Jo

'The Hotties'

Excavation and building survey at Pilkingtons' No 9 Tank House
St Helens, Merseyside

'Like trying to obtain clear water by applying
heat to ice in a container made of sugar.'
(Maloney 1967, 75, on melting glass)

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Contents

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Front Cover: The cone of No 9 Tank House with the furnace foundations below
Rear Cover: 'The Hotties' in the 1970s, with steam from the glassworks being vented over The St Helens Canal

LANCASTER IMPRINTS

Lancaster Imprints is the publication series of Oxford Archaeology North. The series covers work on major excavations and surveys of all periods undertaken by the organisation and associated bodies.

Contents

List of illustrations

Figures

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Abbreviations

LUAU	Lancaster University Archaeological Unit
OS	Ordnance Survey
PPG	Pittsburgh Plate Glass
RSJ	Reinforced Steel Joist

Summary

Between 1991 and 1997, Lancaster University Archaeological Unit (LUAU; now Oxford Archaeology North) conducted a phased programme of standing building survey, excavation, and oral and documentary research, targeted on the remains of Pilkingtons' No 9 Tank House, on the 'Hotties' site, in St Helens (NGR SJ 5135 9475). The cone house element of the complex still stands, and is an impressive Grade II* Listed building. The tank house was purpose-built by Pilkingtons in 1887 for the manufacture of window glass using the blown cylinder method, and housed a continuous tank furnace, which made use of the regenerative technology patented by the Siemens brothers. The site, which is bounded to the north by the 1757 Sankey Canal, had previously been used as the pit head of a coal mine and, until 1884–5, was occupied by the Bridgewater Chemical Works; thus, the history of this plot of land neatly illustrates the town's industrial progression from coal, through chemicals, to the glass industry, which still dominates the local economy.

By 1991, the area of the former glassworks had been earmarked for urban regeneration. The cone house and its immediate surroundings were acquired by the newly formed Hotties Science and Arts Centre Ltd, later the World of Glass Project, with the aim of recording and consolidating the remains of the glass furnace, and eventually opening the site as a visitor centre. In the same year, LUAU was commissioned to undertake the first of four stages of fieldwork, stage 1 involving a survey of the fabric of the cone house building, the planning of adjacent surface remains, and the archaeological recording of a number of geotechnical test pits. The investigations were commissioned and funded in the first instance by the Ravenhead Renaissance consortium, and latterly by English Heritage. A second phase of investigation, from November 1991 to March 1992, involved the removal of chemically contaminated overburden to a depth of 3.50 m from all areas around the tank house, with preliminary excavation of the sub-surface tunnel system located beneath the building. A third phase, conducted in 1993, saw the total excavation of the interior of the tank house, including clearance of the numerous underlying tunnels and flues. Between 1995 and 1997, building work to consolidate and repair the tank house remains proceeded; LUAU was commissioned to monitor these works, and also to carry out further excavation in two limited areas.

The investigations have revealed the surviving base-level remains of a continuous tank furnace, with its regenerator chambers and gas supply flues still largely intact. Though details of the original Siemens tank furnace design are well known owing to the survival of the original patent drawings, excavation of No 9 Tank House has demonstrated that very significant modifications of the standard design were made by Pilkingtons. Most notable was the division of the furnace into two distinct and independently-heated components, the 'melt end' and the 'working end', housed in two adjacent buildings, each with its own dedicated set of regenerators; this arrangement was developed in order to allow the different conditions needed for melting and refining glass, and gathering and working glass, to be achieved with maximum efficiency, cutting costs and increasing quality. As the commercial sensitivity of furnace design ensured that few detailed records were kept, elucidation of the modifications has been largely dependent on the detailed analysis of the surviving elements of the No 9 Tank House. Pilkington's development of standard furnace design was crucial to its commercial success, and the archaeological investigations have thus given a valuable insight into the reasons for the company's dominance of the British window glass trade from the late nineteenth century to the present day.

The No 9 Tank House remains represent a unique survival from an age of rapid technological development within the glass industry, a period characterised by innovative but short-lived design. No comparable continuous tank furnace site is known elsewhere in England; the Cannington Shaw Bottle Shop, also in St Helens, represents a second excellent survival of a late nineteenth century glass furnace, but was built for the manufacture of bottles rather than window glass, and exhibits a lesser degree of technological development. The World of Glass Project has succeeded in ensuring the preservation of a rare industrial monument, and the multi-million pound visitor centre and museum, constructed across the canal, now portrays the technical development and heritage of the glass industry to the public, using the surviving archaeological remains as the pivotal element.

Résumé

Entre 1991 et 1997, l'unité d'archéologie de l'université de Lancaster (ou LUAU) a dirigé un programme progressif comprenant l'inