley Lane (136) and a new tannery at Buslingthorpe. The other partner in this venture, J. Wilson, lived at Roundhay. Richard Britton lived at the Leeds

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1. Census Enumeration Return 1851 HO 107/2317

Pottery and his partner, Samuel Warburton, lived at the White House, Hunslet Road; Warburton also owned the chemical works on Hunslet Carr, Warburton & Sons (214).

The development of the railways into the Dales enabled entrepreneurs to commute easily from towns like Ilkley and Harrogate and several transferred their interests away from Leeds. Joshua Bower went into property development in Harrogate and settled in Grove House there. James Bray, who started the New Dock Foundry (96) in 1838, became a railway contractor, built the Leeds & Thirsk Railway and in the process became 'squire' of Beckwithshaw, near Harrogate.

The emphasis on local origins is notable in the entrepreneurial class. Very few came from outside the Leeds district to set up business in Hunslet or Holbeck. John Marshall's father was a linen draper with a house on Mill Hill. Marshall employed Murray, who came from Darlington, at Scotland Mill, Adel, before they both moved to Holbeck. Benyon had joined Marshall from Shrewsbury before he set up on his own in 1804. James Kitson's father was a publican on Camp Road and Joshua Tetley was an Armley maltster before he leased Sykes' brewery in 1822. Indeed, it is easier to list the exceptions than to cite all the locally born.

Pym Nevins came from Co. Kildare and married Elizabeth

Jowett of Gildersome ten years before he bought the Larchfield estate.[1] Titley, Tatham & Walker, the flax spinners, were a partnership of a local man, Walker: a Staffordshire Quaker: and a Nottingham brassfounder. Faustino de Gama, tenant of Dawbridge Mill (139) was an Italian woollen merchant who employed a fellow countryman, Antonio de Macedo, as his mill manager.[2] Macedo turned to the wine & spirit business after the mill closed down in 1839. The Claytons and the Riddells came from South Yorkshire, the former to start the City Boiler Works on Belinda Street (204) in 1864 and the latter to establish the Yorkshire Patent Steam Wagon Co. (218) at the end of the nineteenth century. George Wilson, founder of Wilson Bros., axle, screw & bolt makers, came from Sheffield, where he had served his time as a blacksmith, to open his works on Victoria Road (52) in 1851.[3] John Fowler was a complete outsider but it will be recalled that prior to the building of the Steam Plough Works in 1860 he had had his traction engines built by Kitson at the adjacent Airedale Foundry. Another South Yorkshire engineer who came to Hunslet was Henry Berry who opened the Croydon Works (183) in 1882 to build hydraulic machinery. Examples of outsiders who came to Leeds and then settled south of

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1. LCD 18098
2. Factories Inquiry 1834 Vol. II C.1. 137
3. Oral evidence: George Wilson, also indenture of George Wilson dated 1839.

the river include E. J. Arnold from Barnstaple, who came to Leeds in 1870 and took over a malting on Butterly Street as his headquarters in 1900 (135). Finally, from Pontypridd, the Cambrian Vinegar Co. established a branch in New Briggate in 1865 and then moved to a purpose built vinegar brewery on Elland Road (221) in 1877. The Leeds pottery had a succession of owners including Humble, Brandling's agent and Thomas Wainwright, who was postmaster of Ferrybridge also.[1] There was a 'subsidiary' of the Leeds Pottery at Swinton, which shared the same partners but in time this became completely separated from the 'parent company'.

1. LI 1.2.1796 note relating to the marriage of his daughter.

CHAPTER 21

CAPITAL FORMATION

Information on this vital subject is somewhat variable. For some businesses the documentation is excellent[1] but otherwise the main sources are insurance records, which indicate capital investment: and title deeds, which frequently contain details of mortgages, but rarely mention tenants, both sources often list partnerships fully without indication of the active 'manager'. The rate books give details of ownership of properties as well as occupiers so by the use of all these sources it is possible to build up a fairly accurate picture of sources of capital, especially about the 1800 period.

John Marshall set up as a flax spinner with some £9,000 from his father Jeremiah Marshall, linen draper, and his first partners were James Fenton and Ralph Dearlove, the latter having connections with the Knaresborough linen weaving trade. By 1800 Marshall had regrouped the company and it had become Marshall and T. & B. Benyon.[2] The two mills then in use had cost almost £30,000 including £10,000 for the machinery.[3] Marshall was the prince of flax merchants and could well afford to plough back

1. W.G.Rimmer, Marshalls of Leeds, Flax Spinners 1788-1886(1960)
2. Sun CS30/68720(1800) 'no millwright's work, engine etc. included'. Other policies two years later indicate that the risks were insured with the Sun and Phoenix Ins.Co. to a total value of £12,300 equally shared. This illustrates the difficulties of relating actual cost to insured values. Each policy included £210 for stocks which suggests that the partners carried the greater part of these risks themselves.
3. W.G. Rimmer op.cit. p.28

profits. The 28 h.p. engine in Mill B was replaced with one twice as powerful, in 1814, at a cost of £2782 and a similar amount was spent on the installation of a gas making plant also. By the time the Benyons withdrew from the partnership in 1803 sixteen acres of land for further development had been acquired for £11,510. The Benyons took out £10,000 in cash and over £2,300 in 'stocks and utensils' when they set up on their own. Their original partnership included Chas. Bage as well as the Benyon brothers. Marshall took one of his managers into partnership, but in turn he left to set up as Hives & Atkinson.

Ard Walker began as tenant of the Waterloo Mill, which had been built by J. Storey, his father-in-law, and on his death Walker, a wine merchant, was one of the trustees, as well as tenant. Walker soon leased the property and commenced rebuilding in 1801, the new mill was insured for £7,500 - 2/3rds with the Sun Insurance Co. and the rest with the Royal Exchange Insurance Co.[1], but the records show that actual expenditure at that time was only £4,000,[2] the 36 h.p. steam engine installed was costed at £362 yet was insured for £900.[3] Although the building and first frames were installed within a year it was three years before all the machinery was in.

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1. Sun CS52/74631(1802) included stocks valued at £300.
2. Leeds City Archives DB23.
3. There were amounts shown as paid to Murray of £700 but this included unspecified items of machinery. Walker's wine and spirit business was insured for £7,000-£8,000 Sun CS65/774591 (1805)

Pym Nevins married a Jowett and set up his Larchfield Mills with the aid of a loan from Jowett in 1790. There is no reference in any mortgages to his partner at the time, William Gatliffe, who was also a partner of Musgrave in Simpson's Fold, but in 1795 Nevins and John Brooke borrowed £2,750 from Abel Smith, the banker. This was probably used to build the mill and buy a Boulton & Watt engine for power.[1] In 1810 Pym Nevins gave his son, John Jowett Nevins, £5,000 on his marriage to Hannah Birkbeck of Settle (daughter of a woollen merchant) and Robert Jowett was a witness to this deed. By 1830 Jowetts were owned £3,500 and this was increased to £9,300 by 1834 when the conversion of the newly-built dry house to a mill by addition of another engine was completed. The estate passed to George Goodman in 1835 on Nevin's death and a part interest at least went to Mary Goodman, with a mortgage to Banks, Beckett and Gott, in 1836, Goodman having paid £15,000 for the property. Part of the land was sold to Robert Wood, machine maker, in 1838 and an indenture of 1840 shows that his partners included J. F. Ogle, Payne & Locke, J.E. Brooke, J. Wilkinson, H. Wood and E. Hemingway. Most of these were well established woollen merchants and it would appear that they provided the bulk of the capital for this textile-machine building concern.[2]

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1. RE 32A/1555019 (1797) Nevins & Gatliff, total £3,300 insured.

2. LCD 18098. E. Hemingway was Nevins' solicitor.

It is perhaps fortunate that before the introduction of limited liability, 'shareholders' were partners and therefore tended to be named in indentures and insurance records, or provided the capital on mortgage. Further examples of the variety of involvement include the Jowetts. Apart from loans to Nevins previously noted they traded as Jowett, Jowett & Birchall, wool staplers, with 3 warehouses next to John Jowett's house in Hunslet Lane.[1] Ben Jowett was involved with Jeremiah Glover, of Stanley, and Samuel Elam, of Leeds, in the operation of a water-powered fulling & oil mill at Heaton Bank, Dewsbury.[2] According to the 1791 Hunslet Rate Book[3] the Elam's owned the scribbling mill (210) run by William Copley, and Ben Jowett owned a brickyard. Another example of the complex trading partnerships of the time involved William Hodgson. He was an iron founder (and scribbler) in partnership with Thomas Rainforth and John Hinchcliffe, on Balm Road (214)[4] in 1796. Earlier he was noted with Israel Burrows, Robert Wilcock, James Sowden and William Burrows at a water-powered scribbling mill on the River Aire[5] and another water-powered scribbling and rasping mill at Dewsbury.[6] In addition Hodgson and Sowden were tenants of a house near

1. Sun CS358/552176 (1789)
2. Sun CS 40/717933 (1801)
3. LO/HU 4 (1791) RV £28
4. Sun CS 11/649650 (1796)
5. Sun CS 343/537499 (1787) (Kirk Ings)
6. Sun CS 359/555025 (1789)

the 'Old Mill' at Holbeck.[1] Rainforth rented a dyehouse next to the Balm Road scribbling mill from J. Ainsley, who became the operator of the iron works next to Jaques & Nell's brewery on Meadow Lane. In 1800, New Mill, Holbeck (15) was owned by Marshland and Lee, let to S. W. & G. Longbottom and J. Bentley.[2] The following year the mill was sold to V. Woodcock, a scribbler[3] but there is no evidence that the tenants changed at this time.

Many scribbling mills were owned by merchants and let to scribbling millers who worked on a commission basis for these same merchants, and others also. The capital investment was therefore spread amongst the millowners (often substantial merchants), the operator (also a merchant) who provided the machinery and other merchants whose wool formed the 'stock in hand', but many of the partners were employed in other trades than woollens.

The picture seems to be that, where today a successful business man might invest in shares in a number of companies other than his own, for most of the period under review this provision of capital, either for diversification or as a temporary home for surplus cash, took the form of partnerships, fully participating in the profits and the risks.

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1. Sun CS 358/550773 (1788)
2. Sun CS 31/699254/5 (1801)
3. Sun CS 38/713813 (1802)
   Sun CS 390/607266 (1792)

Benjamin Pullan, dyer, was a partner in Wilkinson & Pullan, scribblers, between 1792 and 1802[1] then with Poppleton, Pullan & Shaw at Beeston Royds iron works by 1810. In 1817 he had, as had Shaw, set up on his own making steam engines on Low Road, Hunslet. The Pullan family owned land in Hunslet by Jack Lane where the Bowers built their chemical works. The main site was bought from Wm. Varley in 1814 and Pullan had a quarter share in the works valued at £700. He sold out to the Bowers in 1818 for £250[2] and S. Ingham joined the partnership in his place.[3]

The Leeds Pottery showed how complex capital investment could be. The original partners were Humble, Green '& Co.' in 1750. Humble was the Brandling estate agent who was soon replaced by Hartley, under whose management the Leeds Pottery achieved its greatest fame. By 1775 the partnership had become William Hartley, John Green, Joshua Green, Savile Green, Henry Akeroyd, John Barwick, Samuel Wainwright, Thomas Wainwright and George Hanson. In addition to the pottery at Leeds they had a warehouse at Selby and barns at Thorpe Arch,[4] where they ground calcined flints at the mill. With Thomas Bingley, John Bramley and Willoughby Wood they also operated another pottery at Swinton, near Mexborough.[5] John Green was a brewer also[6] and Hartley, Green, Green and Salt acted as trustees for the widow of Joshua Blackburn of Holbeck Moore Mill.[7] In 1825 Samuel

1. Sun CS 52/74692 (1802)
2. LCD 17602
3. LCD 582
4. Sun CS 344/5306338(1787) Sun CS 328/503473(1785)
5. Sun CS 345/530639 (1788)
6. Sun CS 328/505594(1785)
7. Sun CS 357/550882 (1788)

Wainwright took over control of the Leeds Pottery and was followed by S. & S. Chappell in 1839. They financed the pottery by mortgage loans for £40,000, in 1842, from Sir W. Pilkington, C. Dawson, and Harrison, with another £1300 from Charlesworth, the great coal owner. In 1850 Warburton and Britton took over and new mortgages were negotiated in 1863 & 1868. The original loans came from the partners (Warburton was involved in chemicals also) and they were replaced by three separate mortgages, £1000 with Yewdall, £3200 with Brown & Co., bankers, and £13503 with the Middleton Estates. The Brandling estates at Middleton had a chequered history also. C. J. Brandling borrowed £3,000 from Ann Humble in 1815 for 1000years. A further £2,000 was added in 1825. In 1862 F. W. Tetley, the brewer, bought the estate for £100,000 and paid off the mortgages. This must have stretched his finances considerably since there was an active redevelopment programme at the Salem Place Brewery at this time and so Tetley, Rhodes, March and Maude borrowed £24,000 @ 4½% and then £16,000 in 1865. In 1867 they formed the Middleton Estates & Colliery Co. Ltd. - almost thirty years before the brewery went public.[1]

The mortgage method of finance was popular with smaller concerns right up to the end of the century and frequently a bank provided the capital. The National Provincial Bank

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1. LCD 3246 Middleton Estate Mortgage lists.

foreclosed on R. & J. Barton in 1888.[1] When the 'Thomas' Malthouse was sold by Pearson's heirs in 1897 to G. Aspey, oil merchant, for £2615, he took out a mortgage for £1500 with them at the same time.[2] This was a popular system since it provided some capital for immediate use as well as an income, from the interest, for the estate.

By 1914 the majority of concerns which had any significance in their own sector had become limited liability companies. Even firms such as Grisdales, the tallow candle makers, had become J. Grisdale & Son Ltd. (Kelly 1914) but it seems that this process of incorporation had only really developed after 1907, possibly as a consequence of the Companies Act of that year which, for the first time, created a distinction between public and private companies. Many of the old established family firms were slow to adopt limited liability yet the scene was full of unexpected contrasts. In the clothing trade Wm. Blackburn & Co. were already a limited company, yet their larger neighbour, Joseph May & Sons, were not incorporated until 1914. By 1910 most of the important clothiers south of the river were limited companies, as were the majority of engineering concerns, where the only leading firm to remain completely in private hands was J. & H. McLaren at the Midland Engine Works, who were incorporated during the war period.[3]

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1. LCD 15830 Corn Mill, 20 Wortley Lane (9)
2. LCD 4871 Thomas Malthouse (19)
3. Based on analysis of Kelly's Directories 1906/7/14 and the Leeds Chamber of Commerce Year Books 1910/13/20. R.C. Depression of Trade (1885) Q 6331 Leeds ... very few ltd. cos.

The value of a business, including an element for goodwill, is fundamentally what it will actually fetch on the open market, and such a sale is subject to a variety of factors of an ephemeral nature, as anyone familiar with the vagrances of the stock market will know. In a similar manner the valuation of a property, unless tested on the market, can only be hypothetical and based on a comparative analysis. For example, a leading valuer placed a figure of almost £7,000 on the Meadow Maltings in 1889, but Tetley bought it for £5,700[1]. Another maltkiln, noted above, for which G. Aspey had paid £2,615 was valued at just over £1,800 a year later by the same valuers, yet B. Chapman, who had sought the appraisal, paid over £3,000 for the property in 1899.[2]

Probably the biggest industrial unit south of the river after the closure of the Marshall flax spinning business was the Steam Plough Works which had become 'John Fowler (Leeds) Ltd. after Fowler's death. Heppers were engaged to value Fairburn, Lawson & Co. prior to their merger with Coombe, Barbour & Co. They based the valuation of the Wellington Street works on a direct comparison with Fowlers, and on this basis assessed Fairbairns at 15s 7d per sq yd for the land and 26s 10d for the buildings. Fowlers were slightly lower for the land, at 12s, reflecting the

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1. Leeds City Archives, Hepper Collection VB 23B pp 117-9.
2. Leeds City Archives, VB 270 pp 139, 140, Valuations for B. Chapman (1899).
   LCD 4871. Chapman raised a mortgage of £2,000 with Jabez Woolley.

different locations, but higher for the buildings, at 29s 9d. Using these figures the value of Fowlers premises were £55,486 and the site itself £21,140. Thus, apart from fixtures, fittings, stocks in hand and goodwill, Fowlers were worth over £75,000. The value of the plant and stocks could easily double this figure so that the total value of the firm would be nearly a quarter of a million pounds in 1900[1] as a going concern. Since the valuation of property and businesses is a complex art, rather than a science, it is not proposed to develop this aspect further.

1. Leeds City Archives, VB 270 pp 191-201 (1899)

CHAPTER 22

INDUSTRIAL BUILDINGS

The basis of this study of industrial development in "Transpontine Leeds" has been the development of the various sites from 1800 until 1914. For the purposes of this survey the definition of Industry used has been "production, or manufacture, based upon the use of power". This definition excludes handicrafts but includes the use of power as heat energy in distinctive premises. Thus the farrier or shoeing smith is excluded, along with the hand weaver and the cropper but the brewer, maltster and dyer are included. The problem areas involve builders, who were still basically craftsmen, but became 'industrial' when they installed a steam engine in their yard to drive saw mills, and in extreme cases, where a wind mill was used to power sawing machinery.

In order of introduction the water-mill followed the animal-powered wheel. There were examples of horse-mills being used south of the river for malt-grinding, tobacco mills and oil crushing but they were hardly significant developments.[1] Water wheels were generally of the over-shot or breast wheel pattern so that a mill needed a system of goits or leats to bring water to the wheel and then to take it away again to prevent 'backing up' and a

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1. Horse driven malt mills were used at Moorside and Low Road.

consequent loss of power. In order to provide a head of water, rivers were dammed and reservoirs constructed to ensure as far as possible a good and steady supply of water. The oldest mills were corn mills and the prime examples in the area were Millgreen Mill at Holbeck and the Hunslet Soke Mills. Because there was sufficient power, fulling stocks were added, in the tradition of the first fulling mill of the Knights Templar at Temple Newsam in 1155. The Soke Mills were able to draw on the main river for water but at Millgreen there was a lengthy goit leaving the Low Beck nearly ¾ mile above the mill and returning ½ mile below the mill in order to obtain a good head of water for the mill wheels. Almost immediately opposite the point where the tail goit entered the beck another 'goit' led away and was known as the Benyon Beck. It is clear from the 1768 Rate Map of Holbeck[1] that this stream existed then and the details of the site of the Co-op Flour Mill (36) shown on the Round Foundry Estate Sale Plan of 1848 suggest that this site may have originally been that of a water-mill. The Balm Beck powered a water mill, later called the Waterloo Mill (134) which Ard Walker rebuilt in 1801 and the work included cleaning out the reservoir behind the mill dam.[2]

Windmills as a form of power are normally associated with

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1. Leeds City Archives DB/M 150

2. Leeds City Archives DB23 (1801)

corn milling or pumping water but the Leeds Pottery used a tower mill for grinding calcined Kentish flints from 1750 until 1775 when the operation was transferred to a water mill at Thorpe Arch, the windmill then being retained to grind corn for another half century.

The introduction of the fulling mill in the twelfth century was the first application of power to the manufacture of woollen cloth and the next development was the use of scribbling and willeying machines towards the end of the eighteenth century. These used very little power and were added to existing fulling mills. Rogerson of Bramley built a fulling/scribbling mill as described in his diary for 1808/14.[1] It is at this stage of 'factory evolution' that the relationship between structure and use becomes important. The weight and vibration of working fulling stocks required a firm foundation but the new machinery needed no more than a normal floor to stand upon: almost any attic floor would suffice.

Early Textile Mills

Both Dr. Stanley Chapman and Dr. Jennifer Tann have written extensively on early factories, especially cotton

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1. W. Crump (ed.) 'The Leeds Woollen Industry 1780-1820' Thoresby Society XXXII (1931) pp 77 et seq.

mills.[1] The design of these cotton mills seems to have followed that of the first Arkwright mill at Cromford, Derbys., built in 1777. This was several storeys high and thirty feet wide. Subsequent cotton mills took this width almost as a standard and varied in length from seventy to two hundred feet. This standard width is generally attributed to the need to provide good light, for a greater width would lead to insufficient light in the centre. Fieldwork in various parts of the country shows that wider mills were built by 1790 so that good natural lighting was not a major factor of design. Structural requirements were perhaps more important. The main loading was on the walls and a thirty foot long beam was about the limit which could be easily obtained in a substantial cross section. Thus this became the optimum span usable. After 1800 there was an increased use of cast-iron for supporting columns and beams so that wider factories were built with one or two rows of columns supporting the floor beams. In this, the work of Charles Bage, of Shrewsbury and Leeds, played an important part. He built a fire-proof flax mill at Shrewsbury in 1796, and then built a cotton mill in Salford, followed by another cotton mill for Jebediah Strutt at Belper, a few miles south of the Arkwright mills at Cromford. In 1803 he joined the

1. S.D. Chapman 'Fixed Capital Formation in the British Cotton Industry 1770-1815' Econ.Hist. Review XXIII (1970)
J. Tann 'Industrial Archaeology and the Business Historian' Business Archives 31 (1969)

Benyon brothers in their new flax-spinning business on Meadow Lane and designed a fire-proof mill to his new theory of beam loading and design. Previously he had based his designs on Galileo's theory of 1638:

$$\text{Strength} :: \frac{\text{breadth x depth}^2}{\text{length}}$$

and used cast-iron beams as if they were timber baulks. This added needless weight to the floors, used an excessive amount of iron and required very substantial walls to carry the loading. By the time he came to Leeds he had evolved a new theory of beam strength:

$$\text{Strength} :: \frac{\text{flange area x depth of web}}{\text{length}} \quad \text{(i.e. a T-section beam)}$$

Benyon Mill was built in the form of an inverted L-shape with a 50 h.p. Fenton engine at the southern end. The dressing mill was five storeys high, 157 ft long and 36 ft wide, the heckling shops were four storeys high, 120 ft long and 27 ft wide. Cast-iron beams were used which were 9 ft long, 12 inches deep, with a 1½" flange, capable of carrying a load of 25 tons with a safety factory of 3x. Between the beams were shallow brick arches and the beams were supported on rows of star-section cast-iron pillars. In order to reduce fire-risks even more the roof trusses and window frames were also of cast-iron, almost certainly cast at the Round Foundry which had been opened the previous year.[1] Although this mill is technically important it would have won no prizes for architectural merit, being of plain brick and slate with the windows composed of small panes. Nothing survives of this mill which was demolished and replaced by the "Holbeck Woollen Mill" in 1875.

The oldest surviving mill south of the river is probably Water Hall mill which dates from either 1808, when Titley, Tatham & Walker bought it from Kaye, a canvas maker, or from 1813 when they added a 50 h.p. Fenton engine. Pym Nevins installed a 16 h.p. Boulton & Watt engine in his Larchfield mill in 1796 and added a 16 h.p. Pullan engine in 1818 when mechanical cloth dressing was introduced. The design of both these mills is similar, stone walls and Bramley Fall slates on the roof. It is difficult to see them since they are surrounded by later buildings which hide them away. From the records of Ard Walker's cotton mill it is clear that the existing water-mill had a steam engine added in 1795 to pump water back to the dam. This was almost certainly one of the Newcomen-type engines which

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1. LI 6.4.1807 "Cotton Factory for sale ... lower floors supported by iron pillars, the Window Frames are all arched with Brick, and Window Frames of Cast Iron". This was Musgrave's Cotton Mill rebuilt in 1806 after a fire. It was 4 storeys high, 84 feet long and 34 feet wide with a 10 h.p. engine.

were widely used in the district for pumping water from coal mines, and were considerably cheaper to install and run than a rotative engine.[1] In 1800 it was decided to reconstruct the mill and rely on direct steam power. The main building took a year to complete, including ten sets of spinning frames from Longbottom, near Halifax. Ard Walker directed operations and employed a stone mason, who seems to have acted as an architect, since there is little mention of building stone in the records. Nearly everything was bought in and apart from his own men he employed 'labour only' contractors for most of the specialist work. Wm. Farmery, spindle maker, built several more spinning frames, no doubt to the same design as those already installed, from parts supplied by Walker. Fenton, Murray & Co. supplied the steam engine but the boiler plates came from Shaw's Hunslet Forge and the boiler itself was built by Ben Pullan of Low Road, Hunslet.[2]

Much of our knowledge of these early textile mills is drawn from insurance records and Dr. Chapman has expressed

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1. Millgreen Mill also had an engine of this type. LM 4.6.1804. Analysis of insured values of engines c1800 and known 'throw back' Newcomen or Savery type engines suggests that engines valued at under £300 were 'throw back' types to supplement water power.
2. Leeds City Archives DB23. Accounts for the building of a cotton mill (1801-05).

concern that these valuations of invested capital omit the ancillary mill dams and goits, since they were fire-proof like the actual site of the mill itself. Most policies refer to the building, clockmakers' gears, i.e. the machinery, and millwrights' work, i.e. driving shafts and gearing. From these records there appears to be no evidence of power-spinning of wool before 1815. Gott's Bean Ing mill and Benyon and Tatham's flax mills all used hand looms for weaving and most woollen yarn was spun by hand on the 'great wheel' or on a hand powered jenny.[1]

The shape of these early textile mills was related to the transmission of power by shaft drives and pulley belts to each machine. This may be seen as deriving from the corn mill with a drive from the wheel to a vertical shaft and then through more gears to horizontal shafting on each floor. Because of this, the engine in the Benyon mill was located at the end of the main spinning block, where the power was used: the heckling sheds at the opposite end still relied on manual labour until the 1820s. Similarly, the weaving sheds, which were built soon after the dressing mill round the perimeter of the site, were for hand looms and there was no provision for power in the lay-out adopted.

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1. Pym Nevins' Larchfield Mill had spinning and weaving shops but power was only used for fulling, raising, sheering, scribbling and carding in 1820. Sale Notice 1820.

The design of the small mill appears to have been secondary to its function. There were advertisements in the newspapers round about 1800 for 'Corn mill, suitable for conversion to a cotton mill' and a speculative builder put up a mill in Leeds 'Suitable for an iron foundry, cotton mill or tobacco manufactory'.[1] This versatility of use may have been due to an increased employment of cast-iron beams and columns in factory building, which led to floors capable of withstanding heavier loadings.[2] Such a building might serve very different trades over the years without the need for expensive reconstruction. The clothing industry took over many old flax mills in the 1890s. The rising chromo-lithographic printing trade took over old mills and replaced the fulling stocks with their heavy printing presses and used the upper floors for the lighter collating and binding machinery, or for storage, in the last quarter of the century.

Many textile mills built before 1850 had power loom sheds added in the 1860s. Considering function in relation to design, the large woollen mill used self-acting mules for spinning; with these machines there was a relatively light floor loading since the mule carriage travelled in and out,

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1. LM 4.6.1804 '... the building ... may be, at a small expense, converted to a Corn Mill, Scribbling Mill, Factory or Foundry'
   LI 14.6.1785 Nether Mills, open to improvement, cotton, corn, wool, wood, oil or iron slitting.
2. LM 6.4.1807 Lot 1. Cotton Factory, iron pillars ... window frames of cast iron.

taking up a great deal of space for their weight. Normally one man looked after a pair of frames so the optimum lay-out for a spinning mill was a long multi-storey building wide enough for two sets of mule frames with a walk-way down the centre. At full-stretch the frames ran out to the centre and when wound back the weight would be concentrated near to the walls. From the late 1830s rotary milling machines began to replace fulling stocks. These also required substantial foundations so that they replaced the stocks in the mill basement.

The new power looms were much heavier than the wooden framed hand-looms. To meet this floor-loading and to provide good light, loom sheds were normally single storey with north-light roofs and covered an extensive floor area. Such buildings had a high potential for conversion at a later date to engineering workshops.

Clearly, the need of some industries was for strong floors capable of carrying the weight of heavy machinery, which became heavier as the years went by, and they had little use for multi-storey blocks except for offices of varying types. This meant that such industries required extensive sites which cannot normally be had cheaply enough in the central area. This 'rent-gradient' can be seen in central Leeds where the multi-storey offices of the banks and insurance companies occupy the streets around East Parade. There are some old mills near the city centre but they were built when the area was still undeveloped in past years.

In Hunslet several good sites came on to the market in the 1860s with the sale of the Denison and Goodman estates, off Hunslet Road towards the river, and these were quickly taken up by engineering concerns needing relatively extensive sites.

There are many other factors affecting the siting of a works and these have already been dealt with earlier. The "Spanish Leather Works" closed down and was replaced by a new works at Meanwood because of technological changes in the industry. In the 1860s the use of mixed tannage and hot liquors led to a greater throughput in tanneries and so much more water was used than the Daw Beck could provide. More of the work was carried out indoors so that the new tanneries were built to meet these new requirements. Another industry where technological change led to a new building style was brewing. The original Sykes' brewery in Salem Place was a single storey range of buildings when Joshua Tetley rented it in 1823. In the 1860s the development of the Yorkshire Square system led to the building of a new tower-type brewery. Most breweries built after 1860 were tower-type but there has been so much further development recently that the tower of Tetleys is difficult to see. In glass making the traditional cone of the glasshouse was replaced by the Siemens continuous gas-fired furnace in the

1880s and once again the shape of the glass works changed to reflect internal technical changes.

It seems that Marshall was the first industrialist in Leeds to employ an architect, the Temple Mill (1840) and offices (1843) were designed by Ignatius Bonomi in the Egyptian style; this may be traced to the Napoleonic invasion of Egypt before 1800; or to his brother, who was an Egyptologist. Bonomi's railway stations show no such influence however, so it is possible that Marshall suggested the Egyptian motif. The Temple Mill is an interesting building with its 66 conical rooflights and a roof supported by cast-iron pillars which double as drains to carry off the roof water. The roof itself was covered with a thick layer of soil for insulation and in a short time grass grew on this. The story that sheep were grazed on the roof is probably apocryphal.

Few industrial architects are known from this period and there were no more Egyptian-style mills built. Nicholsons, the building contractors, began in Hunslet in 1822 and, apart from banks, built Tetleys, the Midland Goods Station at Hunslet, Alf Cooke's and many other industrial buildings in the district in a variety of styles.[1] Not all were as ornate as Alf Cookes, which was based on the Regency Aquarium at Brighton. It is felt that Cubbit's King Cross Station was a more important influence that Broderick's

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1. City Engineers (Factory Plans) 1870-1914. Architects submitting plans included J.Ambler,G.Smith & Son,Wilson & Bailey. Contractors included Nicholson and Benjamin Woolley

Town Hall and Corn Exchange. There seems to have been a close relationship between the social status of the owner and the design of his new works. Marshall was the Prince of Flax-spinners, his mill complex was the largest in the world by 1840, he was an MP, and so his new mill had to match this status. Colonel Harding had become a local worthy by 1864 so when he developed his hackle & gill-pin works on Globe Road he employed Thomas Shaw to design an ornate chimney based on the campanile at Verona. In 1889 a bigger tower was built over the boiler house to extract dust; this too was modelled on a church tower, in Florence. At the base there are a series of portrait medallions and the main entrance gates are comparable with the west doors of a cathedral or a modern city bank.

Industrial building in Leeds south of the river has produced many fine, well-proportioned buildings, usually in a severely utilitarian style, but frequently relieved with decorative string courses, or dog-tooth borders, and restrained door frames and porches in a sound classical style. Many were built specifically for one industry, such as the large lofty halls needed to assemble engines, boilers and other large machines for which Hunslet engineers were noted. There are no examples of the enormous textile mills built towards the very end of the century, like Hardwick Hall 'more glass than wall'. These had a central 'hall' to accommodate the pulley drives to each floor from the great horizontal mill-engine, which replaced the vertical shaft drive already noted as normal in Leeds.

The majority of works were not specific and have had various users over the years. The first Congregational chapel in Leeds, built in 1758, had become a small tannery by 1817 and in more recent years a mission hall on Czar Street has become a brass foundry. The Round Foundry built by Matthew Murray in 1802 was destroyed by fire and the Victoria Foundry was built on its site. Titus Salt's Hunslet Foundry, now Denisons, has not a pre-war building left on the site and most of Salt and Kilburn's buildings were replaced by new ones built by Nicholsons in the 1890s.

Not all of the mills in Hunslet and Holbeck were 'dark, satanic', neither were they palaces of industry. Chimneys blew down in gales, mills caught fire and the Hunslet Flax Mill, on Goodman Street, was the centre of a cholera outbreak in the 1840s. Whilst the small flax mills adapted from existing houses were poor the working conditions in most mills were far superior to those obtaining in the cottage workshops of the time.

The majority of sites have been extensively redeveloped over the years, and increasingly cleared completely away to be replaced by new development which has obliterated the original street plan completely. Fieldwork has played an important part in that it has been invaluable in showing the size of a concern, which other sources have not revealed, such as the generally small size of brass foundries and the unsuspected capital investment in new premises on an older site towards the end of the nineteenth century.

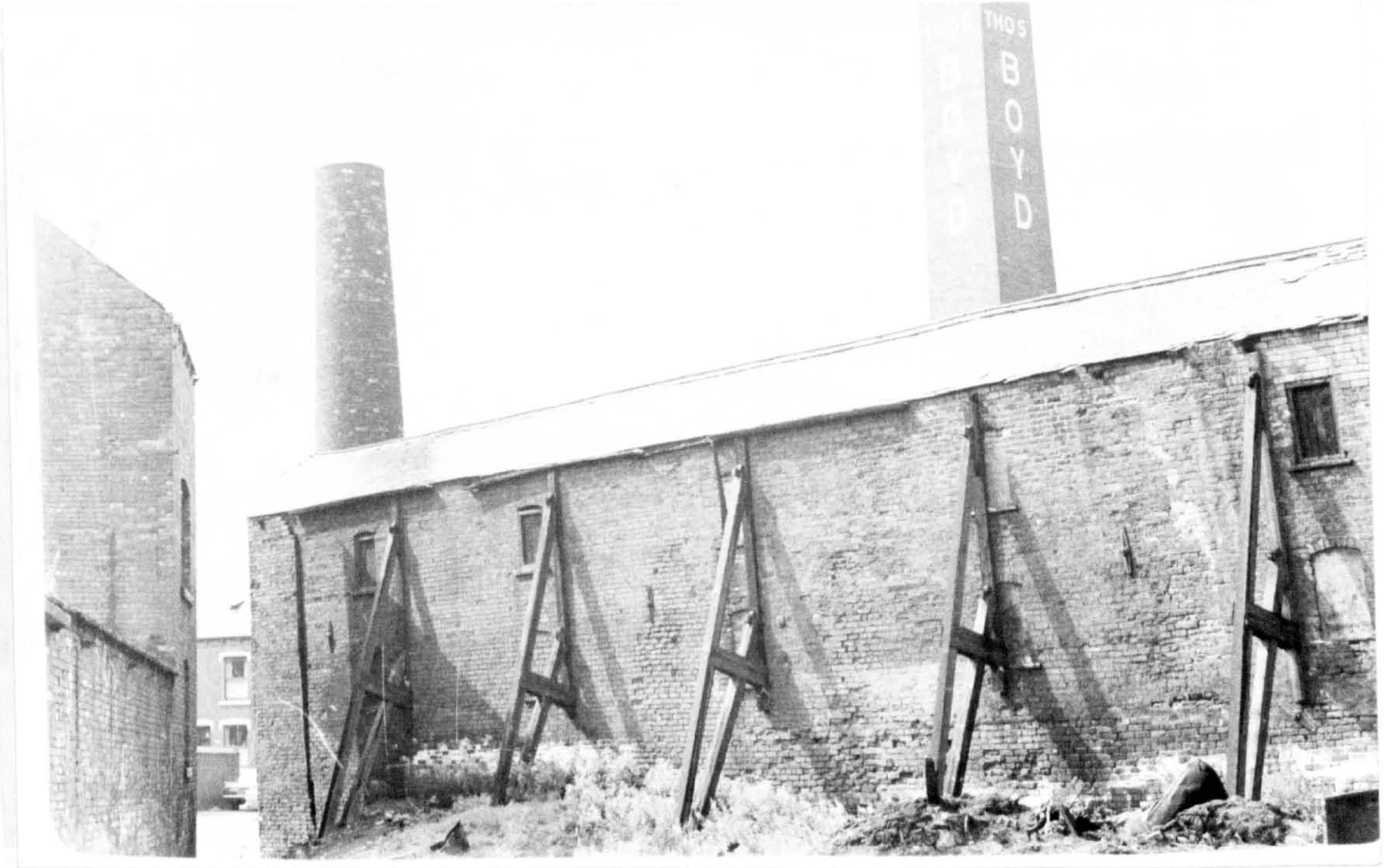
A SELECTION OF PHOTOGRAPHS of INDUSTRIAL BUILDINGS

(Part of a record of buildings carried out with the aid of a Kodak Award)

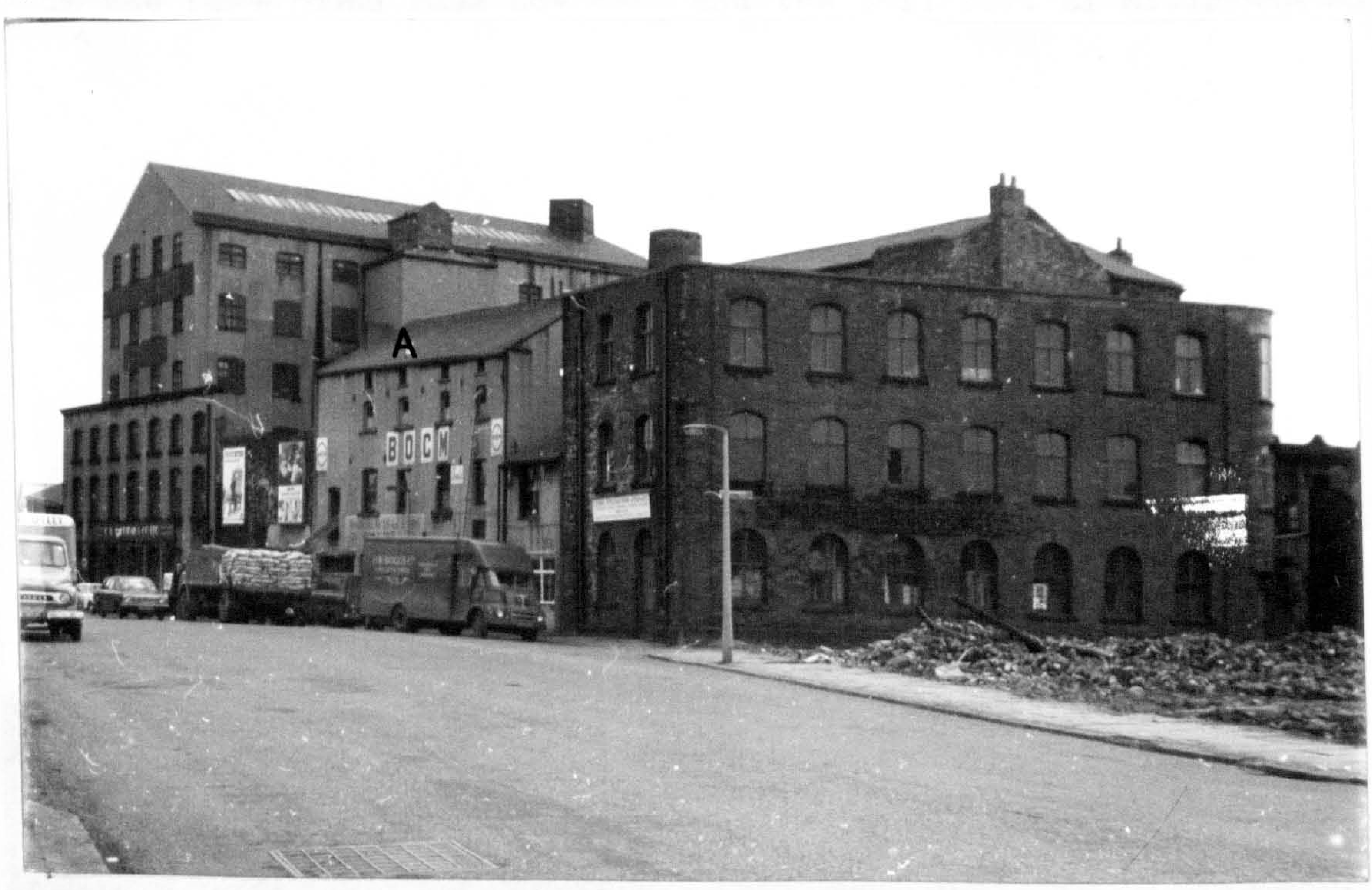
WOOLLEN MILLS

1. HILL'S YARD Before demolition this was used as a glass store. Its probable origin was pre-1800 and would have been press, packing, cropping and burling 'shops' of a woollen merchant.

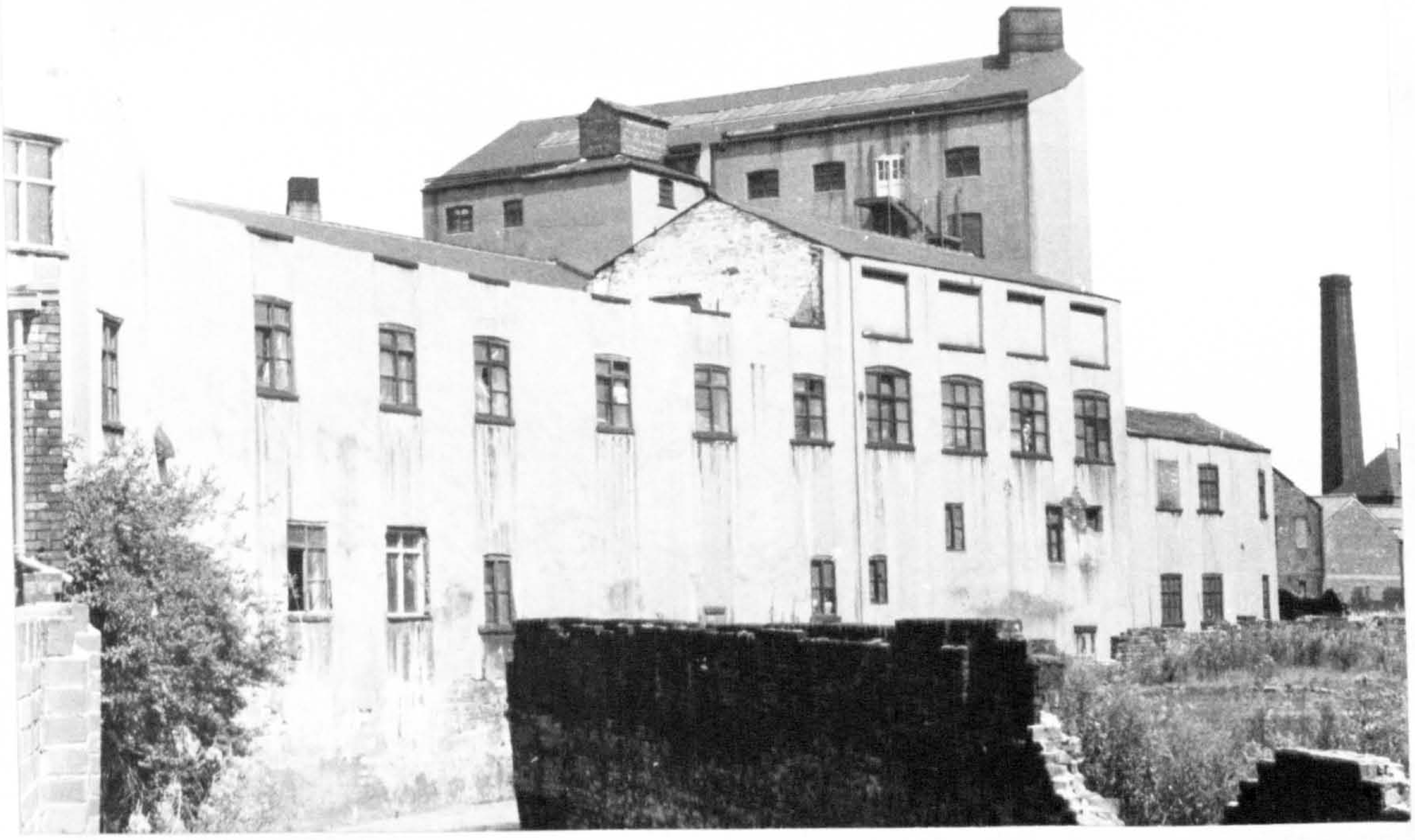
2. LARCHFIELD MILLS (152) Built for Pym Nevins in 1796 as a scribbling mill, of stone with Elland slates. Three storeys high, eight bays.



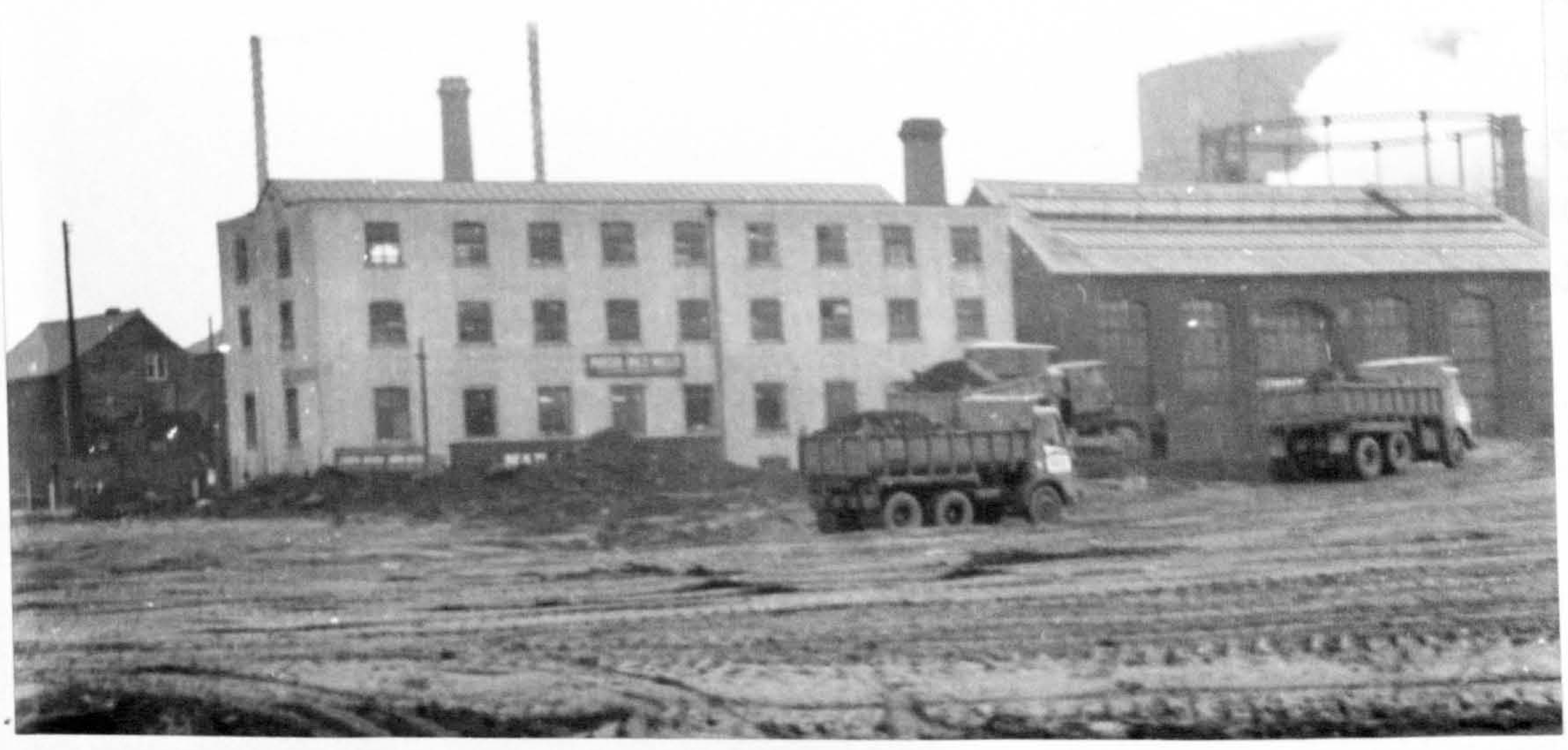
3. VICTORIA MILLS (17) In the foreground Richard Atkinson's mill of 1803 has the squat, round chimney of the period. Behind is the taller, square chimney of Thomas Boyd's dressing mill, c. 1880.



4. NEW MILLS (14) In 1800 Marshland and Lee insured a scribbling mill with engine. This seems to have been the corn merchants (A). It is four storeys high and the squat, round chimney can be seen rising behind the much later Braithwaite Street frontage, c. 1860.



5. NEW MILLS (14) The main block, a cloth dressing mill, was built by Richard Nussey in 1839. The roof-lights of the Burling Shop can be seen with the chimney enclosed within the body of the mill. In the foreground runs Low Beck and the tail goit of Millgreen Mill flows between the original mill and the beck.



6. POTTERDALE MILL (124) Built in 1823 as a dressing mill and dyehouse. There has been little structural change except for the insertion of larger windows. Three storeys high, nine bays long and two bays deep.

7. PERSEVERANCE MILL (67) J. Charnock built this as a dressing mill in 1839 on the site of an earlier foundry. By 1866 it had become Gillam's Trafalgar Iron Foundry. The small-paned, cast-iron framed fireproof windows are the originals but the chimney is of a later date.

8. ORCHARD STREET MILL (204) Built in 1860, it became a woollen mill in 1875. The north-light roof structure shows in the partly-cleared interior. The tall, round chimney and large windows contrast with Larchfield and Victoria Mills.

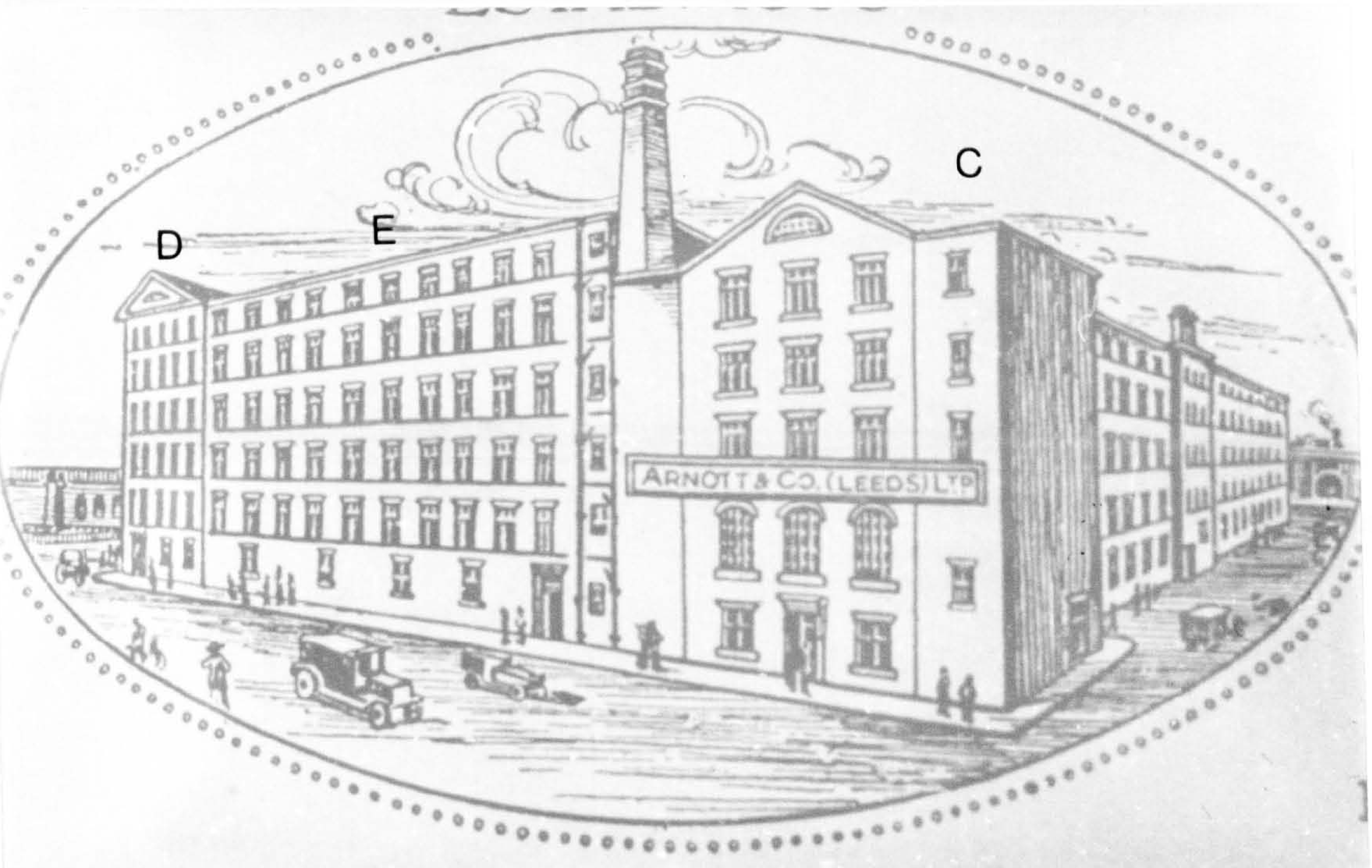
9. HOLBECK MILLS (50) Built on the site of Benyon's flax mill in 1875, the entrance was all that remained of Ibbetson's woollen mill.

CLOTHING WORKS

10. BLACKBURN'S CLOTHING WORKS (12) This was in use by 1906. The cutting rooms are on the top floor and the roof lights can be seen. The design of the entrance based on round arches, with the top floor windows in small pairs over single windows below, is fairly common after 1890. The Springwell Street front is attractive with bays of four windows separating the round-headed features.

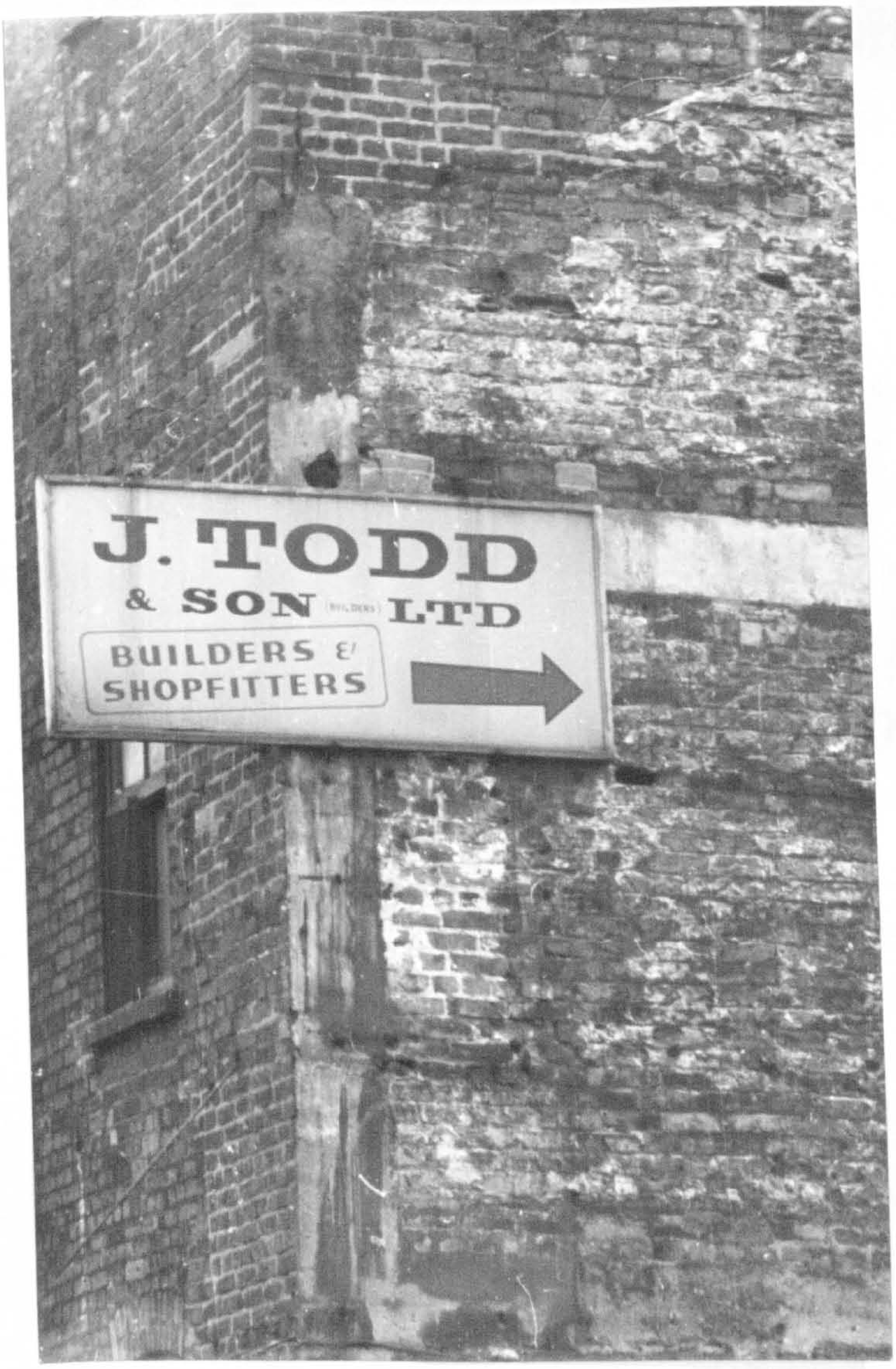
11. CWS CLOTHING FACTORY (105) This was built about 1900 on the site of an earlier woollen mill. Features typical of the larger works include the four storeys height, large windows, the water tank and the tall, square chimney with the name inset in white brick.

12. MAENSON CLOTHING WORKS (11) The entrance is clad in Burmantofts terra-cotta and in the shields is the date 1907. The higher standard of finish reflects the quality of the products. The series of rounded gable-ends conceal north light roofing of the cutting rooms.



13. MARSHALL'S MILLS D, E & C (29) The illustration is from an advertisement in the LCYB 1920. Mill C was built in 1817, 12 bays long, 5 storeys high, with a staircase block of two bays which projects in the centre. Mill D was built in 1826, 6 storeys in height but shorter in length. Mill E filled the gap in 1830 and is built in the same style as Mill D.

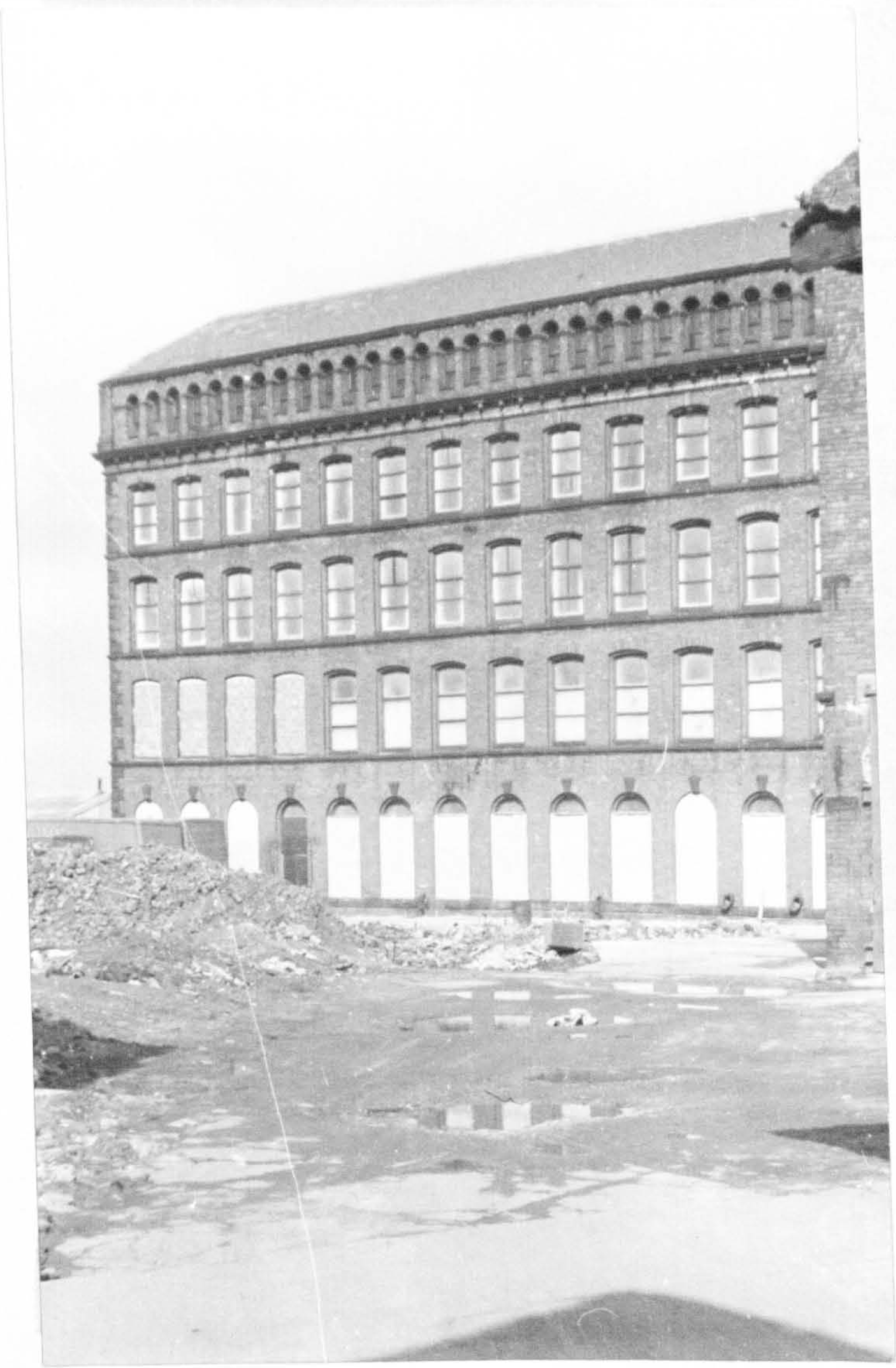
14. The ground floor of Mill E has half the number of windows of the upper floors. Under these alternate windwos there are inverted brick arches whose function is to spread the load more evenly on to the foundations. This is feature found in other buildings in Leeds, but it seems rare elsewhere.



15. The end of the workshops built in 1817 was cut away in 1890 to give better access to Mill C and to form Union Place.

16. TEMPLE MILL & OFFICES (30) The Mill was built in 1840 and the Offices in 1843. There are six recessed Egyptian lotus columns, the spaces between, to half way up, filled in "a la Dendera".

17. BALM ROAD FLAX MILLS (214) The entrance and range of buildings facing on to Balm Road date from 1826. The style of the gateway is found on other mills built at the time. The 26 bays of the three storey block support the impression that a 30 ft. span was the reasonable maximum and extra space gained by increasing length.



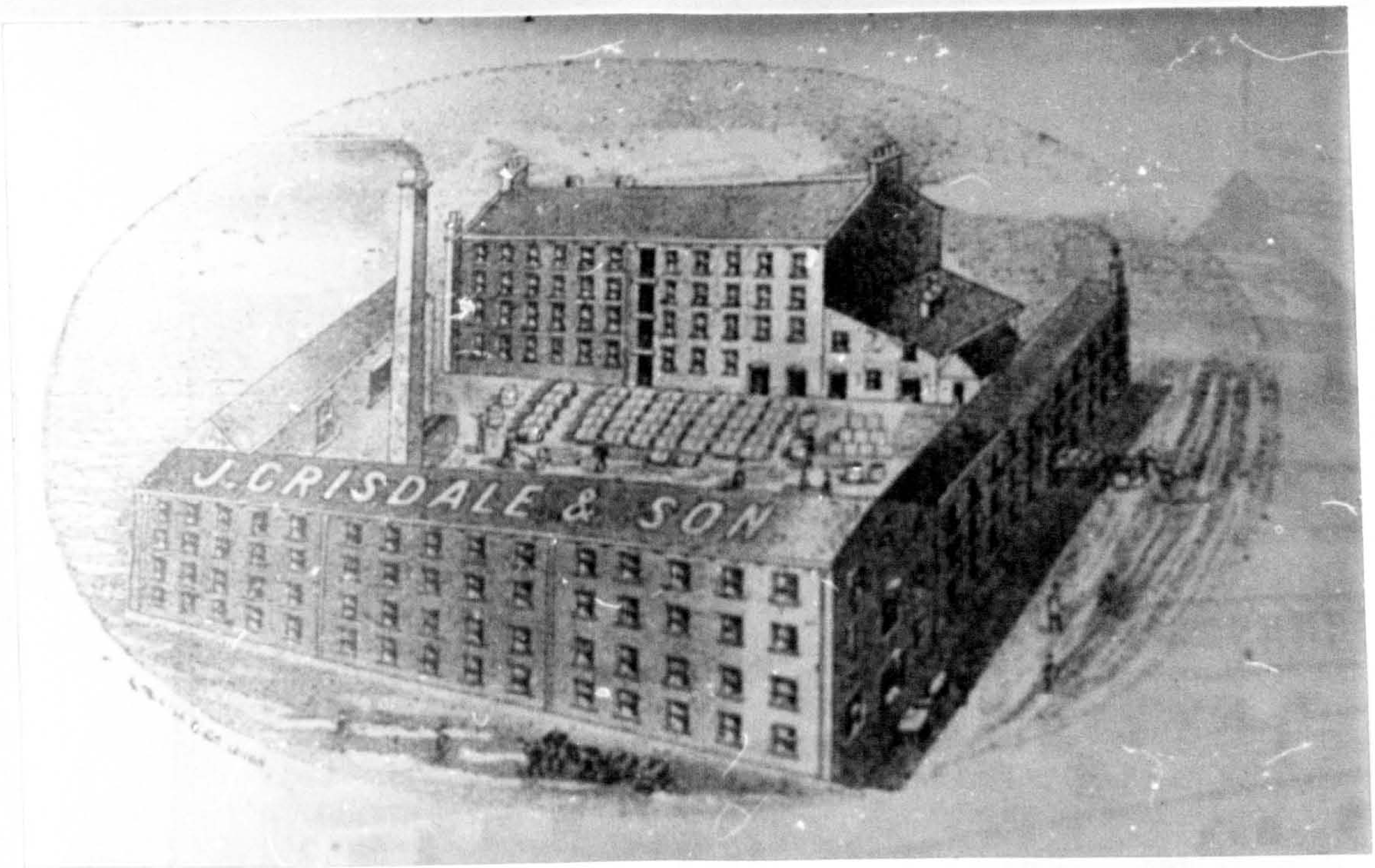
18. To the rear of the site rises a five storey block, c.1880. The style is not uncommon in Leeds. The larger windows giving more light into a deeper building, the small round-headed windows of the top floor contrasting with the bigger ground floor windows. It is thought to have been built by Nicholson from the style.

19. CROFT STREET MILL (58)
Thomas Land's fireproof flax mill was built by 1829 when this part was let as a bobbin mill. It is three storeys high, two bays deep and six bays long, with a square chimney, loading doors on each floor and small window panes set in cast iron frames. The top half of the upper windows open by sliding sideways (Yorkshire casement).

20 QUEBEC WORKS (113) This was originally an iron foundry but the Dockray family turned to flax spinning and built this mill in 1875. After two years it changed to other use until 1912 when it was bought by the Waites who continue to make twine there. Even in the 1870s. the need for day-light and floor support continued the tradition of long, narrow mills.

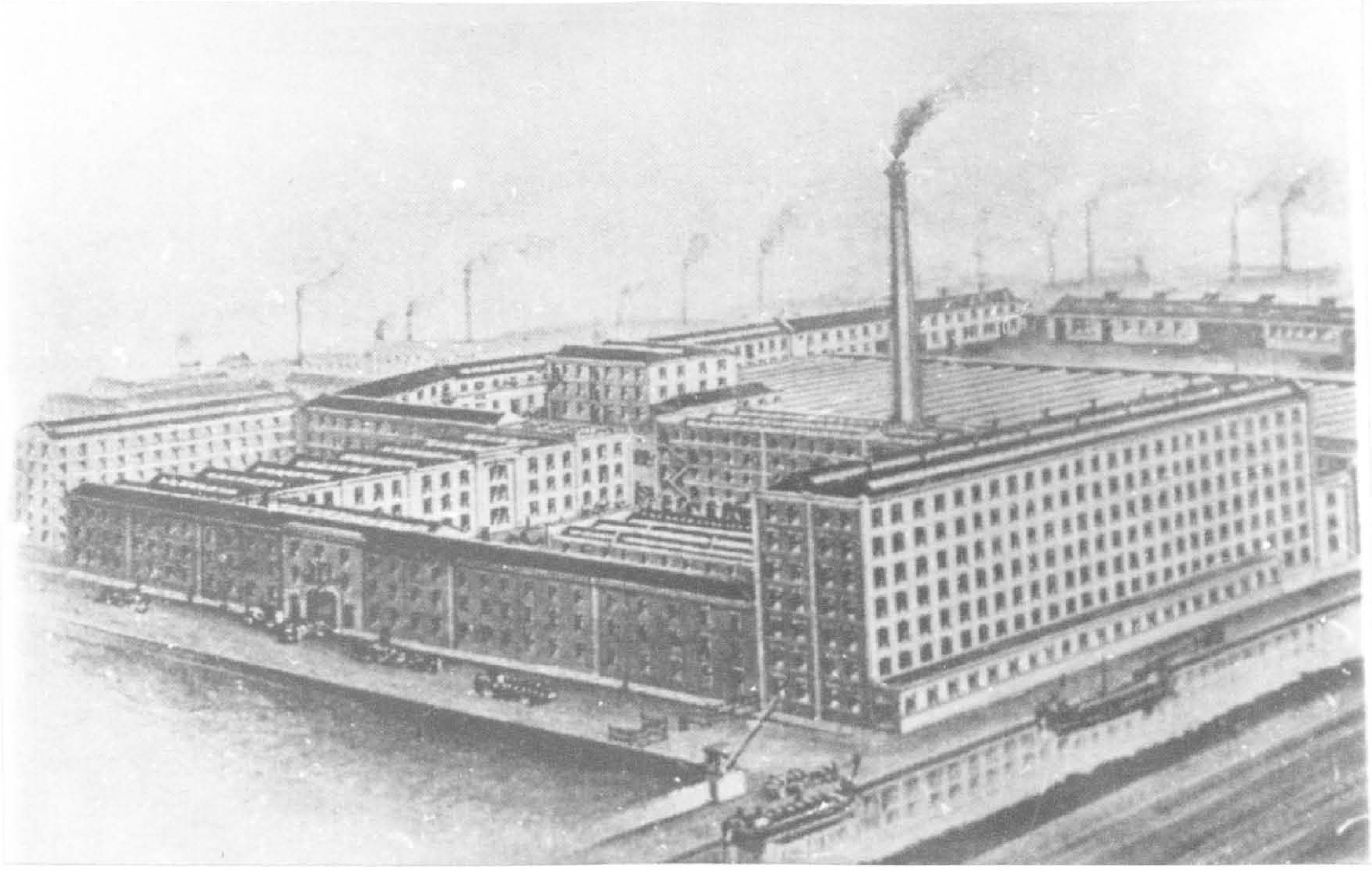
21. HUNSLET SHED (189) The key-stone of the door arch dates this 1872. It was built for Alexander Patterson who was finding the Trafalgar Mill too small. It consists of a 13 bay three storey block and a 12 bay two storey block. The former became a clothing factory and the latter Charles Lightowler's printing works, about 1900. The stone string courses emphasise the height of the middle storey.

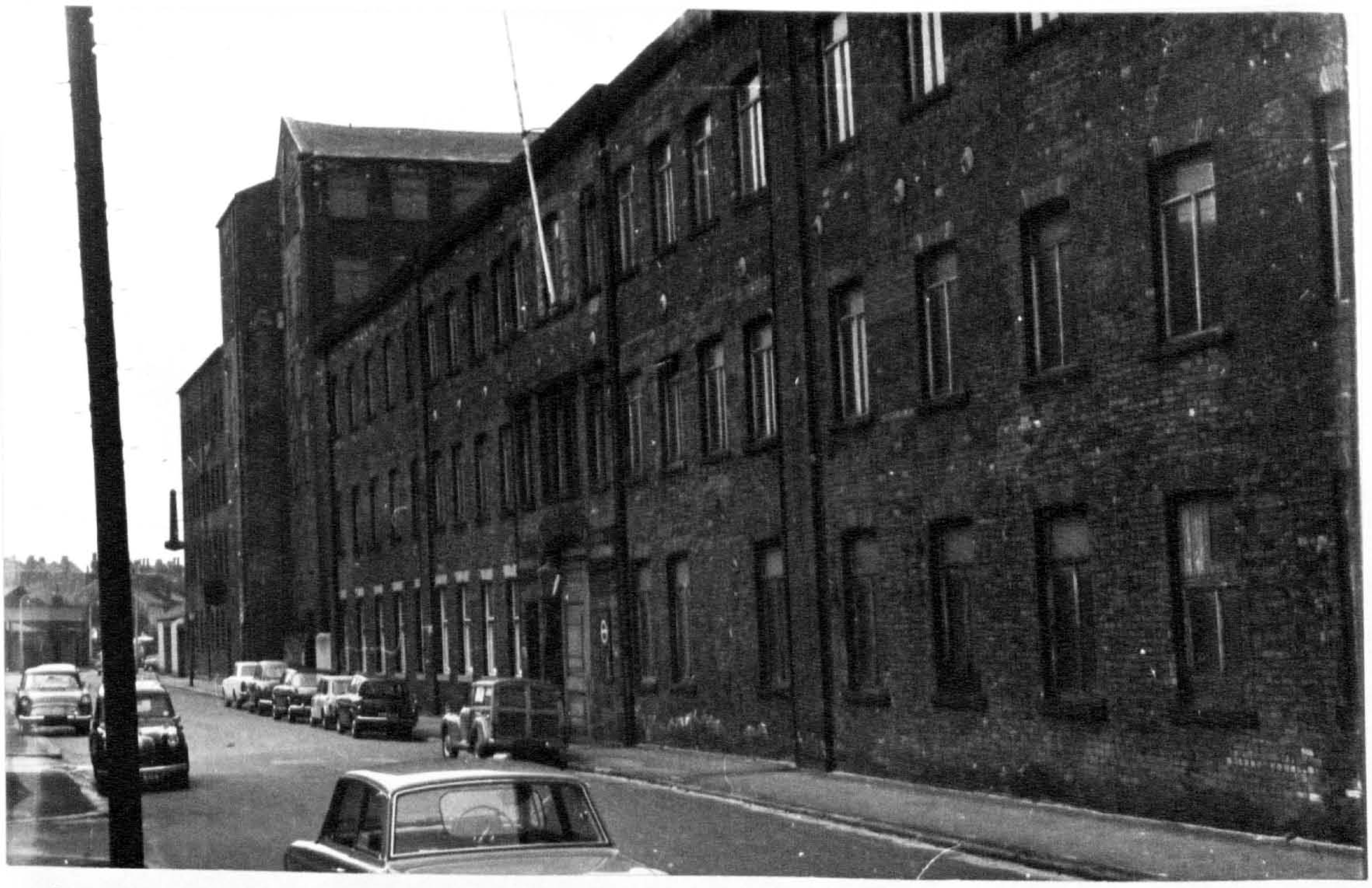
22. HUNSLET LINEN WORKS (173) This was the new works for R. Buckton and Son built in 1865. It shows the north-lighted weaving sheds housing 300 looms and the frames for bleaching the canvas. The enclosing wall is composed of recessed panels with a neat dog-tooth moulding of brick. (From LCYB 1910)



23. WATER HALL MILLS (40) The earliest factory on this site was built in 1788 but most of what is shown here (Century's Progress (1893)) was said to be "over fifty years old". The block in the background possibly dates from 1808 and is still standing. The remainder is almost certainly from c.1840, a period of expansion in the trade when many new flax mills were built.

24. WATER LANE MILLS (41) These are basically as built for E. Briggs in 1835. The small chimney in the gable end indicates the use of a small stove for heating. The main block is four storeys high and 14 bays in length.



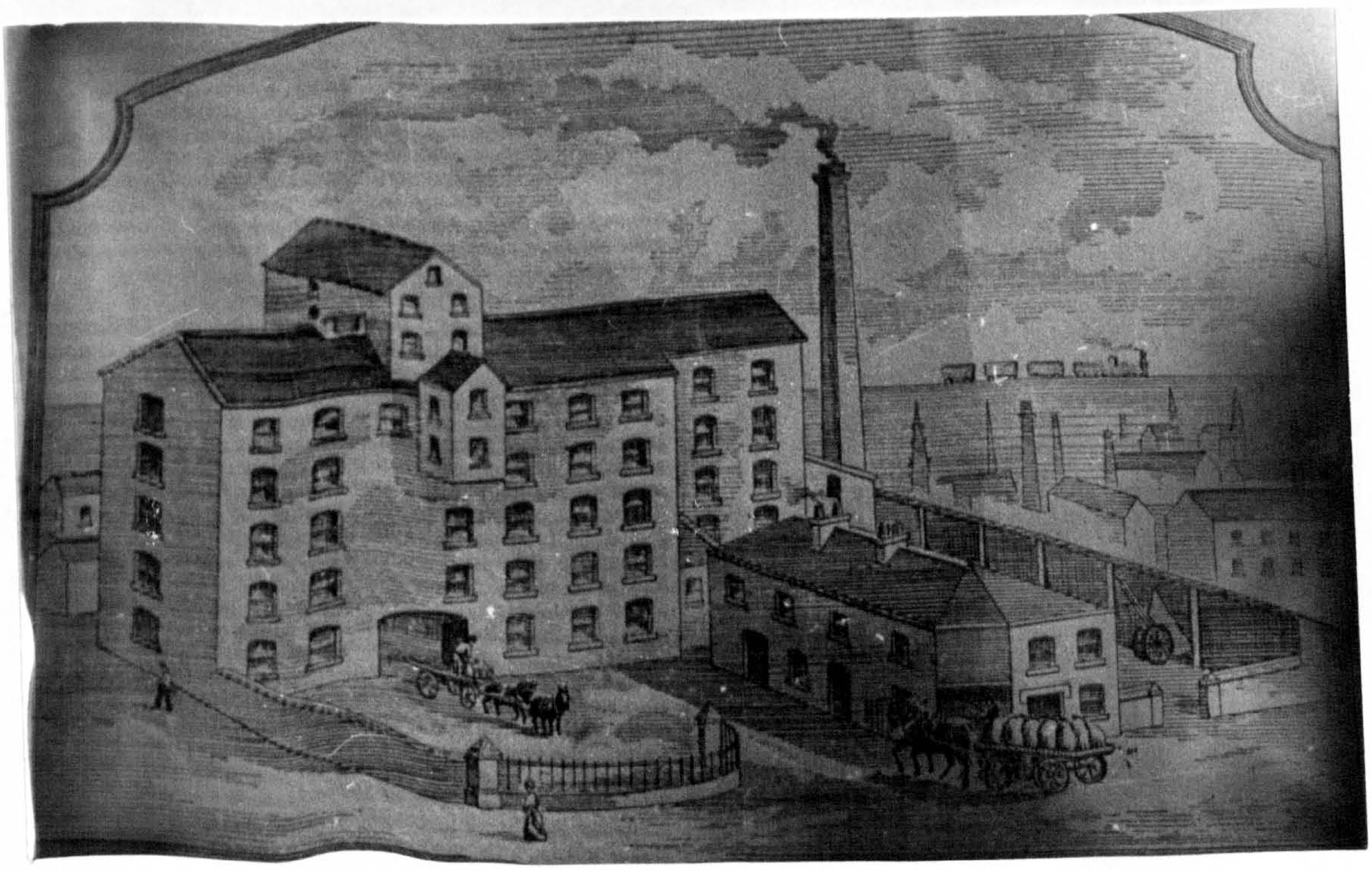


25/26 VICTORIA MILLS (168) and HUNSLET MILLS (172) A comparison of a recent photograph of Goodman Street and the illustration from the LCYB 1913 shows little change in fifty years. The Victoria Mill was built in 1835 and the Hunslet Mills in 1838, both for established flax spinners seeking larger premises. Victoria Mill is the smaller, consisting of a main block of 16 bays, three bays deep and six storeys in height. The access staircase projects a few feet towards the street at the side of the block. The style is similar to Marshall's Mill C. Wilkinson's Hunslet Mill was much grander with a narrow three storey block of 31 bays facing the street, with the central door section projecting slightly. At right angles to this and fronting the river bank is a seven storey block, 26 bays long and four bays deep. The engraving shows the weaving sheds and new chimney added in the 1870s.

27. VICTORIA MILLS (168)

FOOD INDUSTRIES

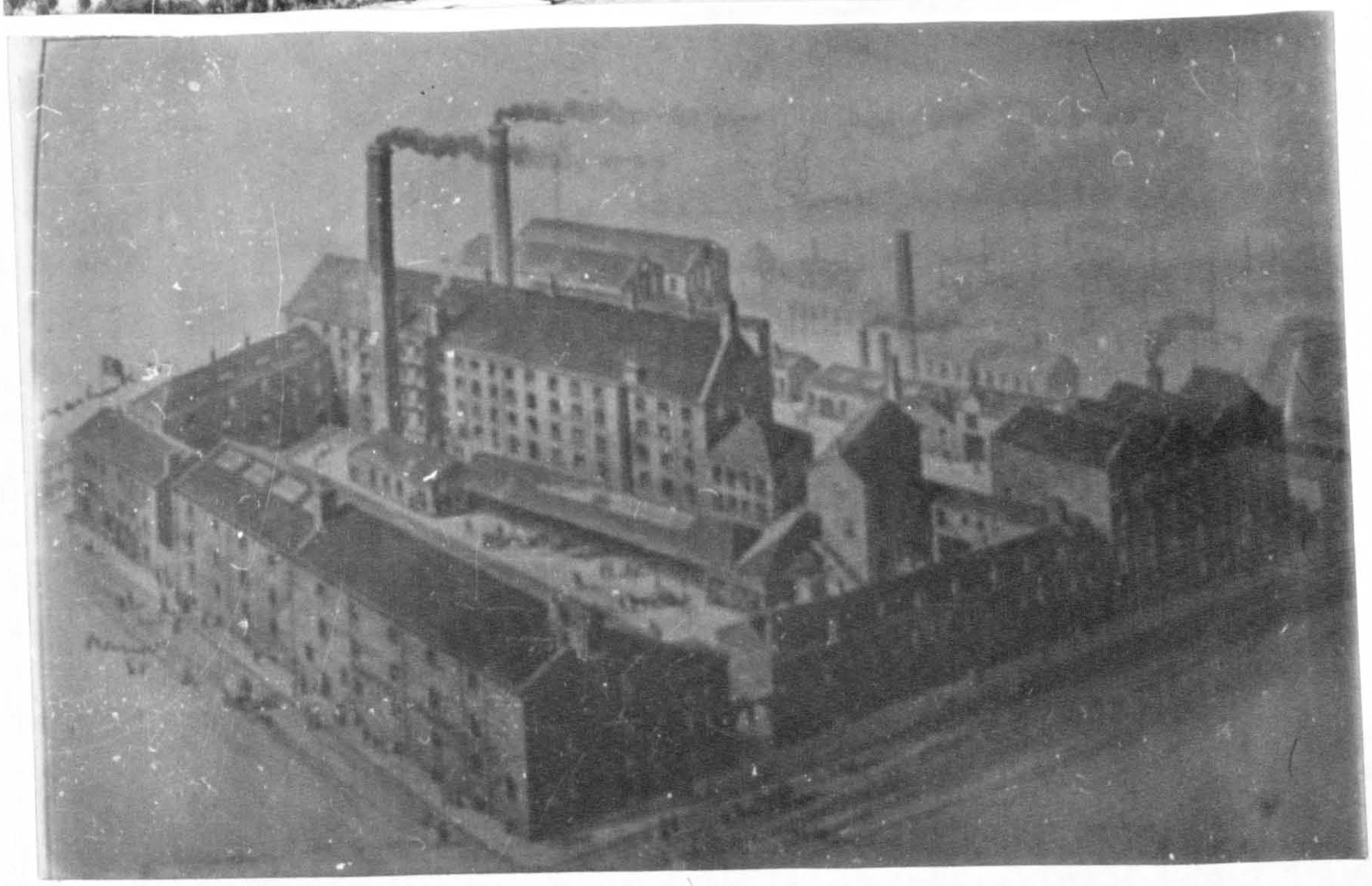
FLOUR MILLS



28. UNION CORN MILL (1) This corn mill was built for Jonathan Shackleton in 1831. In 1890 it became a clothing factory. The only substantial alterations have been the removal of the 'luccam' (the hooded hoist), the shortening of the chimney and the insertion of larger windows. (illustration from YI (1888))

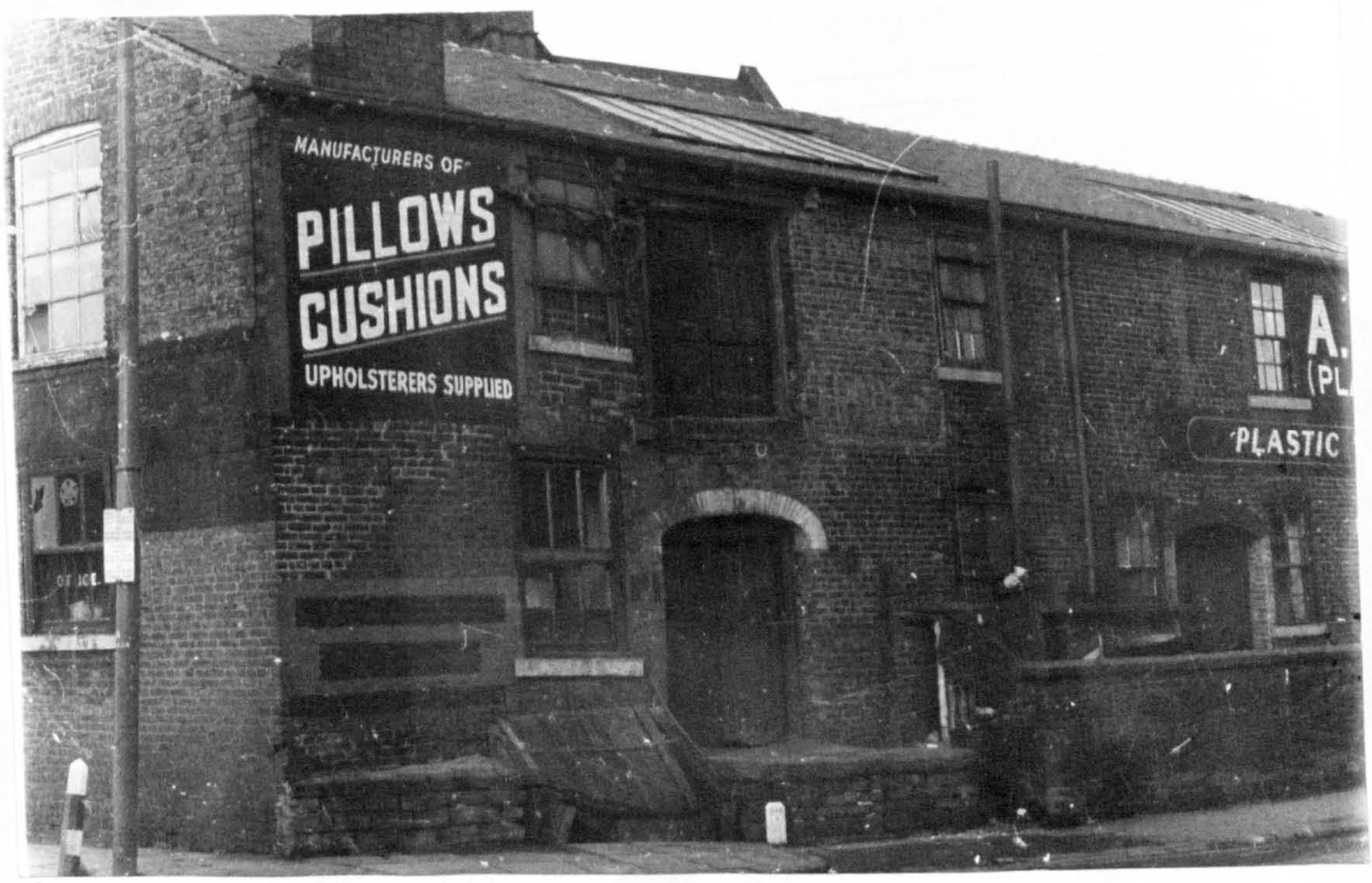
29. UNION MILL (1) The chimney has been almost removed, since it is no longer used.

30. UNION MILL (1) The view from Geldard Road, from LCYB 1920.



31/32 THE PEOPLES' FLOUR MILL (35, 36) The flour mill in the foreground of the upper picture was originally the Erecting Shop of the Round Foundry. The building dates from 1840 and by 1880 it had become Crosby, Wilson & Co., Campfield Roller Mill. The adjacent five storey building was Lot 5 of the Round Foundry Estate Sale (1848), a fireproof flax mill, with a 20 h.p. engine. This was bought by the Flour Mill Co-operative in 1848 and became the People's Mill. Its original date is uncertain but the style suggests c.1820. Campfield Mill became the Co-op Flour Mill in 1905. The lower illustration shows the size of the flax mill (Jubilee History of the LICS (1897)).

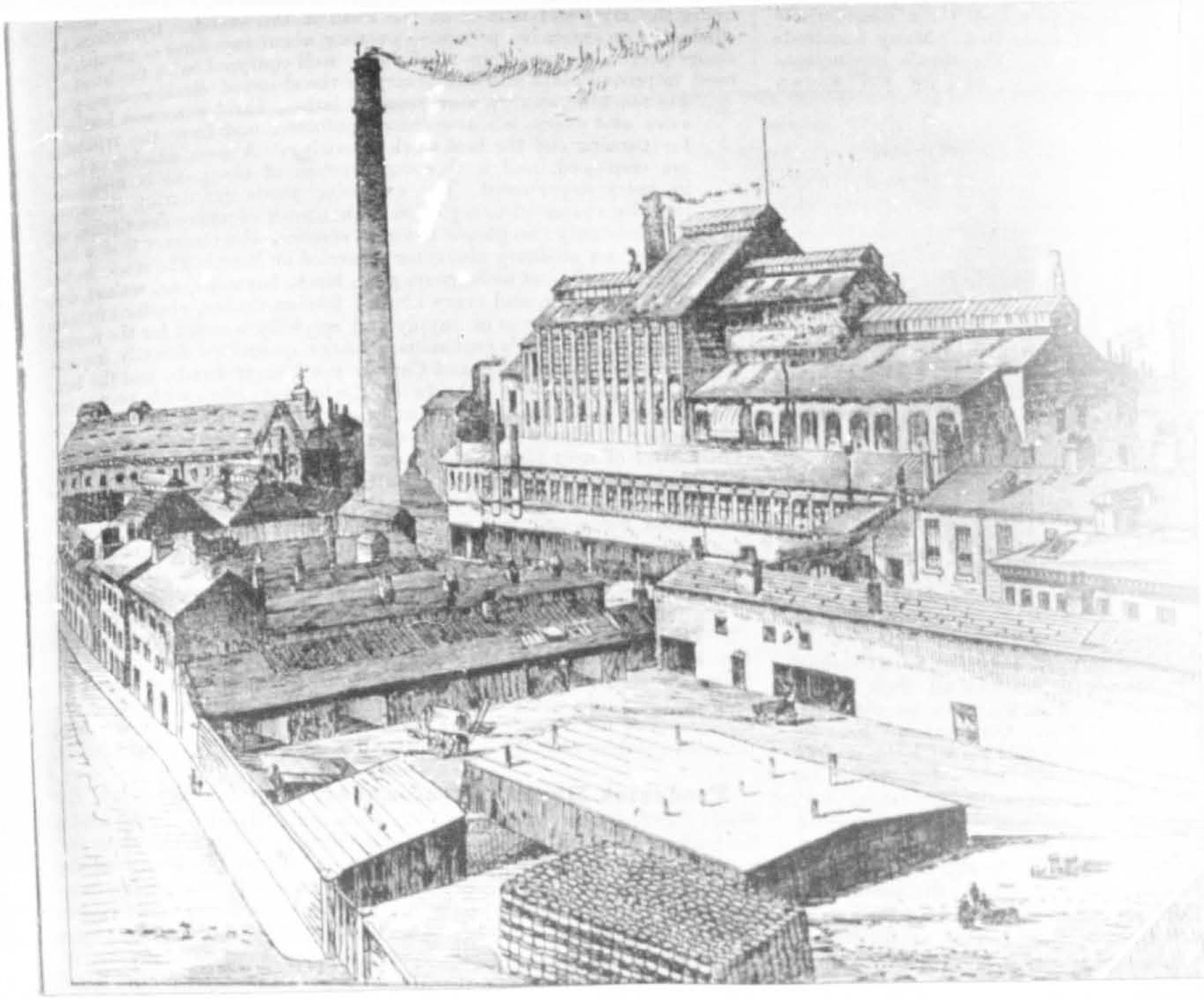
33. STAR MILL (8) The flour mill shown dates from 1844. The cast-iron lintel bears the names of John Shackleton, Wortley (the miller) and William Westwood and Sons, Millwrights. After 1890 it became a malting until Tetleys closed it down in 1939. Westwood worked from a yard on Meadow Lane until listed at the Atlas Works (42) in 1863.



34. ARTHINGTON'S MALTHOUSE (79) Thomas Arthington opened his brewery in 1763 but this malthouse appears to date from 1830. The doorways are original but the windows seem to have been inserted after the closure of the brewery in 1850.

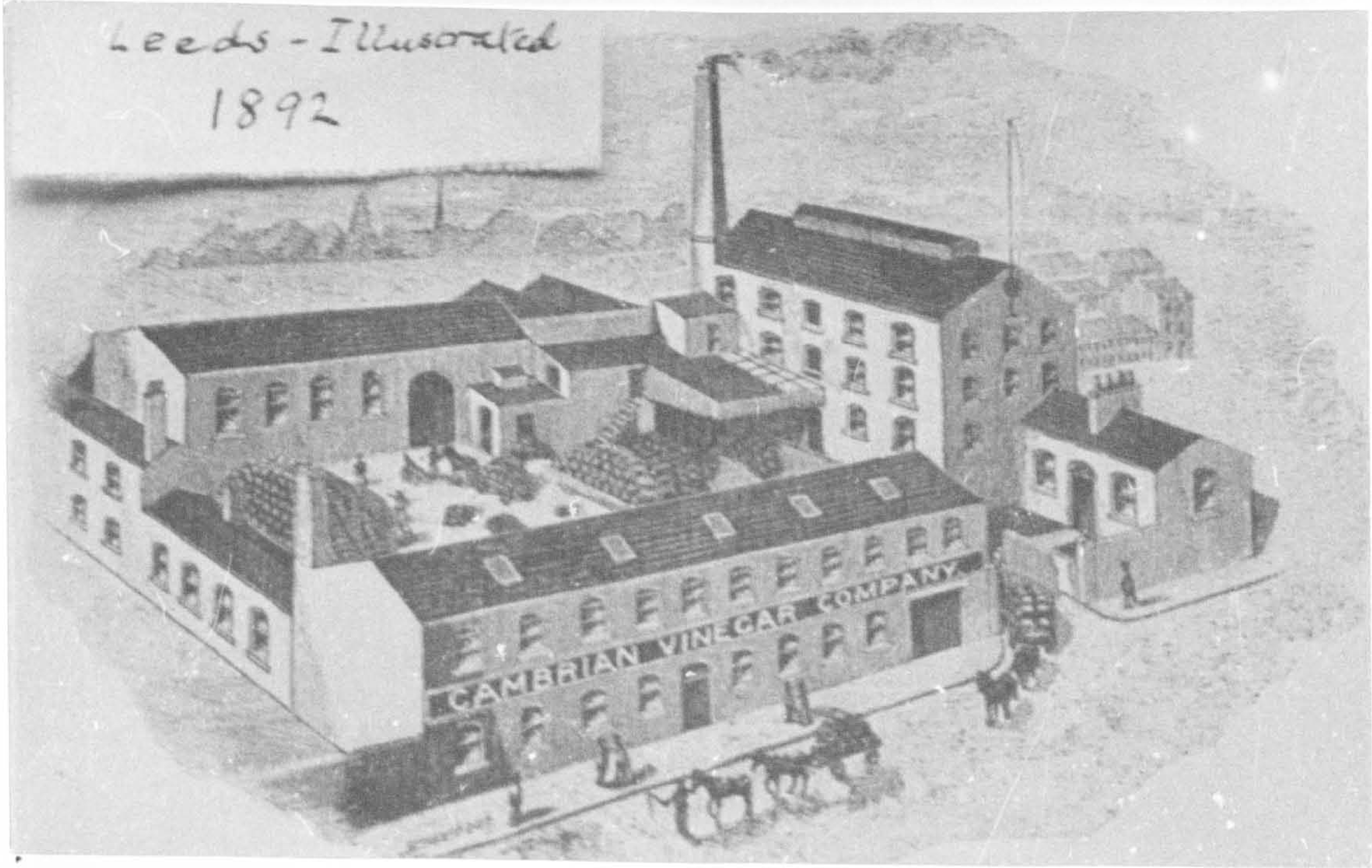
35. CROWN POINT MALTKILN (90) The original maltkiln of Syke's brewery was replaced by the one shown (demolished 1974). It was built by Nicholsons for Tetleys. The design is typical of the second part of the nineteenth century, with a long, ridge flue for the kiln.

36. MEADOW MALTINGS (65) Jaques and Nells Meadow Lane Brewery was rebuilt as the Meadow Maltings in 1872 by G. Kitchen. It was the largest maltkiln unit in Leeds, there being 8 kilns with a total capacity of 197 qrs. of barley. The demolition reveals the kiln flues, the older style on the left and newer on the right.



37. TETLEYS BREWERY (76) This shows the Tower Brewery as built by Nicholsons between 1853 and 1866. Much has since been replaced or masked by later additions (Century's Progress (1893))

38. CAMBRIAN VINEGAR BREWERY (221) The illustration shows the final development (LCYB 1913). The Tower Brewery was originally a single block and the buildings on the left were all built after 1893.



39. CAMBRIAN VINEGAR BREWERY (221) The original brewery of 1877. It had a capacity of 4,000 gallons, and the additions would double this.

AERATED WATERS

40. CHAPMANS TABLE WATER WORKS (19) This was built before 1817 and was known as the Thomas Malthouse. B. Chapman bought it in 1898 and added a lean-to loading dock with the name of the works in white brick. The two kilns and store were turned into a mineral water factory.

TANNERIES

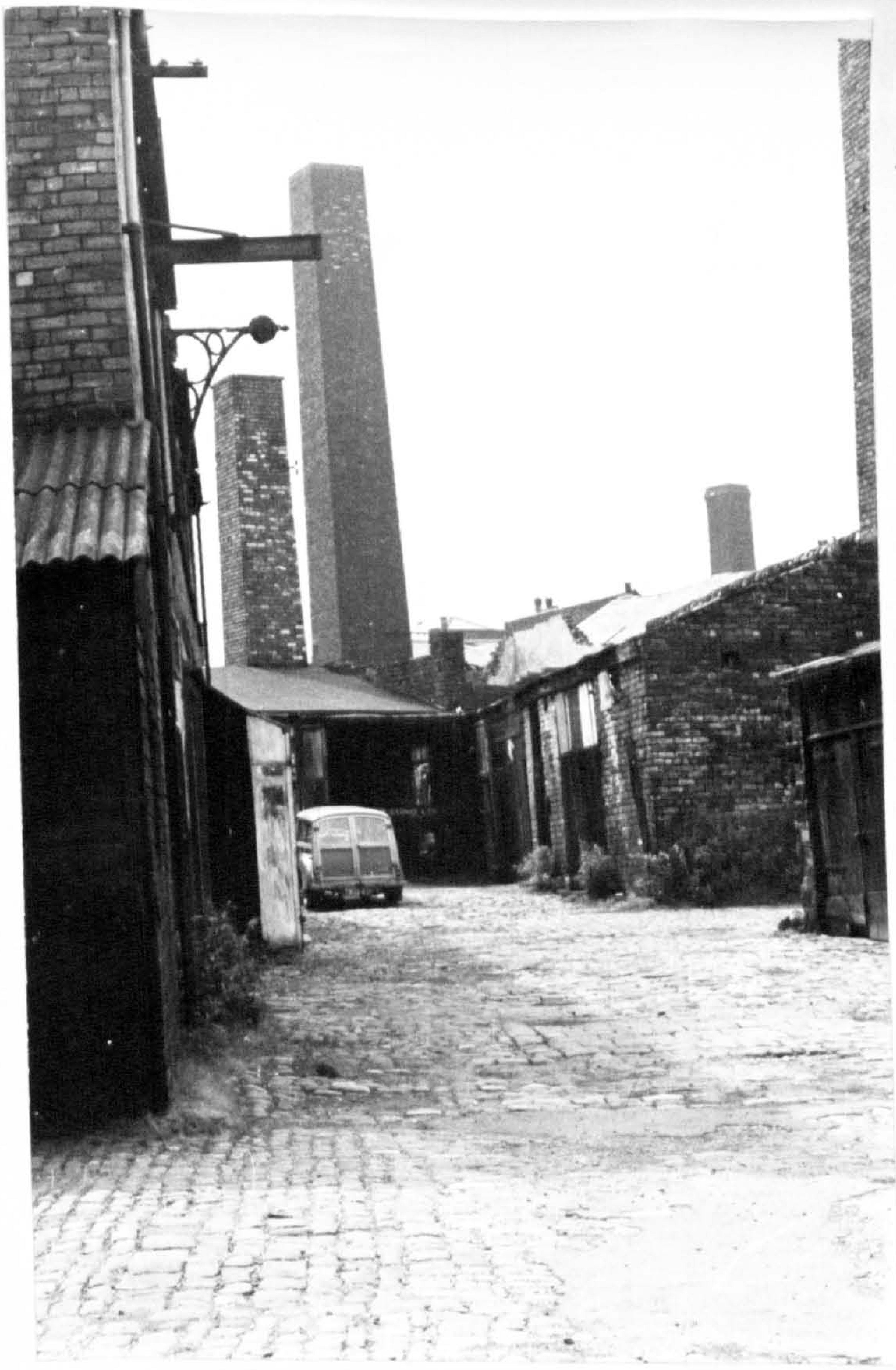
41. WHITECHAPEL TANNERY (73) Built in 1758 as the first Congregational Chapel in Leeds, by 1817 it had become a small tannery with six tan pits in the yard. The main building is of stone with slightly later brick additions

OIL AND GREASE WORKS

42. BATT'S OIL AND GREASE WORKS (10) The dated gable of the office block shows that it was erected in 1898. T. Batt & Co. began business north of the river in 1851 and were the first to build on this site by Whitehall Road.

PRINTING WORKS

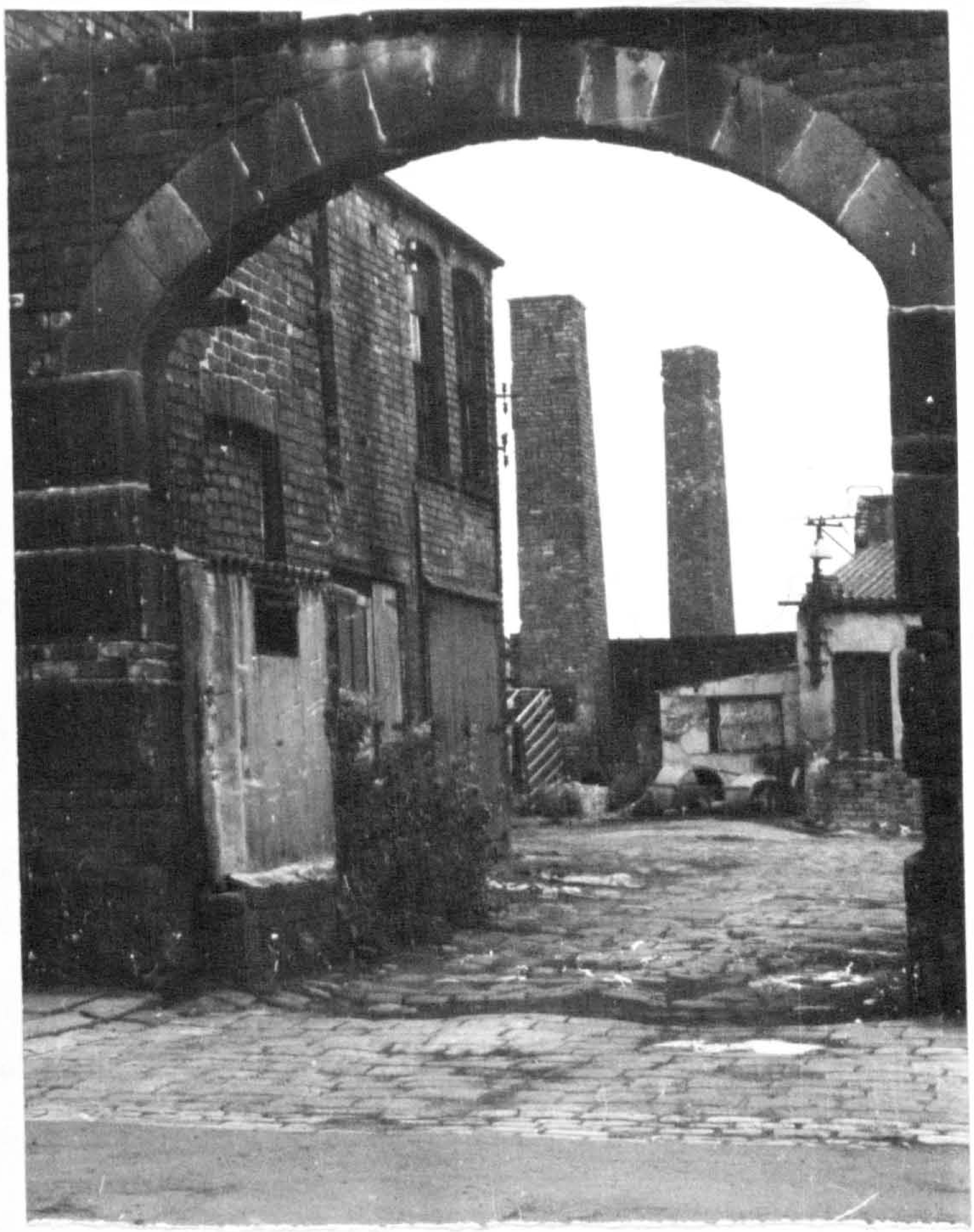
43, 44 CROWN POINT PRINTING WORKS (134) The design was based on the Brighton Aquarium, the ground floor originally housed 18 litho-presses and the gable bays projecting into Hunslet Lane formed paper stores adjacent to each machine. The right hand end and offices were built in 1873 and following a fire in 1894 the works were extended in the original style by Nicholsons. The characteristic use of the double round-arched window on the top floor over single round headed windows below may be seen, with suggestions of Mozo-arabic influence in the use of white stone insets in the arches and pillars. In many large works built towards the end of the century a turret clock was installed to aid good time-keeping and to replace the earlier use of a bell.

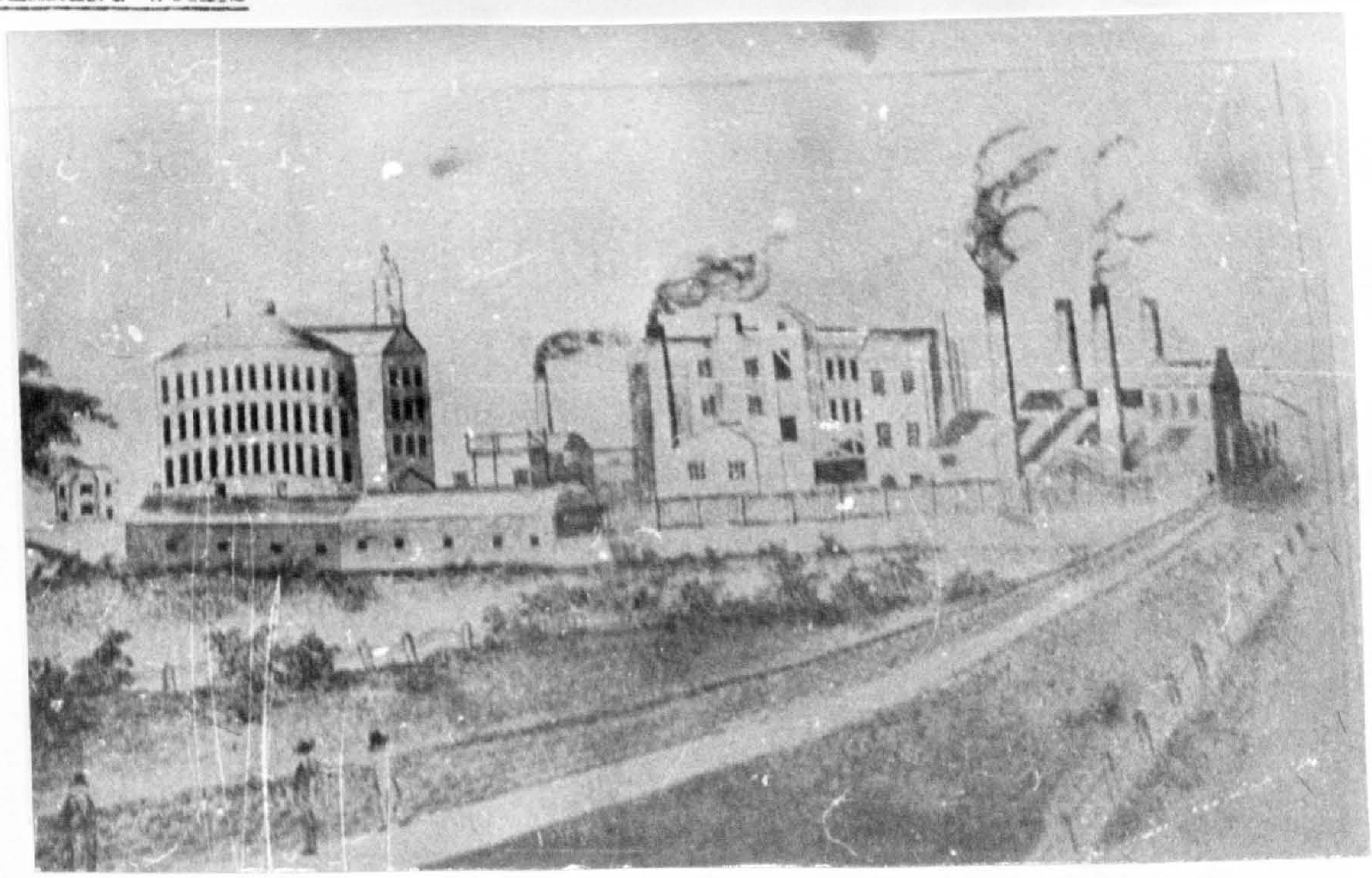


CHEMICAL WORKS

45, 46 VITRIOL WORKS (192)

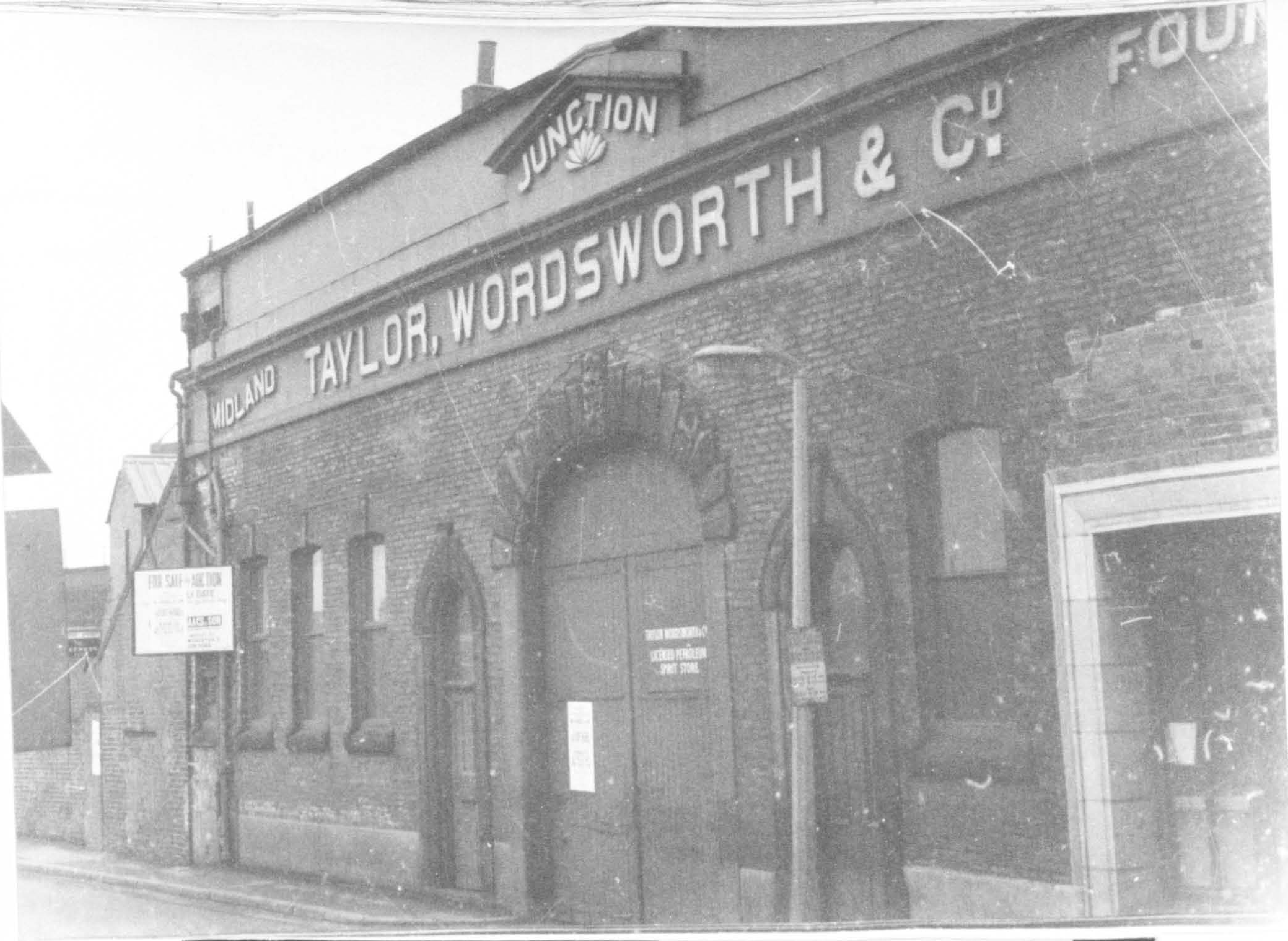
Joshua Bower had a 'distil' house here in 1791, but the surviving buildings seem to date from c.1823. The production of Sulphuric Acid stopped in 1860. The stone gateway, the square chimneys, the cast-iron crane are all that is left of a large acid works.





47. THE ROUND FOUNDRY (34) This was built in 1802. The illustration, from a print c.1806, shows the site from the east with Water Lane in the foreground. On the left is the Fitting Shop, 27 feet in diameter, and in front of that the single storey smiths' shop. From the position of the chimneys the hearths would appear to be in the centre, contrast this with the placing of hearths later, (c.f. Wilson Bros.).

48. Smith, Beacock and Tannet redeveloped the site in 1862 this large workshop replaced Matthew Murray's 'Old Foundry' in 1872.



49. MIDLAND JUNCTION FOUNDRY (23) Although this textile machine making business began in 1793 the surviving buildings are much later. The entrance block dates from 1869.

50. The workshops on Silver Street are some five years earlier, on the site of the Springfield Flax Mill. The tower on the north-west corner of the block houses the water tank.

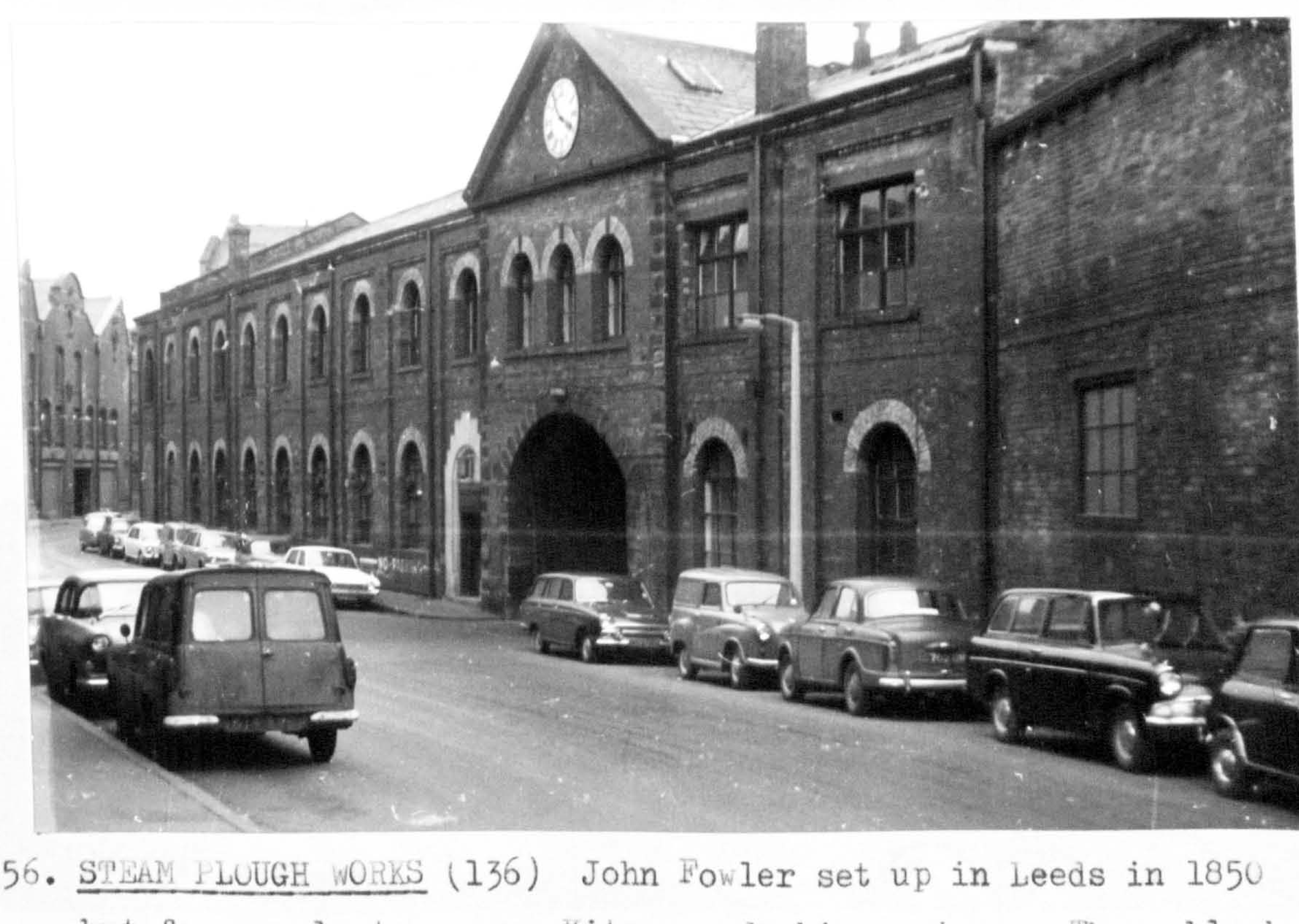
51. UNION FOUNDRY (62) This was opened by Maclea and March in 1825. The front entrance probably dates from then, but may be c.1831. The flat-centred arch enclosing the gateway suggests an early date.

52. The site was developed and the south range (below) dates from 1870. The octagonal tower encloses stairs and toilets and towards the eastern end can be seen chimneys indicating that blacksmiths' hearths were placed against the outer walls, between the windows, leaving the central floor space for machinery. (c.f. Wilson Bros.).

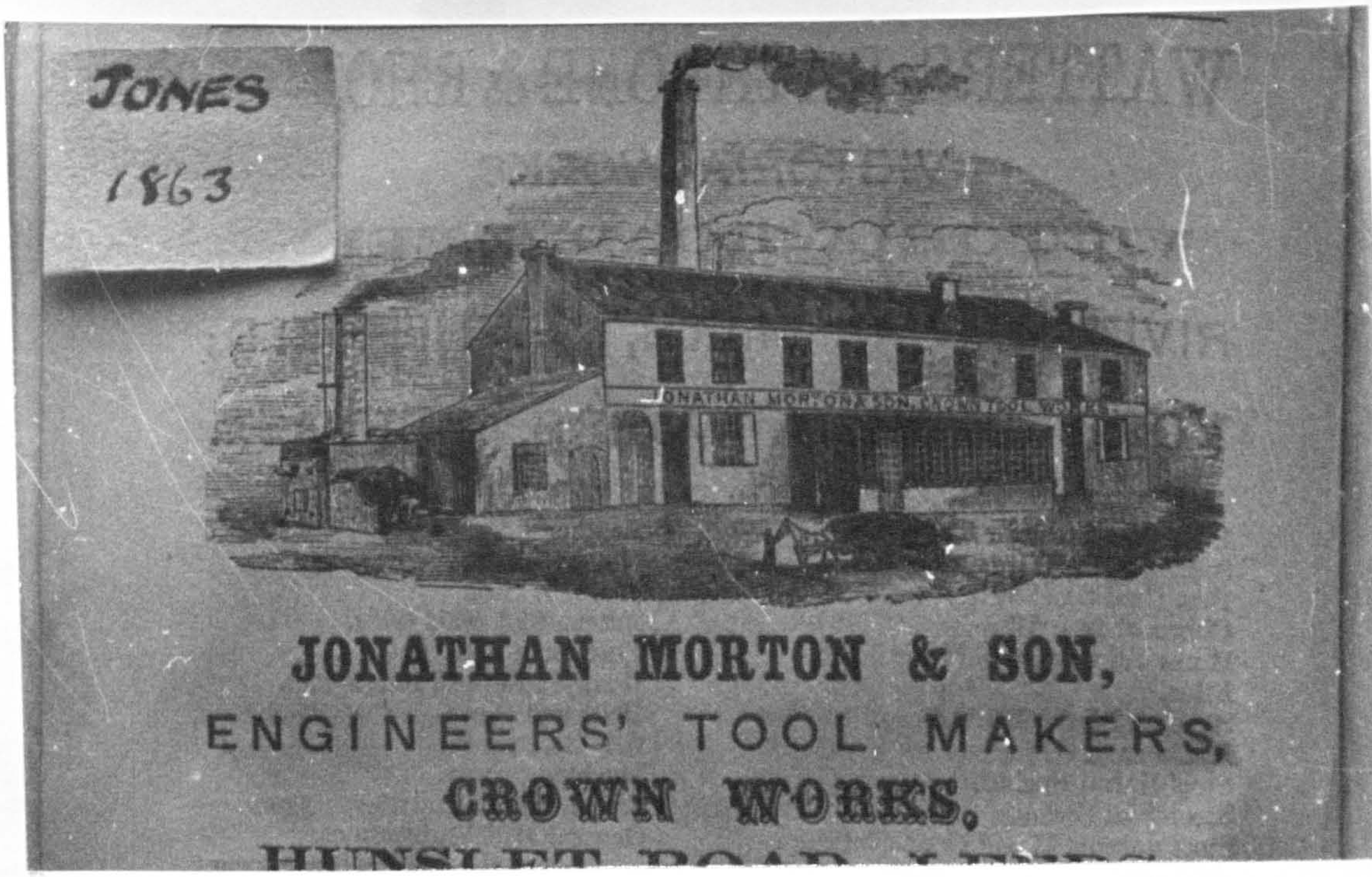
53. <u>BOYNE ENGINE WORKS</u> (132)
Manning, Wardle & Co. bought the site next to E. Brown Wilson's Railway Foundry from Viscount Boyne and built their Engine Works in 1858.

54. <u>HUNSLET ENGINE WORKS</u> (137) When J.T. Leather bought the Railway Foundry in 1864 he began an extensive programme of redevelopment. This was his new office block on the left of the Jack Lane gate.

55. AIREDALE FOUNDRY (140) Kitson set up on his own in 1839 on the site of the old Dawbridge woollen mill. The business expanded steadily and this Hunslet Road frontage dates from c.1880 when Kitson bought Lot 1 of the original Railway Foundry. The offices are to the right of the gateway and on the left the workshops form a series of blocks at right angles to the road. The dominance of the round-headed window is apparent.

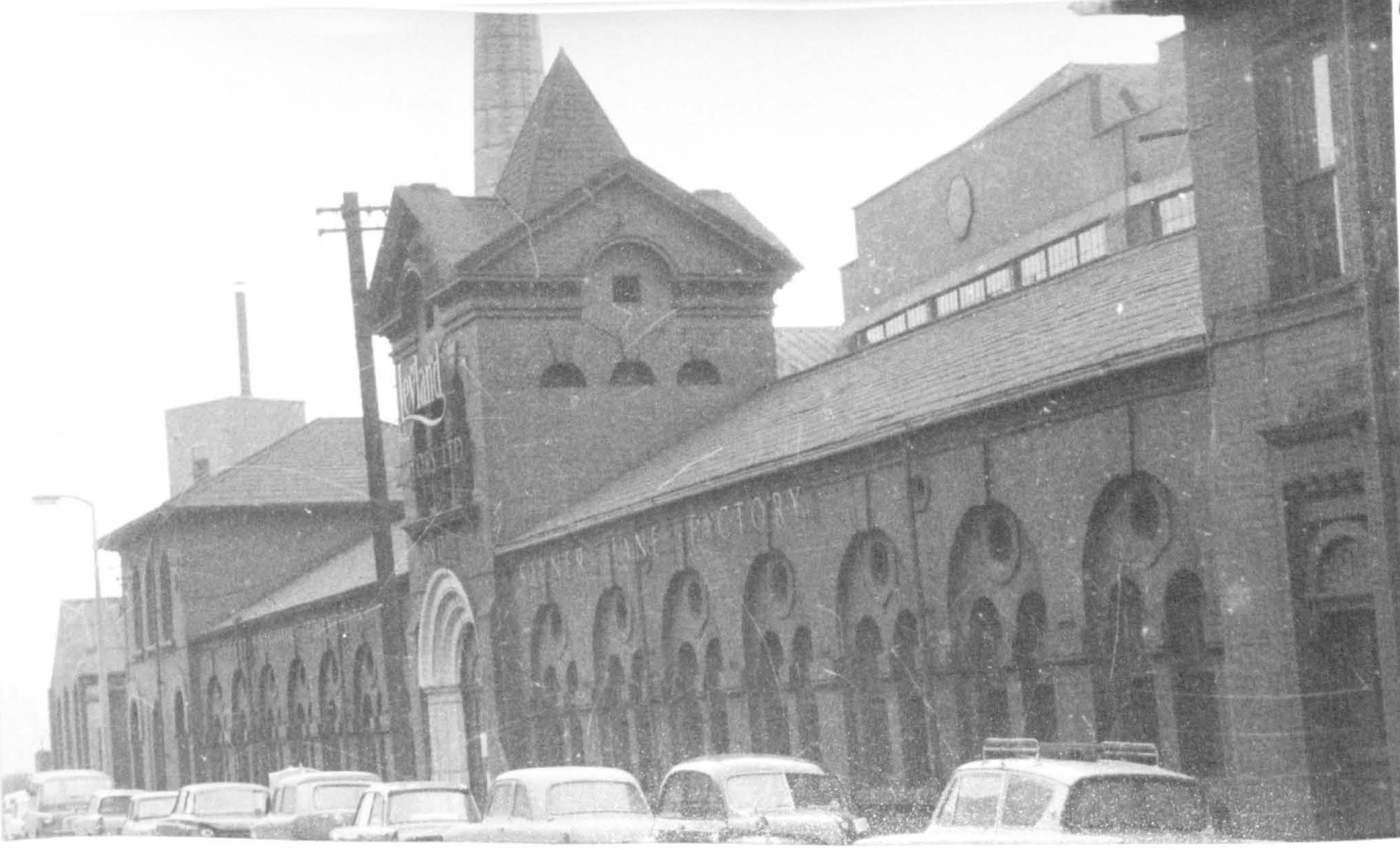


56. STEAM PLOUGH WORKS (136) John Fowler set up in Leeds in 1850 but for nearly ten years Kitson made his engines. These blocks on Leathley Road date from 1860. Once more round arches dominate the facade and there is a works clock set in the gable end over the main entrance.



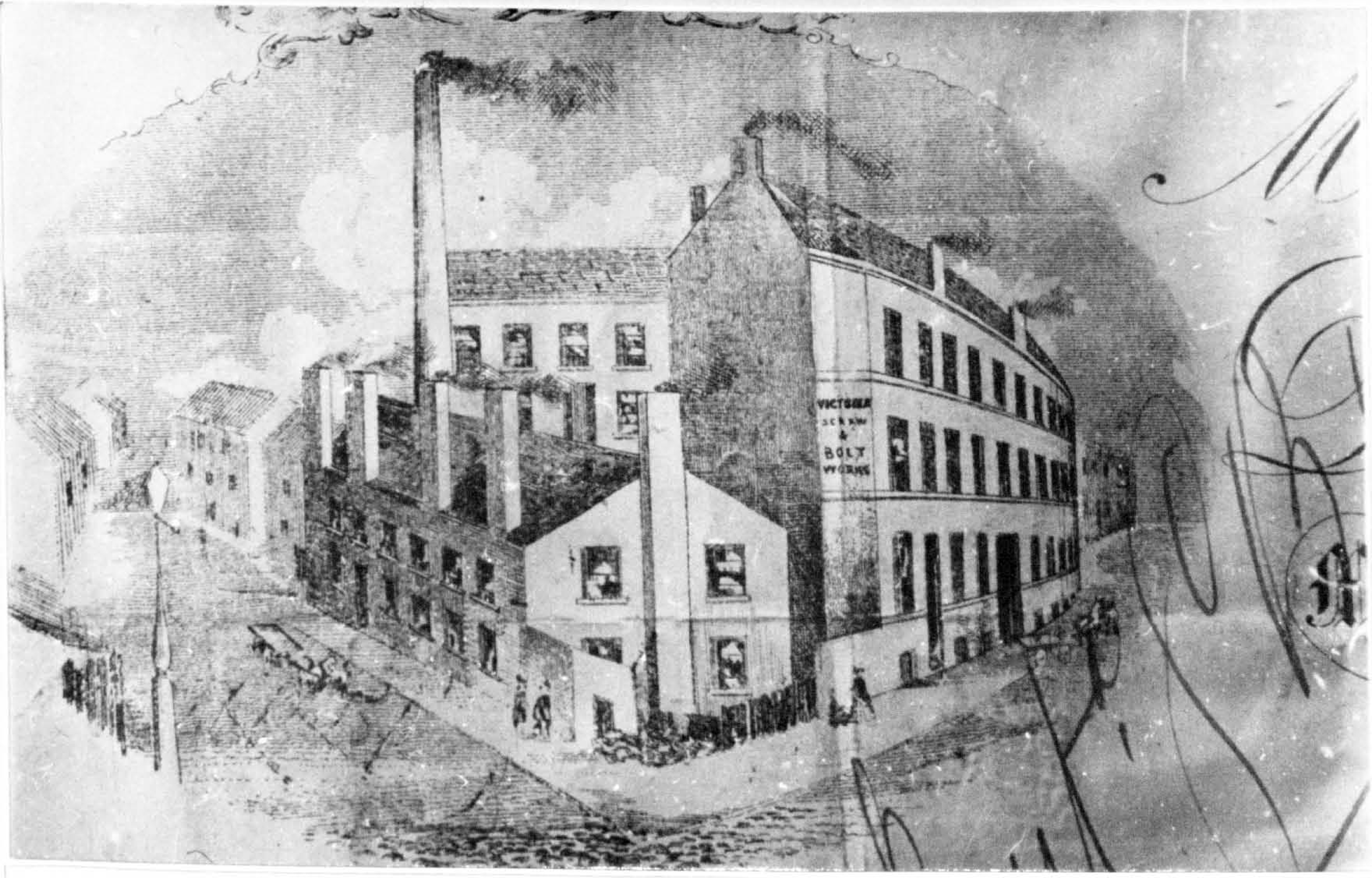
57. CROWN WORKS Jonathan Morton & Son's tool making works, from an advertisement in Jones' Directory, 1863, shows the chimney of the cupola furnace with the damper open, as well as the taller boiler chimney to the rear of the building. This works was typical of the many small engineering works in Hunslet at that time.

58. GLOBE WORKS (85) Originally this was the 'Prospect Works' of Hutton and Macdonald and in 1889 it became the Globe Iron Works of J.Green and Nephew. The output was mainly domestic castings, especially coal-chute covers. This work required a small furnace to re-melt pig-iron and a foundry for casting the molten metal. This leads to a single storey block with a wide span to give a clear floor area. The offices are over the mould shop with the sliding doors opening on to Sheaf Street.



59. CLARENCE IRON WORKS (154) Taylor Bros. bought the site from the Denison and Wilkinson trustees in 1866. The round arch enclosing two round arched windows is the basic motif of the office block, built by Nicholson. Behind were 17 pudding furnaces and five rolling mills for the manufacture of 'Best Yorkshire Iron'.

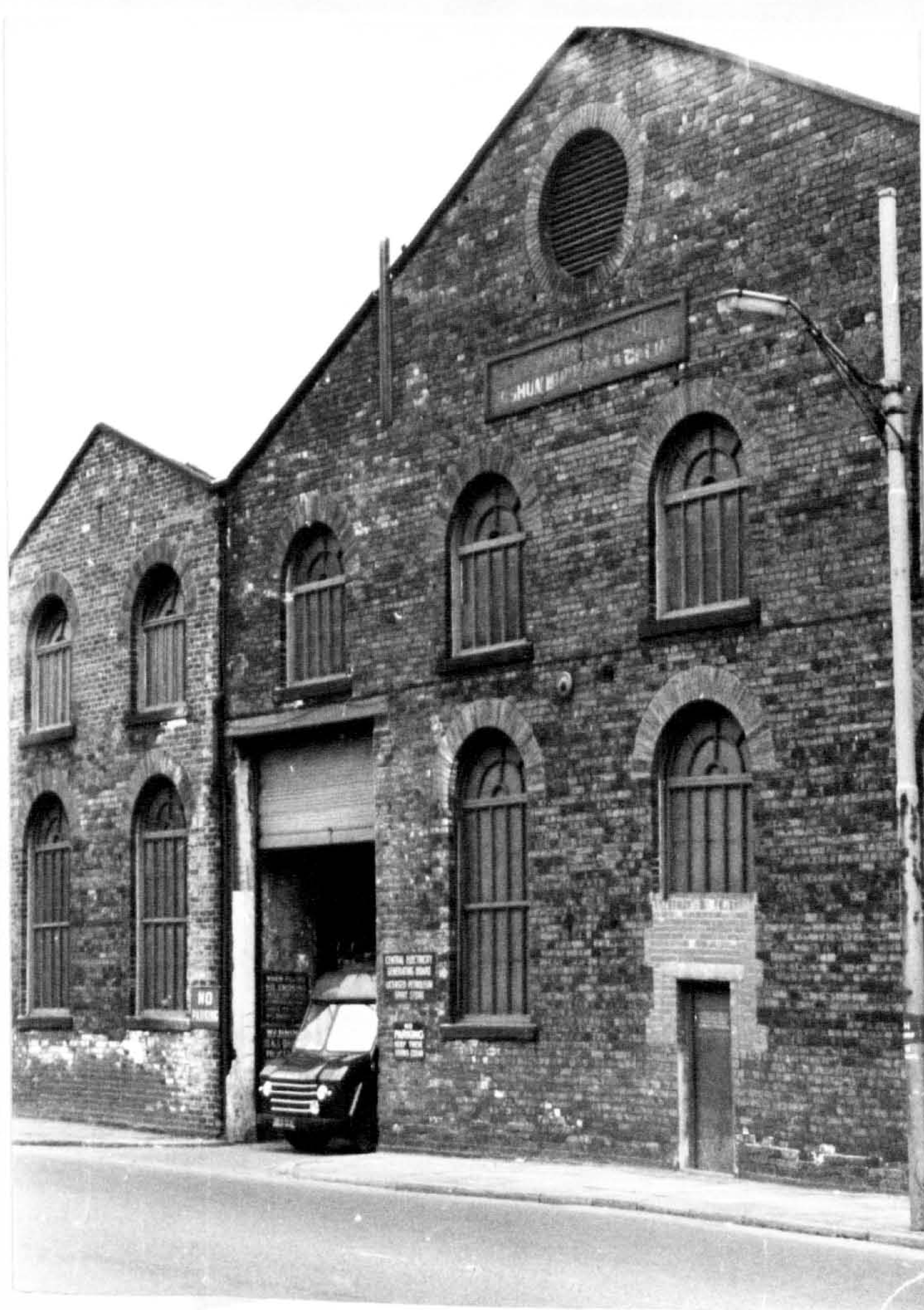
60. SHEAF WORKS (88) This occupies a triangular corner site and was built in 1879 as an engineering works, with a lofty assembly shop on the ground floor and other workshops above. The occupant then was James Yates but in 1900 it became a confectionery works. The design is dominated once again by the round-headed windows.



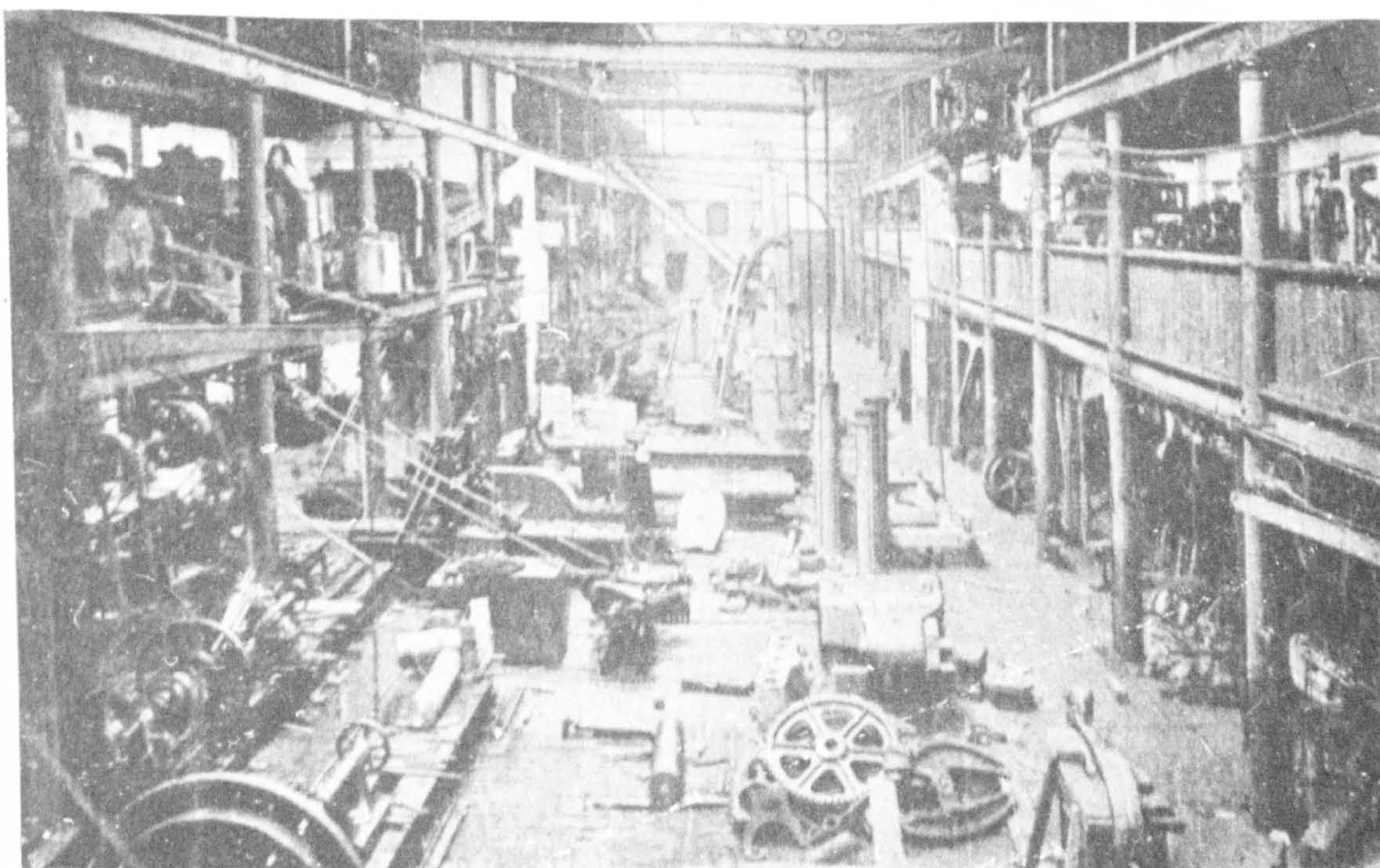
61. <u>HILLS YARD</u> (52) G. Wilson began his screw and axle business here on the corner of Hills Yard and Victoria Road in 1851. This illustration from a letterhead shows the chimneys of the blacksmiths' hearths against the outer walls, between the windows.

62. <u>VICTORIA MACHINE WORKS</u> (54) Wilsons moved up the road to this new works in 1895. Behind the office block shown, across a yard, were the machine shops with hearths against the outer walls as before. The Benyon Beck runs in a culvert under the yard and supplied water for the boilers.

63. ALBERT SCREW WORKS (60) Samuel Stead and Co. began as whitesmiths in Grey Walk and moved to a new works in Fleece Lane in 1864 as Banks, Stead and Goodison. The works were rebuilt in 1880 and are shown being demolished in 1965. Above the roof ridge is the water tank and the blacksmiths' hearths were against the rear wall with three chimneys visible.



64. WELLHOUSE FOUNDRY (118) Joshua Buckton began as a woollen merchant but by 1845 had changed to engineering. The works were extended and rebuilt in 1880. The main assembly shop is shown, with a recently altered doorway. The round-arched windows already noted are a feature of the design.



65. CROYDON WORKS (183) Henry Berry came from Barnsley and built the Croydon Works on Beza Street in 1882. He specialised in hydraulic pumps and the design of the works reflects the usage. The site is dominated by the enormous assembly shop towards the rear. In the foreground the public house is dwarfed by the workshops.

66. The assembly shop doors are 12 feet wide and 18 feet high.

67. This interior, from Cassier's Magazine (1900) (New York), shows the great height required to give the gantry cranes clearance.

68. RAILWAY WORKS (89) Whitley Partners works was the largest brass foundry and engineering works in Hunslet. The business was opened on Butterly Street in 1890 but the weathered slab over the doorway indicates that the office block was built in 1914. 'Estd. 1844' can also be seen, faintly, at the first floor level.

69. ROSE & PARKINSON'S BRASS FOUNDRY (70) This was one of the smaller brass foundries, opened on Wilson Street in 1875. The front is 12 feet wide, the site is 30 feet deep. The upper floor has been re-roofed and was originally lit by sky-lights.

70 SILVER CROSS WORKS (140) Behind the Silver Cross Inn on Dewsbury Road John Milner built a card making workshop. In 1889 part of this was taken over by W. Wilson to make perambulators.

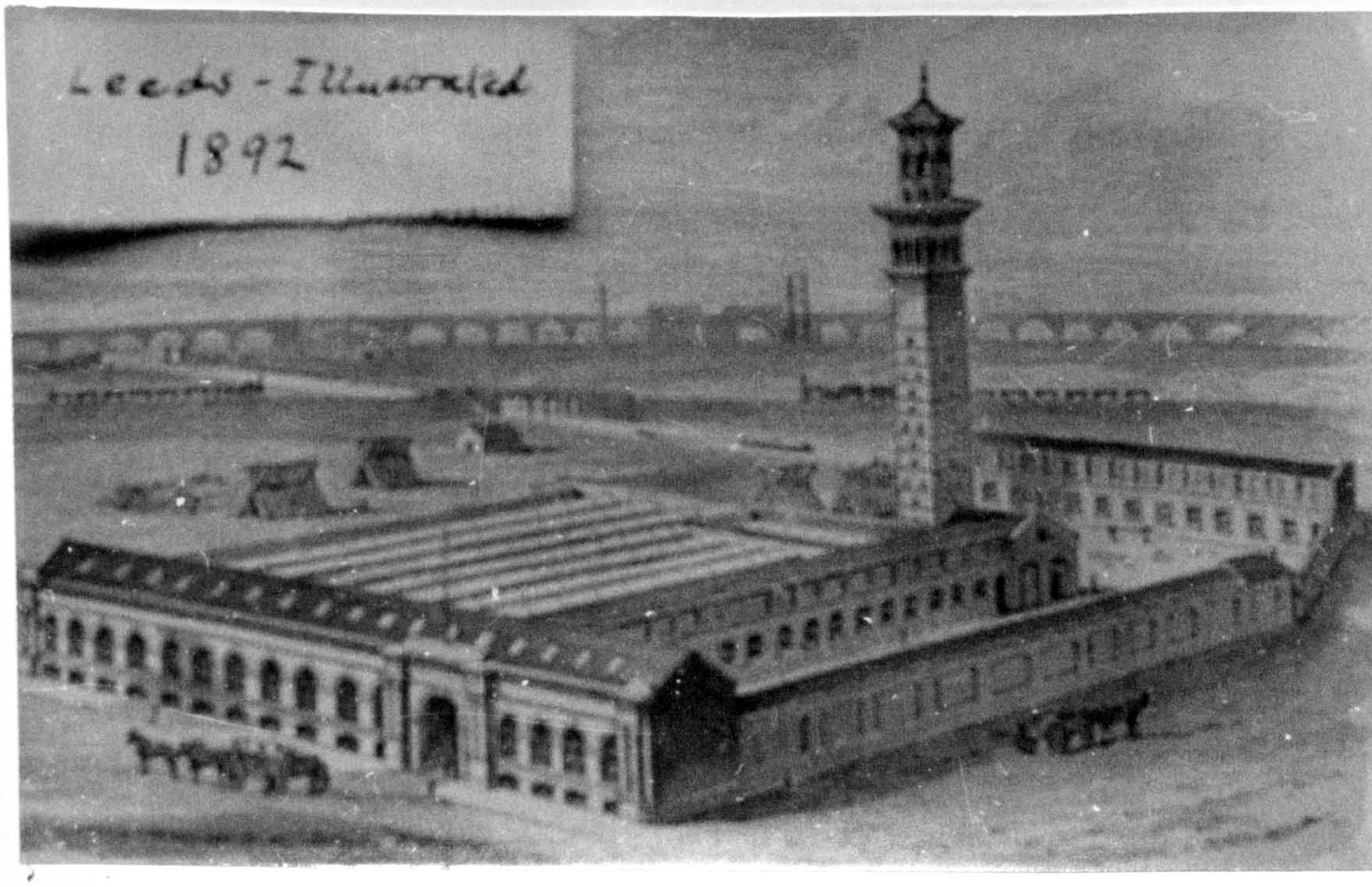
71. Wilson progressed in the trade and built his own Silver Cross Works (144) on Whitehouse Street in 1898 (date over door). Business is still brisk but now the Silver Cross Works is out at Guiseley.

72. BRAIME'S LAMP WORKS (153) T.F. Braime opened a factory making pressings for oil lamps on Hunslet Road in 1905, (date over the window on the ground floor at the corner). By 1914 he had moved to a much larger site a little closer to the town centre.

73. LEEDS STONE CRUSHING WORKS (2) These were built in 1897 by W.H. Baxter, (date shown on the corner) The block shown is similar to many other engineering workshops already shown, with round-headed windows and a circular ventilator in the gable end.

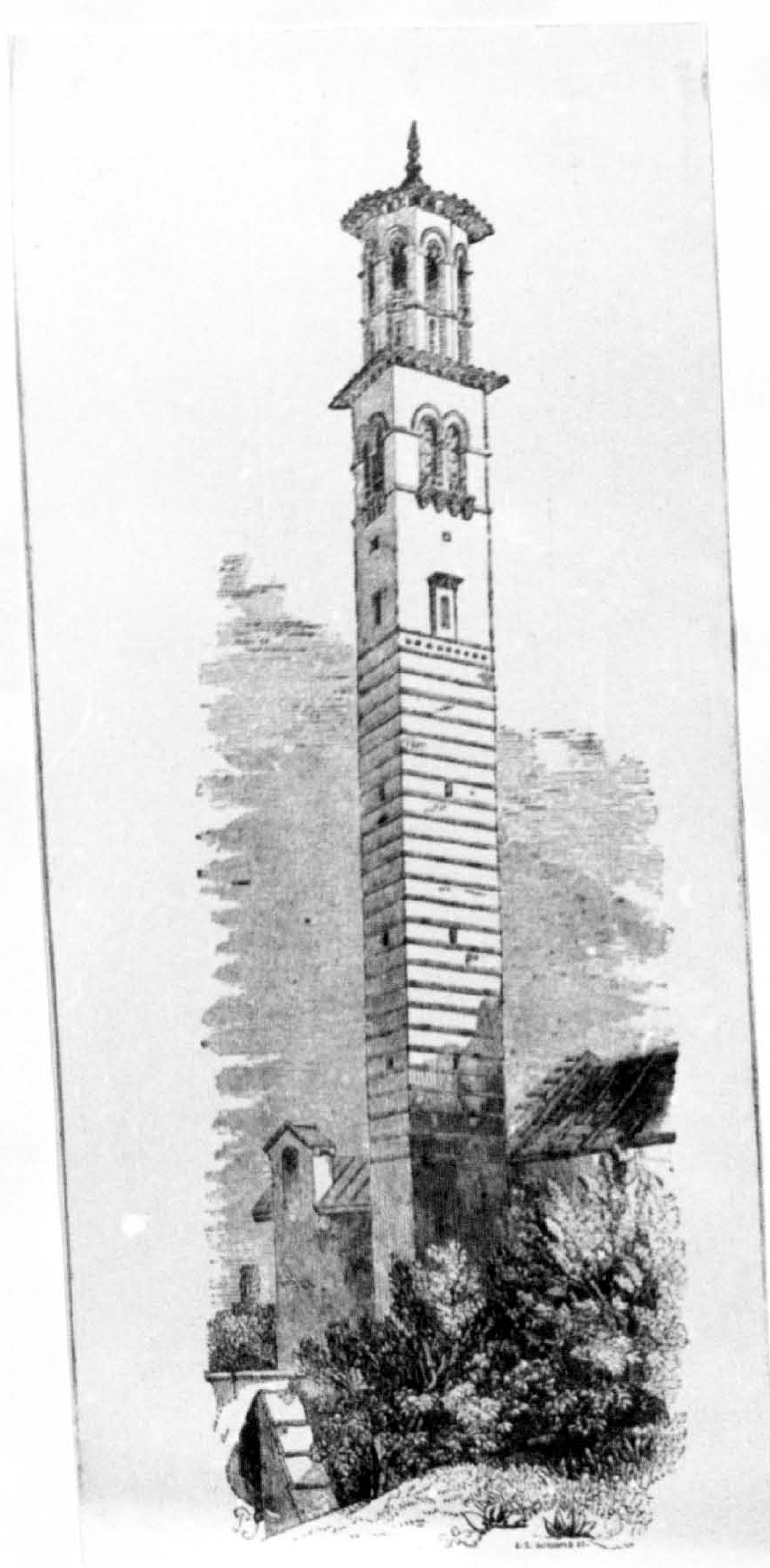
74. <u>LEEDS NAIL WORKS</u> (167) Charles and Edwin Roberts moved to this site in 1869 and are still in business there. The rounded gables conceal eight lines of north-light roof over the nail-making shops (c.f. Maenson Works)

75. <u>GLOBE FOUNDRY & FLOUR MILL</u> (33) Architecturally this is one of the most interesting sites in Holbeck. From the canal bank can be seen the original Globe Foundry of 1844 and to the right, Clough's Globe Flour Mill and Lewiss' Clothing Factory. The flour mill is of brick with red pantiles and until recently was a cigar factory.



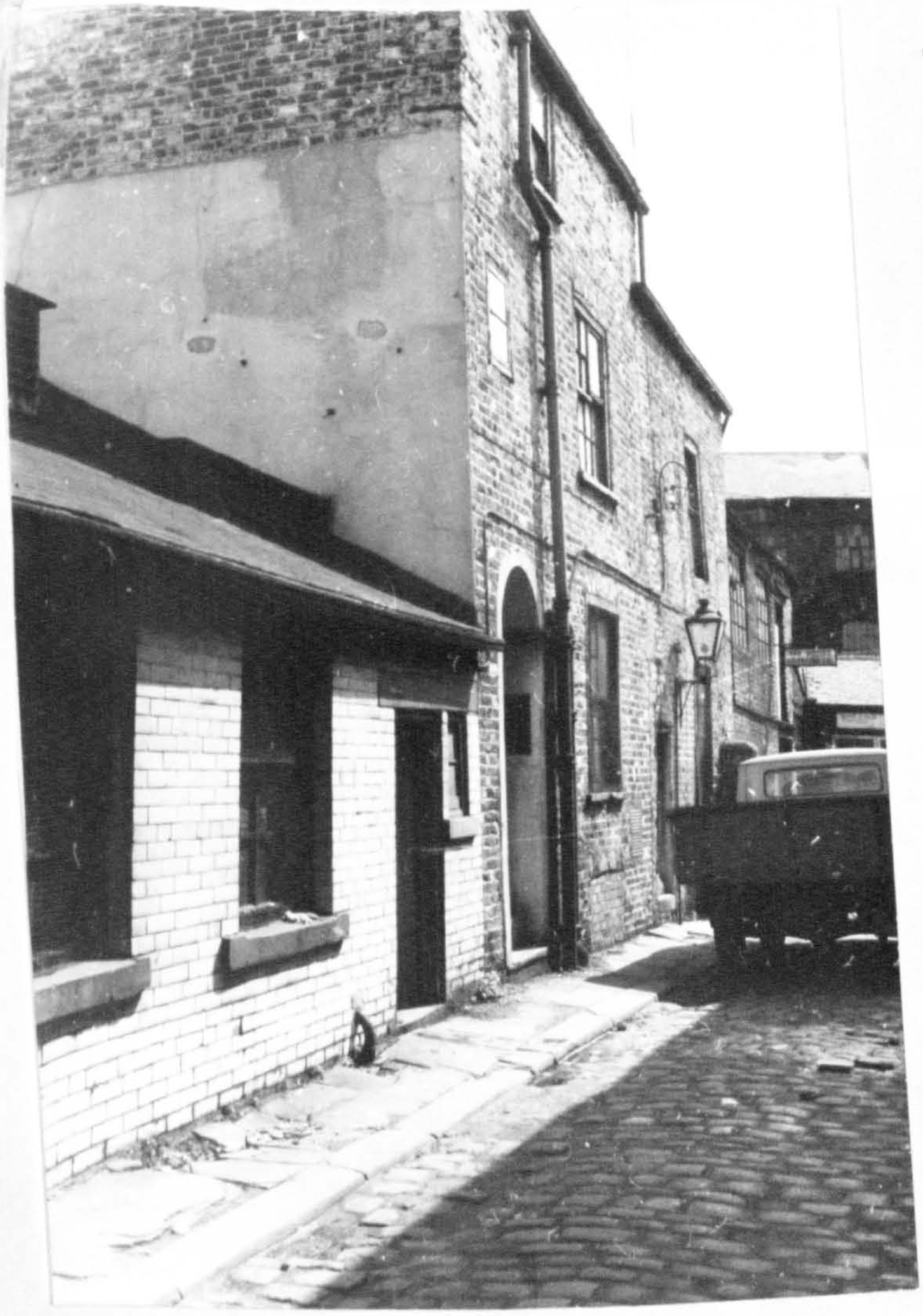
76. TOWER WORKS (33) The Globe Road frontage was built for T.R. Harding in 1864 to a design by Lockwood and Mawson, the Leeds architects. The chimney was based on the Campanile of Verona. Sir Robert Rawlinson in Designs for Factory, Furnace and other Tall Chimneys, (1862) (published privately) clearly inspired the architects as

77. the illustration shows



78/79 In 1900 the top of the chimney was removed and the great ventilation tower was built, this time based on a Florentine Church tower. On the base of the tower are medallion portraits of great engineers. The gates are also richly decorated with bas-relief figures.

80/81. LEE'S YARD R. & W. Lee built a warehouse, dressing and press shops here in 1788. Possibly some of these buildings survived, on the south side, with an extension for a boiler house with a short, square chimney. Opposite, on the north side, is a workshop dated 1822. These premises have been a brass foundry, a tobacco factory and an engineering and pattern-makers' workshop in turn. Lee's Yard is a microcosm of



the development of south Leeds, where the yard of a woollen merchant's house, with his 'shops', formed the nucleus of a miniature industrial estate. It has been very difficult to locate a site in yards like this.

HUNSLET MIDLAND RAILWAY STATION. This was built by Nicholsons in 1888 on the site of Arthington's Brewery, it is still used as a goods depot.

MIDDLETON RAILWAY

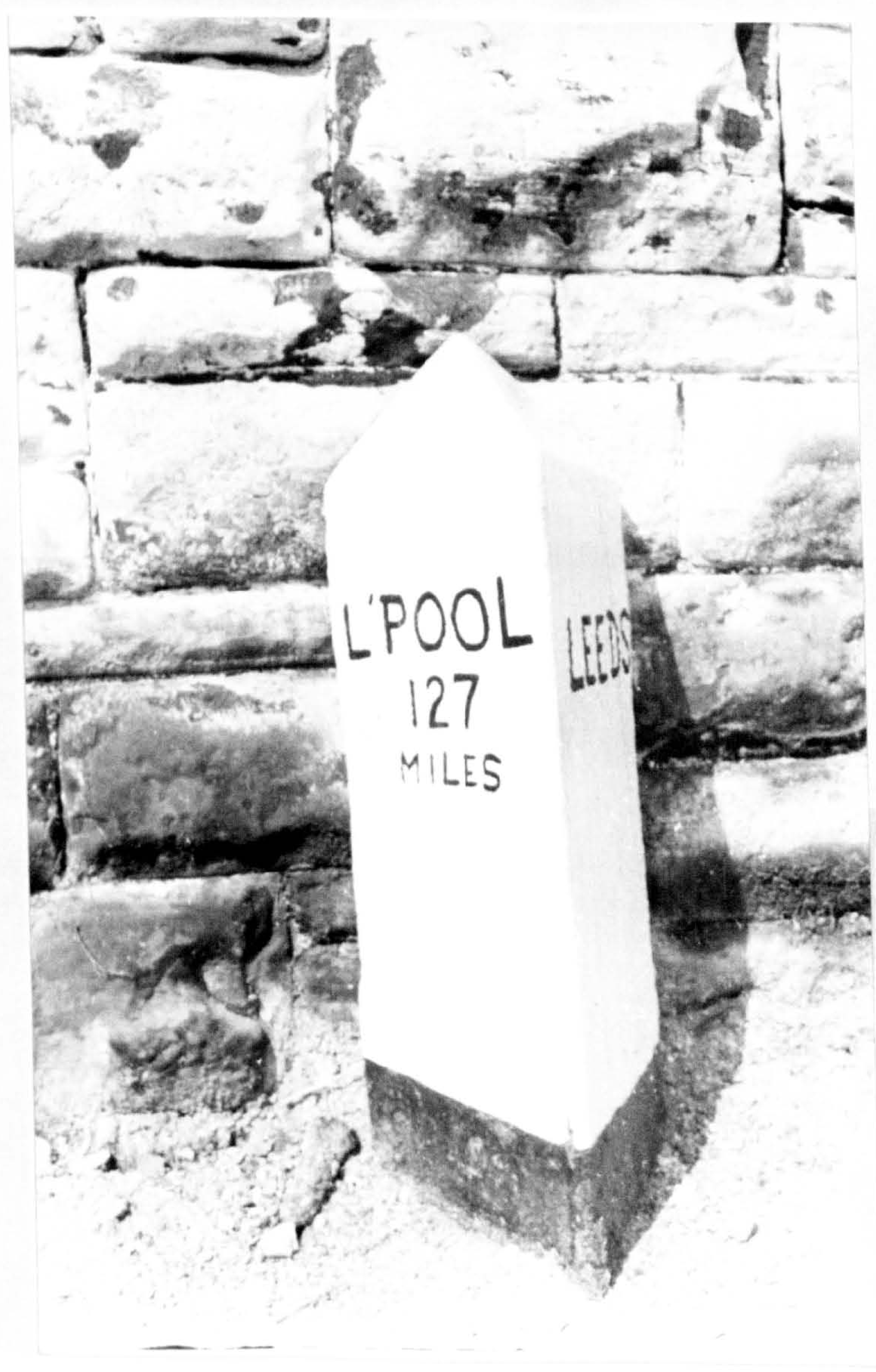
the original cog-rail of Blenkinsop's day gave way to more normal rails. These were replaced as they wore out and in 1881 the line was converted to the standard gauge. Following a case in Chancery the line across the Moor was enclosed in 1901 at the latest. The gate post shown is dated 1903, but others bear an earlier date.

THE LEEDS - LIVERPOOL CANAL

The terminal warehouse of the company at Leeds Lock was first assessed for rates in 1790.

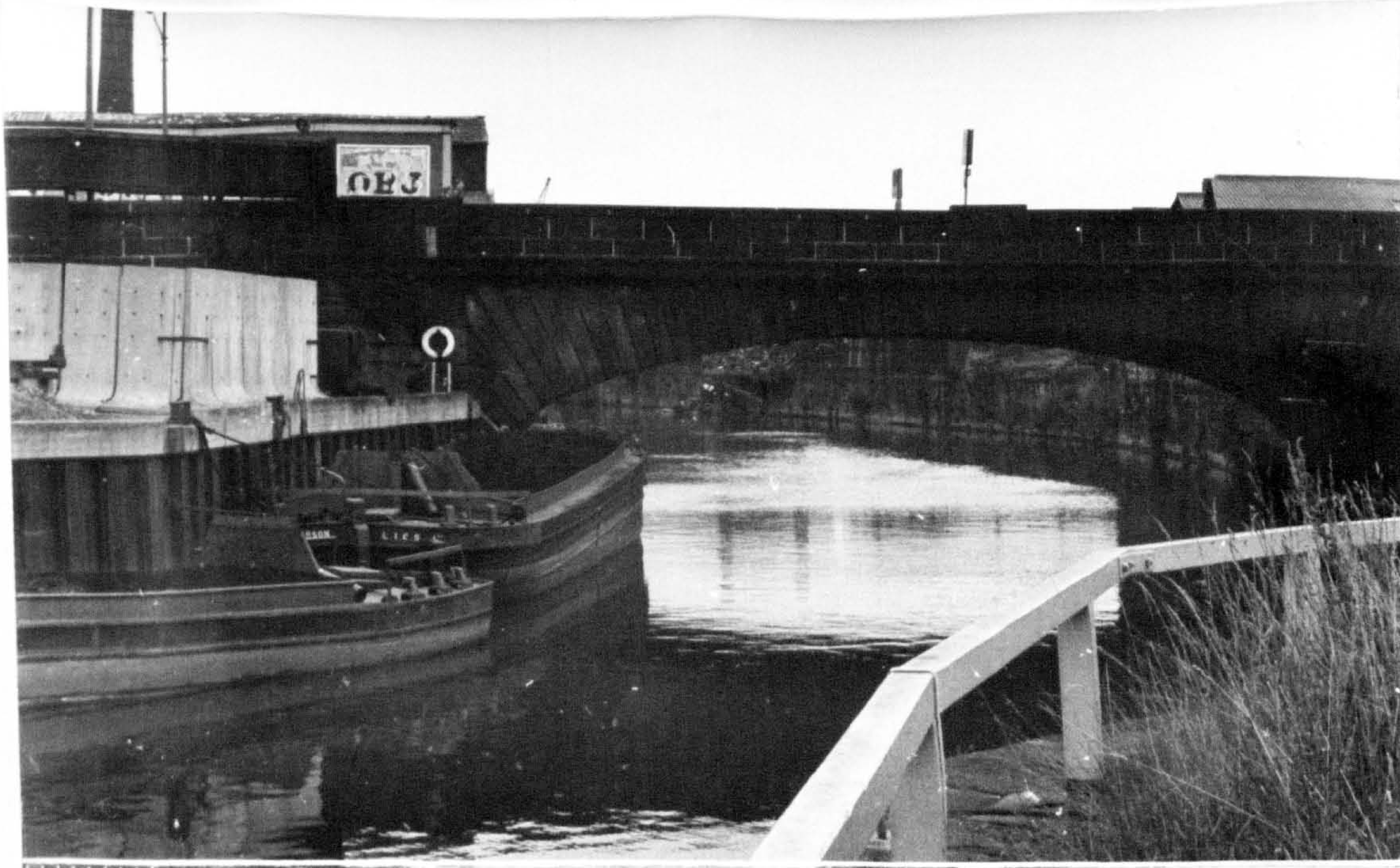
On the north bank were two rows of smaller warehouses, which were let to canal carriers. These probably date from c.1790 also.

Pevsner claims that the canal terminal dates from 1827 but the evidence of rate books and maps show it to be c.1790. The office block is of this period, 1822 and the milepost cannot be earlier than 1816 when the final length was completed and the route to Liverpool was opened.



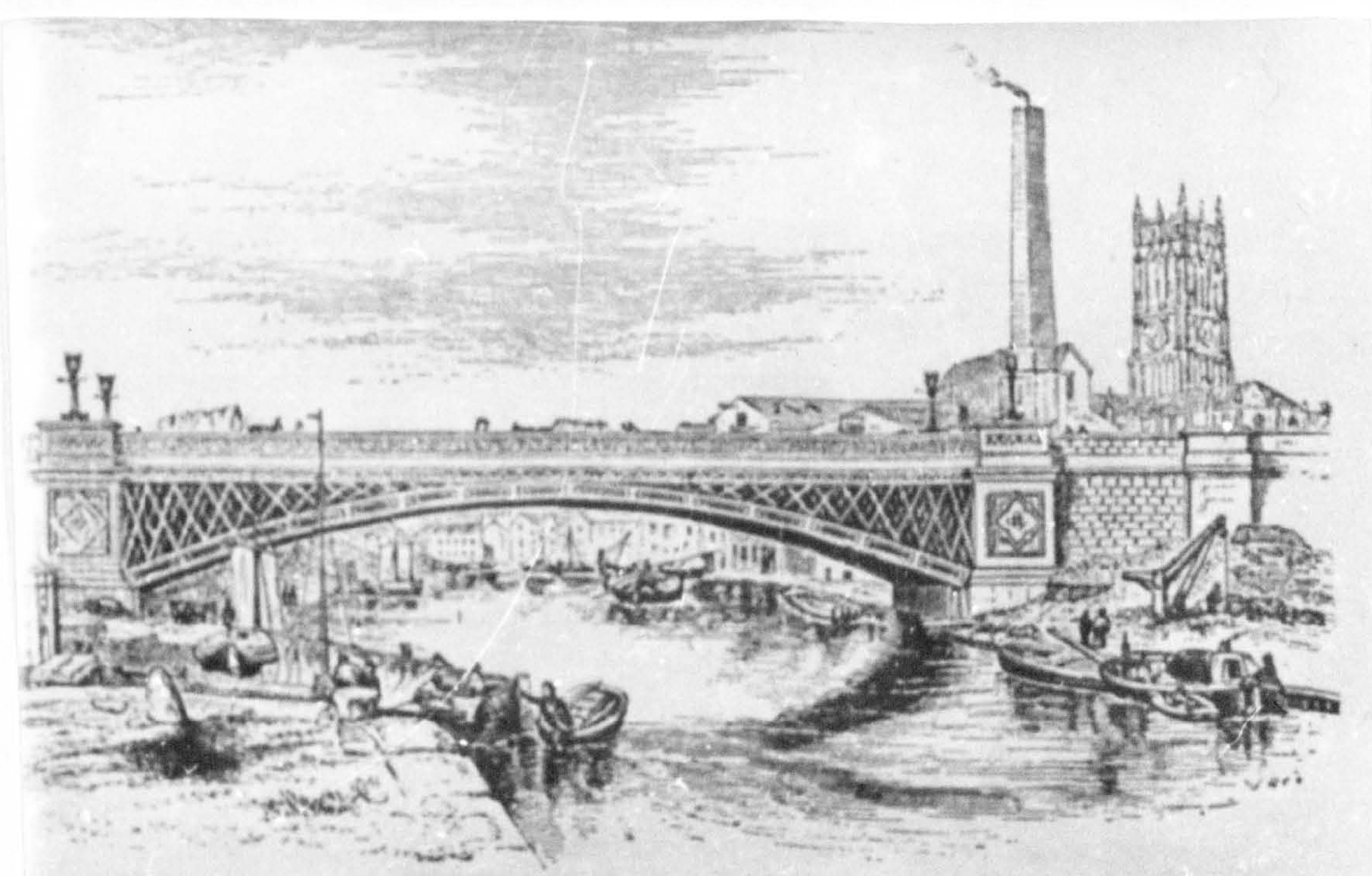
This is shown on the 1847 O.S.Map as the No. 1 Crane. It is not shown on earlier maps so it must be assumed that it was erected c.1845. The arms are two baulks of timber, the gears are housed in between two massive iron castings and the counterpoise is a fine piece of ashlar masonry.

The office block shown is to the east of the main warehouse and backs on to the Holbeck. It is clearly dated 1882.



VICTORIA BRIDGE

Stone built to a design by George Leather in 1837, this is now the oldest bridge in its existing state in Leeds.

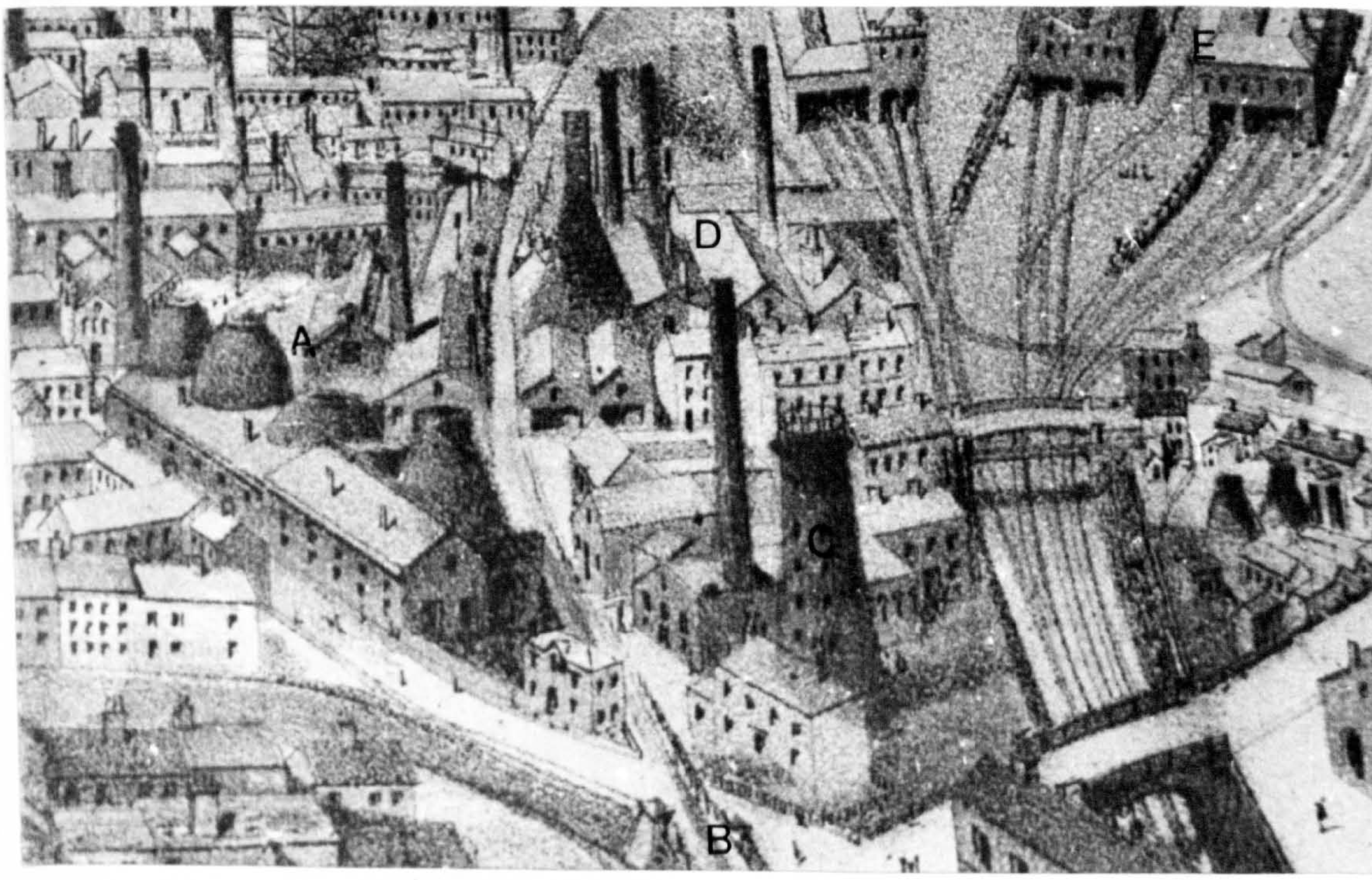


CROWN POINT BRIDGE

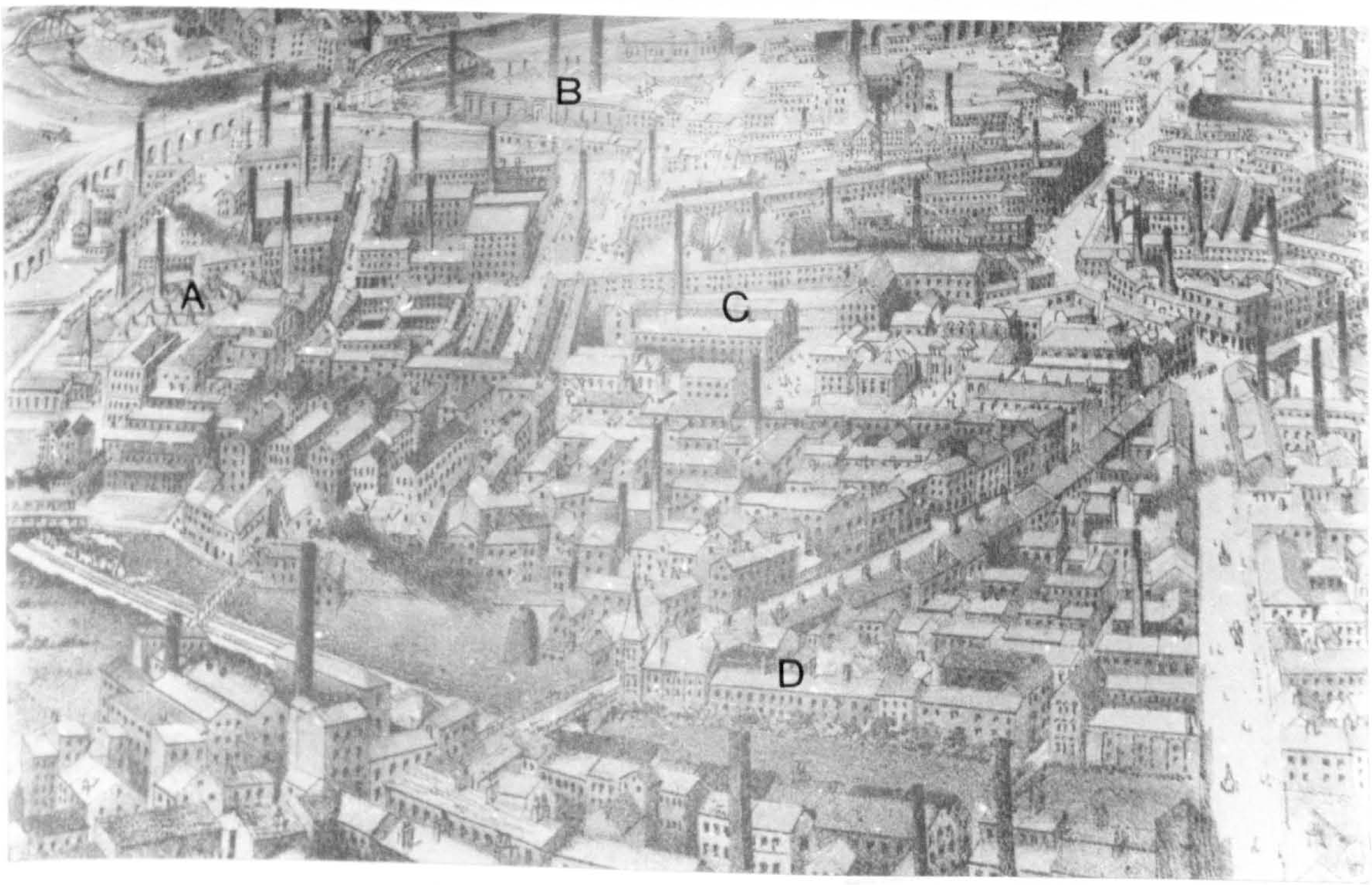
Also designed by George Leather, but this time in cast iron, Crown Point Bridge was built in 1840, the casting being made almost in situ by James Bray at his New Dock Foundry. The print has been chosen in preference to a photograph because the iron work is obscured by rows of pipelines which run immediately down stream on a level with the arch.

Selections from: 'A BIRD'S EYE VIEW OF LEEDS' (c.1874)

A = Leeds Pottery
B = Middleton Railway
C = Pottery Windmill
D = Leeds Iron Works
E = Hudson's Midland Railway Station



A = Union Pottery
B = Airedale Foundry
C = Steam Plough Works
D = Crown Point Printing Works
E = Chadwick Street Maltkilns.



A = Marshall's Mills

B = Tower Works

C = Benyon Mills

D = Wellclose Foundry

CHAPTER 23

CONCLUSIONS

So far this study has traced the development of the different industries in South Leeds, with special reference to the influences of the sites and technological developments.

Without a favourable location development is made more difficult and the evidence of different trades suggests strongly that the area under consideration had many natural advantages. The chief of these were the large areas of level land available for industry, ample supplies of boiler and process water in the critical formative period, plentiful supplies of cheap coal from the Yorkshire coalfield, which stretches to within a mile of the centre of Leeds itself, and from the coalfield supplies of fireclay, pipe (white) clay and iron stone so that industries based on iron and clay could be developed using local materials.

Hunslet and Holbeck changed from out-townships dependent on the domestic clothing manufacture into the main engineering suburbs of Leeds. It will be noted from the preceding chapters that the rich variety of industry formed an organic structure with a complex of interlinking threads so that no single trade was absolutely independent of the others. The basic woollen industry was eclipsed during the first half of the nineteenth century by flax spinning, both relied on local engineers to provide their textile machinery and steam engines. The woollen industry produced grease and used oils for dressing the yarn, soap for scouring the cloth, and lubricants for the machinery, The oil merchant had links with the manufacturing chemist and soap boilers. Chemists furnished dyestuffs, soda and acids for the textile industries and for the glass bottle makers. In turn the bottle makers provided containers for chemicals, foods and, increasingly, for drinks. In Tetleys Hunslet boasted the biggest brewery in Yorkshire by the end of the century and there were also several mineral water manufacturers. The tanners used chemicals and dyes for their 'Spanish' leathers and provided glue for dressing warp yarns for the weavers. In the second half of the century the boot and shoe trade expanded in Leeds itself rather than south of the river, but Hunslet made the nails for the bootmakers as well as the linen thread for the sewing machines.

These links show how closely connected were the different trades, a consideration of the sources of capital shows that finance for new enterprises came from an equally diverse cross-section of the community. Ard Walker was a wine and spirit dealer who married John Storey's daughter and took over and expanded his father-in-law's oil & cotton mill as his executor. Joshua Buckton was a woollen merchant who turned to the making of heavy testing machinery. Benjamin Pullan began as a dyer, became involved in woollen manufacturing and finally built steam engines. Earlier still, John Wilson, the linen manufacturer, received financial support from his fellow Quaker, Robert Arthington, the brewer.

Francis Tetley bought out the Middleton Colliery Estates in 1867. Joshua Bower was interested in coalmines, glass works, chemical works, glue sheds, turnpike toll farming and local politics.

The engineering industry shows the entrepreneurial spirit at its highest. New techniques were introduced, new specialities developed so that there was an overall expansion with great diversification. Individual firms rose, and fell - more often due to management failure than to any other single factor. Some concerns were lucky and were revived under new leadership. An example of this was the Hunslet Engine Company which was started on a period of growth by E. Brown Wilson, a Hull merchant. Wilson limited output to three basic types of locomotive and when new business was short built for stock. Eventually cash flow problems arose and E. B. Wilson left, the firm was closed down despite its profitable order book because of excessive holdings of finished locomotives which tied up capital. The business was revived under new management and, with one other change of control, continues to trade still.

Generally when one firm closed down another one took its place on the same site, frequently using the same buildings for a different trade; Shackleton's Union Flour Mill was little altered when it became a clothing factory and Patterson's Hunslet Shed on Joseph Street changed from a flax mill to a clothing factory and printing works. Benyon's flax mill was rebuilt as Ibbetson's woollen mill in 1871 and Samuel Denison had Kilburn's Hunslet Foundry completely rebuilt when he bought it in 1890.

The cotton spinning trade was short-lived but must be credited with pioneering the idea of large mills powered by big steam engines, bigger than any used in the scribbling and fulling mills at that time. The flax spinners were quick to follow and by the middle of the century Hunslet and Holbeck firms, led by Marshalls, dominated the flax trade of the kingdom. As flax spinning entered a decline clothing manufacturers took over the redundant mills, yet there were new firms starting up as thread spinners and weavers of heavy canvas and duck. On the one hand cotton competed with the lighter linens and on the other hand jute was cheaper than coarse linen. Those flax spinners who were adaptable survived into the twentieth century, but they were few in number.

One factor is clear, in most industries the median unit increased as the nineteenth century progressed. In 1800 there were four common brewers south of the River Aire in Leeds borough; by 1900 only Tetleys was still in production but it had become the largest brewery in the county.

The physical evidence of the surviving sites shows that there was massive investment in new industrial buildings after 1860. Whilst the national economy showed good times and bad it must be emphasised that national statistics are aggregates.

The fortunes of the individual firm might be at complete variance with the national trend. Sometimes the decision to invest in new buildings was made in a time of trade expansion and by the time the buildings were ready for use the trade trends had become less favourable. Such a misjudgement seems to have been made at Balm Road Flax Mill, but other firms, with better capital reserves and sound management survived such calamities. It may be cynical to suggest that the decline in the fortunes of flax spinners may be linked with the fires at the Goodman Street Flax Mill in 1864-5. Possibly the insurance settlement provided more cash than the sale of a declining business might have done. In engineering there was almost continuous expansion as new opportunities arose. Imperial expansion opened up new markets more valuable than those closed by tariff barriers in Europe and the United States. The decline in sail meant less work for the sail cloth makers but the massive growth in steam ships provided opportunities for the marine boiler makers in Hunslet. Keen salesmanship increased sales of both locomotives and traction engines abroad and rising living standards at home created an expanding market for many other trades, the printers of catalogues and tin boxes, ready-made suits and boots and even perambulators.

In Hunslet and Holbeck were all the facilities any manufacturer might require, good sites, access to markets and raw materials by rail, road and water, ample supplies of coal, supporting industries to make machinery, to sub-contract for parts or to deal profitably with by-products. Most of all there was a highly skilled and balanced labour force of both men and women, supported by the commercial centre of the West Riding across the river, with merchants, bankers, accountants, insurance brokers and lawyers.

Chapter 24

Index and Bibliography.

Alphabetical List of Users of Industrial Sites

User	Trade	Dates	Site
Addiman, J.	Tanner	1817	213
Addyman, J. & Son	Hackle/gill maker	1860-1870	74
Addyman, Joseph	Cloth dresser	1807	Hunslet Lane
Ainsley, G. J.	Ironfounder	1825-1876	64
Ainsley, J.	Dyer	1791	214
Airedale Hematite Co.	Ironfounders	1871-1875	200
Aireside Hematite Iron Co.		1875-95	200
(Walter Scott, Leeds Steel Works)		1895----	200
Alexander & Austin	Glass mfg.	1875-85	155
Alexander & Co.		1885----	155
Allison, Joseph	Potter	1806-24	181
Allison, John		1824-40	181
Allison &Green	Brewers	1791	178
Ambler, W.	Maltster	1817-1845	106
Appleyard, T. W.	Tanner	1863-1900	213
Archer, E.	Worstead spinner	1875-1900	190
Armistead, J.	Mustard miller	1798-1873	39
		1863-1866	199
Armistead, T.	Rope & Twine mfg.	1906-1907	201
			206
Armistead, W.	Cloth maker	1867-1906	14
Armitage, G. & Robinson, H.	Glass mfg.	1866-1906	205
		1866-1875	216
Armitage, J. & W.	Dyers	1853-1861	163
Armitage, W.	Chemical mfg.	1847-1880	104
Arnold, E. J. & Son	Printers	1863	Barnstaple
		1870	Leeds
		1890----	135
Arnott, Halliday & Co.	Printers	1890-1920	29
Arthington, Thomas	Brewer	d.1794	81
James		1794-1823	81
Robert		1823-1850	81
Aspin, James	Glue maker	1800-1833	197
		1820-1833	205
Atha, John	Currier	1863-1868	202
		1868-1888	204

Atkinson Bros.(James & Joseph)	Cart Makers	1853-1863	48
		1863----	47
Atkinson, James		1900----	182
Joseph		1900----	98
Atkinson, Hanley	Brassfounder	1858-1876	63
Atkinson, J. H.	Trap maker	1901-1914	70
Atkinson, William	Woollen mfg.	1795-1804	3
Atkinson, Richard		1848-1854	17
Bale, P. I.	Elect, engineer	1890-1914	123
Balmforth, G.	Cloth dresser	1851-1859	67
Banks & Moore	Printers	1903-1914	62
Banks, Stead & Goodison	Screw mfg.	1864-1866	60
Banks & Stead		1866-1900	60
Kirby Banks Screw Co.		1900----	60
Barker Bros,	Millwrights	1852-1875	222
Barker, Samuel	Brickmaking machine mfg.		222
Barraclough & Co.	Drysalters	1890-1914	28
Barton, R. & J.	Cornmillers	1853-1888	9
Bateman Machine Tool Co.	Machine Tool mfg.	1906----	214
Batt, T. & Co. fd.1851	Oil & Grease mct,	1892----	10
Baxter, W. H.	Stone Crushing Machine mfg.	1879----	2
Beaumont, J. &S.	Ironfounders	1853-1863	107
Beaumont, Williams & Co.	Ironfounders	1866-1899	142
Bean & Halliday	Printers	1914----	15
Beilby & Kaberry	Flax spinners	1831-1845	24
Bennet & Glave	Woollen mfg.	1875	124
Bentley, S. & Son	Mungo mfg.	1875	103
Benyon & Co.	Flax spinners	1803-1861	50
Benyon, T,Benyon, B., Bage, C.			
Berry, Henry	Hydraulic eng.	1882----	183
Beverly, Cross & Billam	Cotton spinners	1792-1796	214
Bevers & Wightman	Corn millers	1845-1853	3
Biggs & Liddle	Flax spinners	1834-1839	59
Liddle, W.		1839-1840	59
Blackburn Aeroplane Co.	Aircraft mfg.	1909-1913	215

Blackburn, B. & Son	Woollen mfg.	1798-1844	105
Blackburn, S, & Son			105
Blackburn, W.	Clothing mfg.	1906----	12
Blackith, F.	Chemical mfg.	1853-1870	216
Blakey, S.	Clothing mfg.	1875-1889	147
Boschi, Peter	picture frame mfg.	1910-1914	68
Botterill, Seanor & Co.	Clothing mfg.	1900-1914	168
Bower, J. & Co.	Chemical mfg.	1791-1876	192
Bower, Joshua, Sons; John and Joseph, Pullan, Benjamin		1814-1818	192
Bower, John	Chemical mfg.	1823-1846	216
Bower, Joseph		1846-1853	216
Bower, John	Bottle glass mfg.	1820-1845	185
Bower, Joshua	Crown glass mfg.	1817-1881	185
Brooke, William	Bottle glass mfg.	1881-1932	185
Bower, Joshua jnr.	Chemical mfg.	1839-1875	197
Bowling, J. & Co.	Ironfounders	1900-1910	145
Boyd, Thomas	Cloth finisher	1875----	17
Boyd, W.&A.	Cloth finishers	1889----	17
Boyle, Gill & Co.	Flax spinners	1824-1839	117
		1839-1853	68
Bracken, T. H.	Paper mfg.	1871----	208
Braime, T. F. & Co.	Light pressings	1905-1920	153
Braithwaite, F.	Cloth dresser	1798-1817	14
Bray, James	Ironfounder	1840-1853	96
Bray, Waddington & Co.		1853-1873	96
Briggs, E.	Flax spinners	1836-1880	41
Briggs & Co.		1845-1890	214
Briggs, T.		1889-1906	103
Britton, R. & Sons	Potters	1872-1878	128
Broadhead & Conyers	Leather mfg.	1906-1910	172
Bromley, J. & Harrison	Printers Engineers	1875-1889	204
Brook, George	Cloth finisher	1867-1889	67
Brooke, John	Woollen mct. Mayor of Leeds 1736		
Brooke, John & Edward		1791-1845	147
Brooke, William	Glass bottle mfg.	1881-1932	185
		1889-1891	162
Brooksbank, W.	Woollen mfg.	1853	16

Cartledge, Thomas	Potter	1800-1834	109
Cartledge, Elizabeth		1834-1845	109
Catton & Co.	Steel founders	1873-1906	63
Yorkshire Crucible Steel Casting Co.		1873----	96
		1876----	99
Chadwick Bros.	Clothing mfg.	1906----	172
Chadwick, J. & Co.	Brassfounders	1876----	63
Chadwick, William & Joseph	Dyers	1788-1807	Bowman Lane
Chadwick, Joseph & Son		1807-1807	
Chadwick, Charles		1817-1834	
Chadwick, J. & W.		1834-1860	
Kitchen, W.		1860-1910	
Chapman, B.	Mineral water mfg.	1898-1960	19
Chappell, S. & J.	Potters	1840-1847	128
+ Dawson		1839-1851	131
Charnock, Charles	Woollen mfg.	1815-1822	68
	Flax spinner	1823-1830	68
Charnock, John	Woollen mct.	1795-1824	67
	Flax spinner	1824-1839	67
Chevalier, A.	Textile machine mfg	1840-1845	125
Churton, Thomas Harding & Co.	Elect. Eng.	1906	42
		1907-1914	34
Clarke, B. & Sons	Oil & Grease mct.	1861----	101
Clarke, B. & Nephew		1900----	79
Clarke, J.	Potter	1817-1834	109
Clayton, Son & Co.	Millwrights	1864-1884	204
	Boilermakers	1884----	184
Clegg, B. W. & Sons	Gas Engine mfg.	1889----	204
Clough, J.	Corn miller	1853-1865	22
		1866-1875	32
Clough, Ramsdem & Co.	Cloth mfg.	1890-1900	150
Cludery, Richard	Textile Machine mfg	1815-1845	7
Cludery, C. & W.		1845-1853	7
Cludery, Charles		1853-1875	70
Colley, W. R.	Maltster	1911-1936	122
Conyers, H.	Leather mfg.	1889-1912	72
Cooke, Alf	Printer	fd. 1866 Hunslet Road	
		1872----	134

Dennison	Potter	1796-1800	110
Dibb, John	Mustard miller	1785-1790	64
Dickens & Barraclough	Worsted spinners	1839-1850	103
Diggle, T. K.	Spice mct.	1906-1924	29
Dixon & Butcher	Cloth dressers	1875-1889	56
Dixon & Rhodes		1889-1900	56
Dixon, D. & Brother	Woollen mfg.	1889	147
Dobson, C. B.	Flax spinner	1866-1875	103
Dobson, John	Maltster	1822-1872	178
Dobson, R.		1872----	178
		1866-1890	102
Dockray, B. & J.	Tobacco mfg.	1889----	69
Dockray, J.	Engineer	1853-1875	113
Dockray, A.	Flax spinner	1876-1877	113
Dodgshun, Isaac	Blanket mfg.	1875----	171
+ Ellis, H.		1890-1910	45
Dodgson & Co.	Flax spinners	1850-1866	103
		1866-1874	50
Dodgson, E. O.	Blanket mfg.	1900----	172
Dodgson & Hargreaves			
Dodgson & Mann	Flax spinners	1845-1853	59
Donisthorpe & Croft	Worsted mfg.	1852-1864	150
Crofts, J. & Co.		1864-1890	150
Dovenor, Sarah	Canvas maker	1853-	61
Dransfield, Charles	Linen mfg.	1833-1841	57
Dyer & Jackson	Corn millers	1834-1839	3
Dyson, Sons & Brotherton	Chemical mfg.	1889-1906	126
Brotherton & Co.		1906----	126
Dyson, G.	Ironfounder	1875-1896	146
Eastwood, B.	Clothing mfg.	1903----	62
Ellis, H. & Dodgshun, Isaac	Blanket mfg.	1890-1910	45
Ellis & Lumb	Cloth dressers	1863-1889	59
Lumb, W.		1889-1900	59
Ellison, J.	Engineer	1888-1900	84
Ellison, Joseph	Ironfounder	1863	64
Ellison, T.	Brassfounder	1900-1914	59
Embleton, Mackenzie & Walton	Ironfounders	1865-1889	92

Emmanuel & Co.	Wool extractors	1866-1875	35
Farrar & Bower	Corn millers	1829-1850	210
Farrar, G.	Cabinet maker	1906-1907	68
Fawcett, T. C.	Brick-making machine mfg.	1871----	143
Fenton, Murray & Wood	Engineers	1796-1820	34
Fenton, Murray & Jackson		1820-1843	34
Firth, F. & W.	Steel stockholders	1864----	59
Fisher & Nixon	Woollen mfg.	1792-1816	15
Fletcher, Whitehead & Co.	Cloth mfg.	1863-1875	171
Fletcher, J.		1875-1889	15
Forbes & Groves	Packing machine mfg.	1901-1905	62
		1905----	176
Foster, Davey & Co.	Flax spinners	1839-1845	196
Davey, W.		1845-1853	196
Foster, Leonard	Maltster	1817-1853	19
Fowler, John d.1898	Steam Plough mfg.	1860----	136
Fox, Charles & Son	Linen mfg.	1886-1916	31
Fox & Atkinson	Oil cake mfg.	1900-1914	161
Franklin & Isaacson	Oil engine mfg.	1900-1910	71
Pelapone Engine Co.		1910----	71
Gama & Son	Woollen mfg.	1822-1839	139
Faustino da Gama			
Garnett, John	Corn/Scribbling miller	1763-1788	207
Garnett, Robert		1788-1791	207
Garnett, J. & W.		1791-1832	207
Garnett, J. & R.		1823-1830	207
Garret & Shaw	Woollen mfg.	1875-1889	204
Garret, R.		1889----	204
Garside, R. V. & T.	Ironfounders	1867-1871	199[illegible]
Gibson, W. & Co.	Potters	1861-71	131
Gill & Wainwright	Ironfounders	1845	145
Gillam, J. J.	Ironfounders	1860----	67
+ Bowling, J.		1889----	67

Gilston, Peter	Glass mfg.	1868----	212
		1868-1889	216
Gledhill, J.	Ironfounder	1824-1855	211
Kilburn, R.		1855-1899	211
Glover, D., Lister & Raper	Scribblers	1801	105
Glover, G.	Gass meter mfg.	1903----	62
Glover, M.	Flax spinner	1863	35
Glover, M.	Engineer	1889-1910	124
		1910-1914	15
		1914----	16
Glover, R.	Cloth finisher	1900-1914	147
Goodman, Benjamin & Sons	Woollen mct.	1780-1866	72
Gouarne, R. D.	Cart maker	1906----	160
Good, John	Woollen mfg.	1820-1823	208
Gotthard, John & William	Ironfounders	1823-1825	211
Gledhill, J.(son-in-law)		1825-1855	211
Gray, W.	Flax spinner	1866	Simpson's Fold
Greaves Bros.	File makers	1875-1889	147
Green & Jackson fd. 1846	Ironfounders	1853-1889	12/14 Water Lane
Green, Joseph & Nephew		1889-1911	85
		1911----	86
Green, John	Brewer	1788-1803	178
Green & Allison			181
Green & Smith	Elect. Engineers	1910----	16
Green, W.	Potter	1900-1914	108
Grimshaw, J.	Nail maker	1875	Church St. Hunslet
		1889-1906	156
+ Armistead		1906----	165
Grimshaw, John	Woollen mfg.	1796	5
Grimshaw, S. & W.	Flax dressers	1798	Bridge End
Grimshaw, Brady & Robinson		1829	Simpson's Fold
		1830	Marshall Street
Grisdale, J.	Candle makers	1875-1918	39
Grosvenor, C. & Son	Ironfounders	1875-1900	179
Hart Engine Co.	Engineers	1900-1914	179
Hadley, J.	Packing case mfg.	1910----	161
Hainsworth, J. W.	Woollen cloth mfg.	1867-1890	14

Handley, W. & Sons	File makers	1889-1910	51
Hall, W.	Monumental masons	1840-1874	51
Hall, D. & Son		1874----	51
Harding, T. R.	Hackle/gill pin mfg.	1836-1864	59
		1864-1892	33
Harding, T. R. & Son		1892-1906	33
Harding, Richardson & Rhodes		1906-1920	33
Hargreaves & Co.	Hackle/gill pin mfg.	1888	53
Hargreaves & Gill	Flax spinners	1833-1839	117
Boyle, Carr & Co.		1839-1853	68
Harker, W. & Co.	Axle makers	1875-1889	48
	Spring makers	1889----	48
Harlow, J. E. & Son	Mfg. confectioners	1906-1914	88
Harrap, Mark	Felt carpet mfg.	1854-1861	124
Harrap & Mason			
Harrison, J.	Tanner	1845-1863	213
Harrison & Redman	Fulling millers	1866	124
Harrison & Sugden	Ironfounders	1822	117
Harrison & Woodcock		1823-1826	117
Harrison, R. & J.	Mustard millers	1863-1875	117
Harrison, W.	Maltster	1866-1873	79
Harston & Co.	Mineral water mfg.	1888----	Bowman Lane
Hartley, Green & Co.	Potters	1770-1825	128
Wm. Hartley, John Green, Joshua Green, Savile Green, Samuel Wainwright, Thomas Wainwright, George Hanson Henry Akeroyd, John Barwick			
Hastings & Mellor	Paper mfg.	1863-1871	208
Bracken, T. H.		1871----	208
Hathorn, Davey & Co.	Engineers	1875----	125
Hattersley, Pickard & Co.	Textile machine mfg.	1910----	71
fd. 1851 J. Hattersley, Kirkstall Road.			
Hawkesworth, E. & Co.	Flax spinners	1900-1914	168
Hawkesworth, T.	Tanner	1866-1900	73
Haynes & Dalby	Brewers	1845-1853	129
Heachman, Atkinson & Co.	Engineers	1875	32
Henry, Joseph	Engineer	1877-1878	113
	Ironfounder	1878-1914	44
		1906-1920	151

Henry, Joseph jnr., Wildsmith & Co.	Engineers	1894----	34
Hepton, William	Brassfounder	1853-1889	74
Hepton, W. & Son		1889----	74
Hepworth, John + Mills from 1837	Potter	1834-1839	131
Heuthwaite, G.	Dyer	1871-1900	191
Heuthwaite, G. & Sons		1900----	191
Hick, J. & H.	Maltsters	1875-1900	79
Hill Bros.	Ironfounders	1865----	169
Hindes & Patchett	Worsted spinners	1822	Meadow Lane
Hindes & Dereham		1830-1845	Dock Street
Hirst, Brooke & Tomlinson	Chemical mfg.	1862-1890	161
Hirst, J.	Cloth dresser	1910-1914	15
Hirst, John	Paper maker	1815-1823	Water Lane
		1824-1839	208
Hirst, Delia		1839-1863	208
Hastings & Mellor		1863-1871	208
Hiscoe, John (=Hiscox)	Cloth dresser	1848-1854	124
		1854-1875	17
Hodgson, Joseph	Cloth mfg.	1861-1874	50
Hodgson, Raincliffe & Hinchcliffe	Scribblers & iron founders	1791-1805	214
Hogg, T. & B. and J. &J.	Woollen mfg.	1817-1831	14
Holdsworth, R.	Flax spinner	1822	Simpson's Fold
Holdsworth, W. B.	Flax spinner	1821-1835	58
		1835-1880	168
Holmes, John	Clothing mfg.	1889-1912	22
		1912----	190
Holmes, John & Son (= Stanley Rug Co.)	Rope & twine mfg.	1906----	204
Holmes, John & Thomas, Ben.	Brewers	1853-1860	129
Holroyd, Horsfield & Wilson	Engineers	1875-1905	150
Holroyd, T.	Flax spinner	1863	Simpson's Fold
Horner, Drake & Co.	Corn millers	1827-1845	112
Horner & Sons	Clothing mfg.	1900-1923	168
Horsman, T. W.	Corn miller	1863-1880	43

Hortman, Murphy & Co.	Woollen printers	1875-1889	123
Hudson, Albert	Clothing mfg.	1886-1912	29
Hudson, A. & Co.		1912-1920	22
Hudswell & Clarke	Loco. engineers	1860-1870	138
Hudswell, Clarke & Rodgers,		1870-1879	138
Hudswell, Clarke & Co.		1879-1910	138
Hudswell, Clarke & Co. Ltd.		1910----	138
Humble, Green & Co.	Potters	1750-1770	128
Hartley, Green & Co.		1770-1825	128
Wainright, Samuel		1825-1839	128
Chappell, S. & J.		1839-1850	128
Warburton & Britton		1850-1872	128
Britton, R. & Sons		1872-1878	128
Humphrey, W.	Ironfounder	1853-1906	203
		1906----	206
Hunslet Engine Co.	Loco. Engineers	1864----	137
Hurst, W.	Maltster	1900-1911	122
Hutton & Macdonald	Engineers	1863-1866	Hunslet Lane
		1875-1889	85
Hyde, Dockray & Ambler	Engineers	1839-1845	113
Horner & Dockray		1845-1853	113
Dockray, J.		1853-1875	113
Ibbotson, Thomas & Co.	Woollen mfg.	1875-1918	50
Idle, B. & S.	Maltster	1840-1890	122
Idle, B. & Son		1890-1900	122
Illingworth Bros.	Timber mcts.	1875-1877	126
Illingworth, Ingham & Co.		1878-1914	113
Ingham, J. & J.	Flax spinners	1835-1870	196
	Nail makers	1853----	196
Ingham, Joseph & Joshua	Woollen mfg.	1807-1830	145
		1822-1830	199
Ingham, Samuel	Tanner	1822-1860	217
Inman, C. B.	Mineral water mfg.	1888-1900	165
Inman, R. H. & W. E.		1900-1910	165
Jackson, J.	Dyer, corn miller	1845	207

Jackson, W.	Corn miller	1822-1827	112
Dyer & Jackson		1834-1839	3
Jackson, W.	Machine tool mfg.	1866-1870	84
Japa Blind Co.	Blind mfg.	1910----	214
Jaques, T. G.	Brewer	1756-1786	65
Jaques & Co.		1786-1817	65
Jaques & Nell		1817-1835	65
Nell, Benjamin & Co.		1822-1840	65
Jepson, W.	Potter	1853-1863	110
Jones, George	Ironfounder	1829-1836	127
Jowett & Sowery	Printers	1906----	214
Joy, Edward & Sons	Oil crushers	1840----	75
Jubb, John	Millwright	1791-1817	64
Jubb, John	Chemical mfg.	1823-1853	216
Jubb, T. & J.	Lead smelters	1860----	192
Kay, T.	Potter	1853-1900	108
Kaye, J. & Sons.fd.1868	Lock makers	1884----	170
Kaye, J. W. & J.	Canvas mfg.	1789-1806	40
Kaye, J. & J.		1806-1908	40
Kemp, S.	Tanner	1822-1833	213
Kempe & Co.	Machine tool mfg.	1874-1875	15
Ridley & Kempe		1875-1906	18
Kenworthy, W. E.	Oil mct.	1842----	Simpson's Fold
Kershaw, W.	Cloth dresser	1845-1854	123
Kershaw, W. & Co.	Cloth dressers	1839-1845	67
Kershaw, A. & T. W.		1845-1850	67
Kilburn, Richard	Textile machine mfg.	1850-1866	21
		1855-1899	211
		1870----	219
Kimberley Bros.	Oil mcts.	1877-1890	126
Kirk, J.	Cloth dresser	1839-1853	61
Kirk, W.	Fulling miller	1839-1845	150
Kirk, W. B.	Cloth dresser	1866-1900	56
Kitchen, W.	Dyer	1860-1910	Bowman Lane
Kitching Bros.	Engineers	1875-1889	42
Kitson & Laird	Loco. engineers	1839-1842	140
Kitson, Thompson & Hewitson		1842-1865	140
Kitson & Co. (James Kitson + 2 sons)		1865-1938	140
Knight & Foster	Printers	1900----	25

Land, Thomas	Flax dresser	1815-1830	58
Lawton & Co.	Clothing mfg.	1900-1907	24
Lax & Shaw	Glass bottle mf'g.	1900----	162
		1906----	202
Leathman, W. B.	Engineer	1889----	70
Leadbetter & Cull	Engineers	1906----	14
Leather,, J. T. (Hunslet Engine Co.)			
	Loco. engineer	1864-1872	137
Campell, G. & J.		1872----	137
Leather & Wardle	Potters	1845-1853	110
Leeds Art Pottery	Potters	1889-1900	131
Leeds Flax & Hemp Spinning Co.			
	Flax spinners	1914----	214
Leeds Flour Mill Co-op.	Corn millers	1848----	36
Leeds Industrial Co-op Society		1891----	35
	Cabinet makers	1886----	146
Leeds Hemp Spinning Co.	Rope & twine mf'g.	1889-1906	149
(Parker Bros. + Briggs & Co.)			
Leeds Screw & Bolt Co.	Screw mfg.	1906-1918	123
Leeds Stamping Co.	Light pressings	1900-1914	59
Leeds Steel Works	Steel makers	1895----	200
Walter Scott & Co. Ltd.			
Leeds Phosphate Works	Chemical mfg.	1871----	199
Liddle, W.	Flax spinner	1839-1840	59
Lightman, Victor fd. 1887	Cabinet maker	1900----	103
Lightowler, C.	Printer	1900----	189
Lindley, J. fd. 1850	Brassfounder	1893----	71
Linley, W. fd. 1817	Brassfounder	1845	64
Lister Bros.	Worsted spinners	1848-1900	209
Lister, J. C.	Woollen spinner	1866-1887	124
Liversidge & Cunningham	Clothing mfg.	1906-1911	16
Lockwood, G.	Cloth dresser	1853-1861	15
		1861-1866	14
Lockwood & Bentley		1866-1890	14
Longbottom, J. & Co.	Galvanisers	1875-1889	147
Lubelski & Co.	Clothing mfg.	1906-1908	16
Lubelski & Sons	Clothing mfg.	1900----	180

Lumb, W.	Cloth dresser	1889-1900	59
Lupton, T.	Flax spinner	1845	Simpson's Fold
Lynd, W.	Oil mct.	1866-1920	Simpson's Fold
MacCarthy, D. W.	Oil mct.	1866----	Dock Street
McCulloch Bros. & Co.	Millwrights	1900----	203
MacLaren, J. H.	Engineers	1873----	133
Maclea & March	Engineers	1825-1889	62
Mallinson (Yorks. Dripping Co.)			
	Dripping mfg.	1910-1914	16
Maltby & Walker, J.	Woollen mfg.	1848-1863	124
Mann, George	Printers' engineers	1875-1905	222
		1905-1933	150
Mann's Patent Steam Wagon Co.		1898----	217
Manning, Wardle & Co.	Engineers	1858-1920	132
Manning, John; Wardle, C. W.; Campbell, Alexander.			
Mark, John & Co.	Wood cutting m/c.mfg .		
		1875-1900	69
Marsden Bros.	Dyers	1910----	45
Marsden, W.	Stone crushing		
	machine mfg.	1863----	64
Marshall, Fenton & Dearlove	Flax spinners	1791-1793	27
Marshall & Benyon		1793-1803	27
Marshall & Hives		1803-1806	28,29,
Marshall & Co.		1806-1886	29,30
Marshall, John	Dyestuff mfg.	1820-1900	94
Clemons, Marshall &Carbet		1900----	94
Yorkshire Dyeware Co.		1910----	94
Marshall, T. & Co.	Shirt mfg.	1886----	29
Marsland, J. E.	Shoddy mfg.	1900----	58
Mason & Co.	Scribblers	1791	214
Matheson, Tavernier & Co.	Woollen mfg.	1875-1889	123
Matthewman, F. H.	Maltster	1890-1920	130
May, J. & Son	Clothing mfg.	1907	11
Midgley, & Bairstow	Corn millers	1889	32
Mills, John	Potter	1825-1844	174
+ Crossley, A.		1853-1865	174
Mills, John & Son + Hepworth, J.		1837-1839	131
Mills, John & Son		1863-1870	110

Milner, John	Card maker	1840-1883	183
Mitchell, Stephen	Cloth dresser	1817-1822	56
Mitchell, Walker & Crawford	Clothing mfg.	1906-1910	1
Mitchell, Walker & Co.		1910----	1
Moore, H. & Co.	Clothing mfg.	1900----	175
Mooney & Laycock	Glass bottle mfg.	1868-1900	202
Morfit, J.	Flax spinner	1853	4
Morris, J.	Tanner	1839-1845	213
Mortimer, Elizabeth	Bobbin maker	1829-1833	58
Mortimer, G. & R. (Benjamin Mortimer & Sons)		1865----	27
Morton, Benjamin	File makers	1900-1914	59
Morton, Jonathan & Sons	Engineers	1863-1875	83
Moss, M.	Woollen mfg.	1830	104
Mountain, B. & Son	Nail makers	1868----	166
Musgrave, B.	Cloth dresser	1867	67
Musgrave, S.	Woollen mfg.	1872-1888	14
Musgrave, W. & Co.	Cotton spinner	1800-1806	Simpson's Fold
Musgrave & Gatliffe			
Myer, Adolf	Wool extractor	1870-1879	35
Myers & Blakey	Maltsters	1866-1875	20
Myers & Collet			
Myers Bros.	Engineers	1906----	7
Naylor, Joseph	Card maker	1886-1889	123
Naylor, T.	Maltster	1803-1817	178
+ Thomson, Benjamin	Cotton spinners	1802	178
Naylor, W.	Maltster	1880----	164
Neill, John & Co,	Paper maker	1845-1890	Dock Street
Nevins, Pym	Woollen mct.	1790-1796	152
Nevins & Gatliffe		1796-1800	152
Nevins & Son		1800-1836	152
Newby, Riley & Hartley	Clothing mfg.	1910----	16
Newsome, T. H. fd. 1878	Oil mcts.	1888-1910	61
		1887----	121
Newsum, Wood & Dyson	Printers engineers	1870-1910	114
Newsum, George & Co, Ltd.			
Newsum & Co. (Corrugated Boiler Works)		1900-1914	59
Newsum Bros.		1906-1910	214

Newton, Taylor & Co.	Ironfounders	1831-1839	58
		1844-1865	32
		1865-1889	21
Nichols, W.	Flax spinner	1875-1889	56
Nicholson, Booth & Co.	Glass mfg.	1853-1863	216
Nicholson, J. & Sons	Chemical mfg.	1850----	186
Nicholson, William & Son	Builders	1839-1907	77
		1888----	87
Noble, R. J. & J.	Potters	1830-1847	131
North, R.	Maltster	1825-1827	129
North, Wesley & Co.	Chemical mfg.	1880----	104
+ British Economical Washing Machine Co.		1906----	104
Nussey & Pilling	Ironfounders	1875-1878	44
Nussey, R.	Woollen mfg.	1839-1863	14
Nutt & Co.	Printers	1900-1920	124
Nutter, R. H.	Brassfounder	1906-1914	111
Oldroyd, E. fd. 1848	Printers engineers	1873----	92
Oldroyd, M. & Sons	Blanket makers	1867-1900	172
Oldroyd, T. & Son	Chemical mfg.	1875-1900	194
Pape, J. & W.	Corn millers	1845-1860	112
Parker Bros.	Flax spinners	1864-1906	149
Parker, J. fd. 1845	Screw mfg.	1853-1884	170
Patterson, Alexander	Flax spinner	1856-1872	68
		1872-1900	189
Pearson & Sons	Woollen mfg.	1835-1875	15
Pearson & Kempe, W.		1845-1871	15
Petty, Samuel, & Rainforth, S.	Potters	1757-1797	131
Petty & Rainforth		1797-1817	174
Petty & Hewitt		1817-1825	174
Petty, S. & Son		1825-1845	174
Pitchers, W.	Worsted mfg.	1888	14
Platts, Jesse	Potter	1839-1845	141
Pool, Luke	Screw mfg.	1836-1851	38
Pool, L. & Son		1851----	38
Porritt, M. E.	Twine mfg.	1906-1910	143
Porteus, George	Millwright	1900----	78

Preston & Cooper	Druggists	1889-1906	6
Sydenham Fruit Preserving Co.			
Kirk, Preston &Co.		1906-1914	62
Preston, W.		1914-1918	6
Prince, W.	Corn miller	1823-1830	207
Prior, Nathaniel,&Warwick	Ironfounders	1801-1807	Simpson's Fold
Procter, E. & Co.	Bunting mfg.	1906-1911	147
Procter, J. & J.	Flax spinners	1817-1833	64
Pullan, Benjamin	Ironfounder	1817-1839	203
Pullan, Sarah	Boiler maker	1839-1845	203
Pullan, R. & Sons	Engineers	1845-1853	203
Pullan & Mann	Printers engineers	1905----	222
Ramsbottom, J.	Engineer	1875-1889	147
Rangdale, J. & T.	Flax spinners	1867-1890	14
Ratcliffe, G.	Mfg. confectioner	1900-1920	124
Rayner & Scholey	Dyers	1836-1853	163
Rhodes & Fox	Linen mfg.	1870-1886	31
Fox, Charles & Son		1886----	31
Rhodes, J.	Clothing mfg.	1886----	30
Rhodes, J. & Kenyon	Ironfounders	1864-1879	158
Rhodes, Matthew & Son	Engineers	1855-1870	54
Rice & Co.	Hydraulic engineers	1898----	220
Richardson Bros.	Mfg. chemists	1847-1866	199
Richardson, H.	Ironfounder	1900----	71
Richardson, John	Cloth dresser	1859-1864	67
		1866	124
Richmond, H. & Sons	Boot protector mfg.	1900----	157
		1906----	156
		1910----	159
Ridge, Ceres & Co.	Mfg. Confectioners	1895-1918	70
Ripley, D. & Son	Pattern makers	1900----	69
Ripley, P. & Sons	Woollen mfg.	1817-1834	18
Ripley & Ogle		1834-1854	18
Ripley, R.		1854-1875	18
Ripley & Ogle		1826-1829	5
Roberts, C. & E.	Nail makers	1868----	167

Roberts, J. W.	Mineral water mfg.	1872-1906	195
Roberts, Scott & Taylor	Glass bottle mfg.	1841-1853	188
Scott & Co.		1853-1859	188
Roberts, T.	Corn miller	1817-1846	22
Roberts, Widow		1846-1848	22
Robinson, J. H.	Corn miller	1866-1889	3
	Woollen mfg.	1867-1914	5
Robinson, J. Horner	Maltster	1877-1892	20
Robinson, J. Henry		1892-1915	20
Robinson, S. & T.	Flax spinners	1829	Simpson's Fold
Robinson, W. & Hardy, W.	Potters	1845-1853	141
Robinson & Son		1853-1920	141
Robson & Bucktrout	Seed crushers	1863-1875	150
Rose & Parkin	Brassfounders	1875----	71
Roxbury, E. W.	Engineer	1875	116
Russell, Charles	Printer	1903-1914	62
Russell, William	Potter	1807-1837	111
Russell, Charles		1837-1847	111
Russell, Joshua & Edward		1847-1890	111
Rutland Lamp Co.	Electric Light Bulb mfg.	1911----	205
Salt, Titus, & Gotthard, T.	Ironfounders	1772-1823	211
Gotthard, J. & W.		1823-1825	211
Sands & Mundall	Clothing mfg.	1869----	150
Sands, W.	Ironfounder	1879-1908	158
Sayner, John	Dyer	1792-1845	104
Sayner & Son			
Schofield & Parkinson	Clothing mfg.	1901-1912	190
Scholes, J.	Bobbin maker	1863	58
Scott, S.	Glass bottle mfg.	1845-1866	155
Scott, J. & Co.		1866-1875	155
Alexander & Austin		1875-1885	155
Scott & Co.		1853-1859	188
Scott, Walter & Co. Ltd.	Steel makers	1900----	200
Sellers, J. & Co.	Cloth dressers	1853	59
Senior, George Raikes	Potter	1906-1920	187
Senior, J. & J.		1906	Hills Yard
Senton & Turner	Cloth dressers	1830	104

Servant, Sykes & Co.	Cloth dressers	1841-1853	59
Servant, Ann & Co.		1853	18
Shackleton, Jonathan	Corn miller	1809-1815	3
Shackleton, Joseph		1815-1826	3
Shackleton, Jonathan		1822-1844	8
		1831-1888	11
Shackleton, John		1844-1853	8
Shackleton, R. & Co.		1853-1866	8
Shackleton & Taylor	Potters	1851-1861	131
Shann, Matthias	Mungo mfg.	1866	61
Shaw, E. P. & Co.	Mineral water mfg.	1910----	165
Shaw, Scaife	Chair mfg.	1864-1888	68
Shepherd & Todd	Loco. engineers	1839-1844	137
Shepherd & Wilson, E. B.		1844-1846	137
Shepherd, Wilkinson & Co.	Textile machine mfg.	1845-1853	145
Shepherd, Hill & Spink	Engineers	1853-1860	145
Shepherd, Hill & Co.		1860-1900	145
Simpson, Fawcett & Co.	Machine tool mfg.	1858-1871	143
Leeds Pail & Pram Works	Pram. makers	1871-1918	100
Simpson, J. & J.	Tobacco mfg.	1823	116
Simpson & Sands	Nail makers	1910----	62
Skelton, T.	Maltster	1817-1845	26
		1817-1843	34
Smith, Beacock & Tannet	Engineers	1837-1855	54
		1855-1894	54
Smith, C.	Brassfounder	1889-1906	123
Smith, G.	Flax spinner	1845-1860	56
Smith, Hannah	Corn miller	1906-1914	43
Smith, J.	Machine tool mfg.	1866-1906	107
Smith, J.	Woollen mfg.	1866	124
Smith, S.	Corn miller	1875	32
Smith, S. A. & Co.	Maltsters	1910-1914	195
Smith & Stabler	Flax spinners	1834-1839	Simpson's Fold
Smith, T. & Sons	Woollen mfg.	1863	35
Smith, W.	Flax spinner	1906----	149
Smith, W. H.	Brassfounder	1900----	164
Smith's Shirt Factory	Shirt mfg.	1906----	177
Smithson, Rayner & Ritchie	Woollen mcts.	1798-1807	56
Smithson, Oates & Co.		1807-1810	56

Sowry, Francis	Woollen mfg.	1822-1829	5
Spong4, William	Brewer	1830-1853	140
Spray, J.	Flax spinner	1866-1875	56
Stancliffe, J. L.	Currier	1900-1914	168
Standard Engineering Co.	Hydraulic engineers	1900-1910	147
Star Mill Flour Co.	Corn millers	1866-1890	8
Star Maltkin	Maltsters	1890-1903	8
Stead, J.	Engineer	1875-1906	106
		1906-1910	15
Stead, Jabez	Woollen mfg.	1830-1834	199
Stead, Samuel & Co.	Whitesmiths	1845-1860	Grey Walk
Stephenson, M.	Tanner	1834-1839	213
Stirk, Zebulon	Engineer	1833-1843	64
Stone & Co.	Twine works	1900----	70
Storey, W.	Chemical mfg.	1830-1834	121
Storey & Walker		1834-1839	121
Sturges, John	Ironfounder	1768-1804	22
Sugden, J.	Ironfounder	1823-1839	125
Sugden & Harrison	Machine mfg.	1822-1826	117
Sunderland, T.	Jam mfg.	1889	9
		1900-1914	9
Sutcliffe, C.	Machine maker	1853	37
Swinburn, J.	Cart maker	1875	98
Sykes & Dickinson	Potters	1860-1911	109
Sykes, D.	Cloth dresser	1845-1875	147
Sykes, J.	Cloth mfg.	1875-1889	147
Sykes, William	Brewer	1786-1823	76
Tetly, Joshua		1823----	76
Tannet, Walker & Co,	Hydraulic engineers	1861----	163
Tatham, E. & G.	Flax spinners	1839-1850	16
Taylor	Glass bottle mfg.	1859-1863	188
		1863-1889	162
		1833-1840	205
Scott, Taylor & Co.		1840-1859	188
Taylor Bros.	Ironfounders	1863-1960	154
Taylor, J.	Woollen mct.	1817-1830	140
Taylor & Wainhouse, E.		1822-1830	140

Taylor, W.	Potter	1817-1845	182
Taylor, G. & S.		1846-1866	182
Taylor, S.		1866-1875	182
Taylor, G. & S.		1875-1890	182
Shackleton & Taylor		1851-1861	131
Taylor, S.		1871-1880	131
Taylor, Wordsworth & Co.	Textile machine mfg.	1793-1967	23
Tetly, Joshua & Sons	Brewers	1823----	76
Thompson, Wilson & Co.	Engineers	1866-1887	121
Thompson, Yeadon & Hartley	Cloth dressers	1863-1866	124
Titley, Tatham & Walker	Flax spinners	1808-1880	40
		1880-1900	168
		1827-1839	16
Todd, Kitson & Laird	Loco. engineers	1837-1839	137
Todd & Shepherd		1839-1844	137
Todd, Charles		1844-1852	125
Towler, W.	Ironfounder	1888-1890	32
		1890-1960	21
Turner, W. H.	Tobacco mfg.	1906-1920	32
Varey, F. T.	Ironfounder	1877-1900	64
Varley, William	Wireworkers	1740-1794	206
Varley, William & Sons		1794-1805	206
Varley, James		1805-1845	206
Varley & Cawthrey		1826-1829	206
Varley, Exors. of J.		1845-1879	206
became Charles Procter 1879, and moved to Calls			
Vause, Thomas & Sons	Shoddy mfg.	1900----	209
Verity Bros.	Brassfounders	1876-1906	69
Verity, E. (Mfg.) C.o	Engineers	1906----	69
Vickers, Benjamin & Sons	Oil mcts.	1875	Boar Lane
		1889----	161
Waide, William	Cooper	1840-1890	85
Waide, William & Sons		1890----	85
		1890----	91
Wainwright, Samuel	Potter	1825-1840	128
Chappell, S. & J.		1840-1847	128
Waites, Wm., Sons & Atkinson	Flax spinners	1906-1912	103
		1914----	113
Walker, Ard	Cotton spinner	1787-1823	199
Walker, E. A.	Machine tool mfg.	1889-1900	164

Walker, S. & Sons	Maltsters	1823-1900	198
		1850-1890	130
Walker, S. G. & T.		1826-1840	6
Walker, W.		1840-1914	6
Walker, George		1868-1914	6
Walker & Teasdale		1863-1866	106
Walker, J. A. & W.		1866-1875	204
Walton, S.	Clothing mfg.	1906----	29
Waltons, Morton & Co.	Ironfounders	1839-1844	145
Warburton & Britton	Potters	1850-1872	128
Warburton, James	Worsted spinner	1851	Bramley
+ Taylor, Wordsworth & Co.		1851	23
Warburton, Samuel	Woollen spinner	1830-1839	214
	Chemical mfg.	1839-1853	214
Warburton & Sons		1853-1914	214
Watson, J. B.	Engineer	1880-1900	78
Webster, J.	Wireworker	1860-1864	84
West, W.	Engineer	1863-1866	142
Westley, W. K.	Flax spinner	1821-1823	210
Westwood, William	Millwright	1839 Yard on Meadow Lane	
Westwood & Son		1863-1866	42
Whitaker, J. M.	Cloth mfg.	1875-1900	105
Whitaker, W. & Bailes	Chemical mfg.	1875-1890	193
Whitehead, J.	Cloth mfg.	1875-1889	16
	Dyers	1888	161
Whitley, Joseph	Brassfounder	1880----	71
Whitley, Luty & Co.	Canvas mfg.	1825-1863	58
Luty, T. & Co.		1863-1875	58
Whitley Partners Ltd. fd. 1844	Brassfounders	1889-1970	89
Whittaker, J.	Scribbler	1892-1900	147
Wightman, J.	Corn miller	1865-1875	22
Wilcock & Sons	Jam mfg.	1906-1914	143
Wilkinson & Pullan, B.	Woollen mfg.	1792	143
Wilkinson, James & William		1798-1807	143
Wilkinson, W. & E.	Worsted spinners	1827-1845	143
Wilkinson, John W. & Son	Felt carpet mfg.	1845-1885	143
Wilkinson & Fillingham		1862-1888	161
Wilkson, James	Flax spinner	1835-1856	172
Wilkison & Co.		1856-1867	172

Willans, Peter	Woollen mfg.	1816-1825	15
Willans, J.	Woollen mfg.	1818-1829	209
Williamson, T.	Timber mct.	1863-1889	80
Williamson, W. & J.	Glass bottle mfg.	1850-1866	205
Willow Brewery	Brewers	1903-1939	88
Wilshire, J. B.	Cloth dresser	1830	104
Wilson, E. Brown	Loco. engineer	1846-1856	137
Wilson Bros.	Axle mfg.	1851-1891	52
Wilson, George		1891---	54
Wilson, G. & Co.	Screw mfg.	1906---	51
Wilson, John	Linen mfg.	1754-1833	57
Dransfield, Charles		1833-1841	57
Wilson, John	Tanner	1834-1839	136
Wilson, Armistead & Co.		1839-1853	136
Wilson, Walker & Co.		1853-1863	136
moved to Sheepscar 1863			
Wilson, Sherwood	Cloth dresser	1889	147
Wilson, W.	Pram mfg.	1889-1898	123
		1898---	144
Witham & Riley	Corn millers	1866-1880	112
Wolf, E.	Flax spinner	1826-1845	214
" Woolf & Smith		1839	214
Wood Bros.	Shoddy mfg.	1875-1900	58
Wood, Ellis	Dyer	1885-1900	143
Wood, G.	Glass bottle mfg.	1840-1850	205
		1850-1863	202
		1863---	188
Wood & Co.		1910-1914	182
Wood, John	Brewer	1817-1822	178
Wood, John & Sons	Cloth dressers	1823-1848	124
Wood & Middleton	Cloth dresseers	1900-1914	147
Middleton, H. & Sons		1914---	147
Wood & Ramsden	Dyers	1875-1888	17
Wood, Robert & Sons	Engineers	1835-1875	150
fd. Jack Lane 1822			
Wood, W. A.	Chemical mfg.	1854---	
Woodhouse, J.	Cloth mfg.	1863-1875	14
Wooler, J.	Brassfounder	1815-1900	55
		1888	84
Wormald & Co.	Hackle/gill pin mfg.	1863-1906	58

Wormald, C.		1906---	107
Wright Bros.	Cloth dressers	1875	134
Wright, J.	Corn miller	1875-1888	22
Yates, Jonas.& Sons	Engineers	1879-1900	88
Yorkshire Patent Steam Wagon Co.			
	Steam wagon mg.	1898---	218
Young, J.& Co.	Cloth dressers	1824-1834	56

Alphabetical List of Named Sites

Name	Use	Dates	Site
Accommodation Foundry	Iron fdry	1879-1908	L158
Airebank Mills	Woollens	1863---	L171
Airedale Brewery	Brewery	1830-1855	K140
Airedale Chemical Manure Works		1875-1907	L161
Airedale Foundry	Engineers	1839---	K140
Airedale Mills (Works)	Flax	1868---	L149
Airedale Works	Tobacco	1889---	E69
Albion Foundry	Brass fding	1863-1899	F84
Albert Glass Works	Glass bottles	1875-1908	L162
Albert Mill	Clothing	1875-1900	H105
Albert Nail Works	Nails		L156
Albert Screw Works	Screw mfg.	1864-1965	D60
Albert Spring Works	Engineers	1889	D53
Albert Tool Works	Engineers		L159
Albert Works	Engineers	1873-1889	E69
Atlas Works	Engineers	1863-1894	C42
		1863-1889	E74
	Elect. Engin.	1894---	C 34
Balm Road Mills	Flax	1826---	R214
Belinda Leather Works	Tanning	1863-1906	Q207
Belinda Street Works	Engineers	1863---	Q204
Belle Vue Glass Works	Glass bottles	1853-1910	Q205
Borough Mills	Woollens	1866---	D 56
Boston Engine Works	Elect. Eng.	1875	Leathley Road
Bowman Lane Dyeworks	Dyeing	1866---	Bowman Lane
Bowman Lane Mills	Oil	1848---	Bowman Lane
Boyne Engine Works	Engineers	1858---	K152
Brookfield Foundry	Iron fdry.	1863-1896	K146
Brookfield Mill	Woollens	1875---	L147
Calf Garth Mill	Flax/nails	1853-1900	P196
Campfield Roller Mill	Flour	1875-1905	C 35
Camp Hall	Linen	1754-1868	D 57
	Iron fdry.	1863-1868	D 57
Canning Street Works	Engineers	1866-1875	I121
	Oil	1887---	I121

City Boiler Works	Boiler mfg.	1874---	P184
Clarence Glass Works	Glass bottles	1908---	L162
Clarence Iron & Steel Works	Iron fdry.	1863---	L154
Clarence Oil Works	Oil	1880---	Dinison St.
Clarence Road Dyeworks	Dyeing	1840-1890	L161
Croft Street Bobbin Mill	Various	1822---	D 58
Crown Oil Works	Oil	1861---	F101
Crown Point Printing Works	Printing	1881---	K134
Crown Works	Engineers	1863-1875	F 83
	Engineers	1873---	F 92
Croydon Works	Engineers	1868---	A 6
	Engineers	1882---	P183
Dawbridge Mill	Woollens	1822-1839	K139
Dolphin Foundry	Engineers	1880---	K142
Electric Pottery	Pottery	1906---	P187
Elmtree Works	Leather	1863-1885	Hunslet Lane
Excel Works	Engineers	1875---	E 71
Excelsior Dyeworks	Dyeing	1871-1945	P191
Falcon Confectionery Works	Confectionery	1905---	E 71
Filtrate Works	Oil	1840---	E 75
Frogland Mungo Works	Shoddy		D 61
Globe Foundry	Iron fdry.	1831-1839	D 58
		1844-1865	C 32
		1865-1889	B 21
Globe Iron Works	Iron fdry.	1889---	F 85
Globe Mill	Flour	1861-1900	C 32
	Flax	1860---	F103
Globe Works	Furniture	1895---	F103
Goodman Street Works	Engineers	1861---	L163
Grove Brewery	Brewery	1846-1875	Q210
Hartshead Engine Works	Engineers	1900---	O179
Hartshill Iron Works	Iron fdry.	1875-1900	O179
Highfield Chemical Works	Chemicals	1830-1863	I121
Highfield Mills	Clothing	1866---	N175
Holbeck Engineering Works	Engineers	1914---	B 16

Holbeck Mills	Woollens	1792---	B15
		1875---	D 50
Holbeck Lane End Pottery	Pottery	1815-1910	H109
Holbeck Moor Fdry.	Engineers	1853---	H107
Holbeck Moor Mill	Woollens	1817-1900	H105
Holbeck Moor Pottery	Pottery	1853---	H108
Holbeck Steam Mill	Corn	1817-1885	B 22
Holbeck Steel Foundry	Steel fdry.	1894---	C 34
Holbeck Water Mill	Corn	-----1795	A 3
Holmes Street Chemical Works	Chemicals	1875---	J126
Hope Mills	Woollens	1839-1860	F103
	Flax	1860-1900	C 41
Hunslet Carr Glass Works	Glass	1868---	R212
Hunslet Carr Tannery	Tannery	1817-1900	R213
Hunslet Chemical Works	Chemicals	1839---	P186
		1854	
Hunslet Crown/flint Glass Works		1817---	P185
Hunslet Engine Works	Engineers	1864---	K137
Hunslet Foundry	Iron fdry.	1750---	R211
Hunslet Glass Works	Glass bottles	1859---	L155
Hunslet Hall Pottery	Pottery	1792-1877	N174
Hunslet Linen Works	Linen	1863---	L173
Hunslet Mill	Flax	1839---	L172
Hunslet Nail Works	Nails	1868---	L166
Hunslet Paper Mills	Paper	1824---	Q208
Hunslet Rolling Mills	Nails	1900---	P196
Hunslet Saw Mills	Timber	1888---	F 95
Hunslet Soke Mills	Corn/woollens	-----1850	Q207
Hunslet Steel Casting Foundry	Steel fdry.	1873---	F 99
Ingram Works	Clothing	1889---	A 13
Isle Mills	Woollens	1845---	B 18
Jack Lane Mills			I117
Jack Lane New Pottery	Pottery	1839---	K141
Kiln Brewery	Brewery	1822-1845	J129

Lands Court Mill	Flax	1815-1863	D 58
	Shoddy	1863---	D 58
Larchfield Foundry	Engineers	1836-1866	L150
		1905---	L151
Larchfield Mills	Woollens	1790---	L152
Larchfield Works	Engineering	1866-1900	L150
Leathley Road Pottery	Pottery	1839-1889	K131
Leeds Art Pottery	Pottery	1890-1900	K131
Leeds Bridge Foundry	Iron Foundry	1801-1807	Simpson's Fold
Leeds Iron Works	Iron fdry.	1827-1888	J127
Leeds New Foundry	Iron fdry.	1875	F 96
Leeds Pail & Pram Works	Pram mfg.	1871---	F100
Leeds Phosphate Works	Chemicals	1871	Q199
Leeds (Old) Pottery	Pottery	1750---	J128
Leeds Steel Works	Steel fdry.	1895---	Q200
Leeds Stone Crushing Works	Engineers	1879---	A 2
Leeds Union Pottery	Pottery	1757-1839	K131
Lion Screw Works	Screw mfg.	1836---	C38
Low Gate Mills	Woollens	1848-1900	Q209
Low Hall Mills	Flax	1827---	B 16
Low Holland Chemical Works	Chemicals	1826-1875	Q206
Manor Road Foundry	Iron fdry.	1875---	C 44
Manor Road Mills	Sheddy	1890---	C 45
Marsden's Pottery	Pottery	1817-1839	P182
Marshall Mills	Various	1886---	C 29
Meadow Lane Pottery	Pottery	1807-1880	I111
Meadow Lane Sawmill	Sawmill	1815---	E 66
Meadow Maltings	Maltkilns	1875---	D65
Midland Engine Works	Engineers	1873---	K133
Midland Junction Foundry	Engineers	1868---	B 23
Millgreen Mill	Corn	1795-1889	A 3
	Woollens	1795---	A 5
Monkbridge Bobbin Works	Bobbin mfg.	1865---	C 27
Moor End Iron Works	Boiler mfg.	1874---	P184
Neville Works	Engineers	1898---	T220
Nevins Foundry	Iron fdry.	1865---	L169
New Dock Foundry	Iron fdry.	1838-1873	F 96
New Dock Wagon Works	Cart mfg.	1875---	F98

New Mills	Woollens	1800---	B 14
		1822-1860	H105
New Wortley Steam Mill	Corn	1829-1888	A9
North Midland Glass Works	Glass bottles	1846---	P188
Oakwood Chemical Works	Chemicals	1906---	C 27
Old Brewery	Brewery	1756-1872	D 65
Old Victoria Foundry	Engineers	1863-1890	C 45
Orchard Mills	Woollens	1875---	Q204
Patent Lock Works	Lock mfg.	1884---	L170
Paragon Works	Engineers	1852-1905	T222
People's Mill	Flour	1848-1905	C 36
Perseverance Corn Mill	Corn	1863-1911	C 43
Perseverance Mill	Woollens	1817-1875	E 67
		1826-1875	I123
Perseverance Works	Engineers	1866---	T219
Potterdale Mills	Woollens	1823---	I124
Progress Mineral Water Works	Aerated waters	1888-1910	L165
Prospect Saw Mills	Builders	1880---	F 87
Prospect Works	Iron fdry.	1875-1889	F 85
Providence Mills	Woollens	1863-1880	L171
Providence Works	Chemical	1820---	F 94
	Engineering	1863-	E 69
	Cart mfg.	1866---	C 46
	Iron fdry.	1866-1875	Q204
Quebec Works (Foundry)	Engineers	1839-1875	I113
	Flax	1914---	I113
	Brass fdry.	1906-1911	I113
Railway Foundry	Engineers	1837-1864	K137
Railway Foundry (New)		1860---	K138
Railway Works	Brass fdry.	1889-1907	F 89
Round Foundry	Engineers	1802-1848	C 34
St. Helens Mills	Woollens	1824---	K143
Sayners Dyehouse (Mills)	Woollens	1792-1850	G104
Sheaf Works	Confectionery	1905---	F 88
Silver Cross Mill	Card makers	1840---	I123

Silver Cross Works	Pram mfg.	1889-1898	I123
		1898---	K144
Simpson's Fold Mill	Cotton	1801-1866	Simpson's Fold
Soho Foundry	Iron fdry.	1822---	Q203
		1825---	D 64
		1863-1910	Q206
Spanish Leather Works	Tanners	1834-1863	K136
Springfield Mill	Flax	1831-1850	B 24
Springwell Works	Clothing	1906---	A 12
Stafford Pottery	Pottery	1900-1910	K131
Standard Works	Clothing	1900---	0180
Standard Works			L148
Star Mill	Corn	1822---	A 8
Star Works (Foundry)	Millwrights	1815---	A 7
	Nail mfg.	1900---	L157
Steam Plough Works	Engineers	1860---	K136
Sun Foundry	Engineers	1839---	I125
Sweet Street Foundry	Engineers	1860---	A 37
Temple Mill	Clothing	1886---	C 30
Temple Works	Flax	1872---	P189
Thomas Malthouse	Maltkilns	1817-1897	B 20
Tower Works	Engineering	1864---	C 33
Trafalgar Iron Works	Iron fdry.	1860---	E 68
Trafalgar Mill	Flax	1822-1870	E 67
Trafalgar Works	Furniture	1900---	E 68
Trebla Clothing Works	Clothing	1885---	B 22
Union Boiler Works	Boiler makers	1906---	K145
Union Corn Mill	Corn	1831-1888	A 1
Union Foundry	Engineers	1825-1889	D 62
		1839---	K145
Union Mills	Woollens	1817-1845	B 18
	Various	1889---	D 62
	Clothing	1889---	A 1
Union Pottery	Pottery	1757-1839	K131

Victoria Axle Works	Axle mfg.	1863-1888	C 47
Victoria Brewery	Brewery	1889-1911	D 53
Victoria Chemical Works	Chemicals	1845---	G104
Victoria Foundry	Engineers	1837-1885	D 54
		1855-1894	C 34
Victoria Machine Works	Engineers	1855---	D 54
Victoria Marble Works	Masons	1874---	D 51
Victoria Mills	Woollens	1803---	B 17
	Flax	1835---	L168
Victoria Pottery	Pottery	1853-1885	H110
Victoria Saw Mills	Timber	1868---	C 48
Victoria Wagon Works	Cart mfg.	1888---	C 47
Vulcan Foundry	Lead	1875---	P192
Vulcan Works	Engineers	1898---	S218
Washington Works	Engineers	1853-1866	Hunslet Lane
Water Hall Mills	Flax	1788-1888	C 40
Water Lane Mills	Flax	1838-1860	C 41
Water Lane Printing Works	Printers	1900---	C 25
Waterloo Iron Works	Iron fdry.	1867-1871	Q199
Waterloo Mill	Woollens	1822-1846	Q199
	Chemicals	1846-1867	Q199
Wellhouse Foundry	Engineers	1845---	I118
Wellington Iron Works	Iron fdry.	1914---	Q206
Wellington Mill	Flax	1839-1867	A 4W
West Riding File Works	File mfg.	1892-1911	D 51
Whitehall Grease Works	Oil	1892---	A 10
Whitehouse Engineering Works	Engineers	1871---	143
Wilson Street Mill	Flax	1830-1910	D 59
Yorkshire Brass & Copper Works	Brass fdry	1866---	E 74
Yorkshire Crucible Steel Casting	Foundry	1873-1906	D 63
Yorkshire Glass Works	Glass cutters		F 82
Yorkshire Steel Foundry	Steel fdry.	1876---	F 96

Sources frequently cited

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ABBREVIATIONS AND SHORT TITLES

B & W Mss(B'ham)	Boulton and Watt Mss. Birmingham Reference Library.
Ec.H.R.	Economic History Review
Factories Inquiry	P.P.(1834) xx.Factories Inquiry Commission, Second Report.
LCD	Leeds Corporation Deeds.
LCYB	Leeds Chamber of Commerce Year Book
LE	Leeds Express
LI	Leeds Intelligencer
Lindley	'Number of Steam engines.. in Leeds' William Lindley, March 1824. University of Leeds, Brotherton Ms.18.
LM	Leeds Mercury
Sun CS	Sun(Country) Insurance Registers
RE	Royal Exchange Insurance Registers
Rivers Commission	P.P.(1867) Third Report of the Commission appointed to enquire into the best means of preventing pollution of rivers.
YI	Industries of Yorkshire,Part I(1888) Historical Publishing Co.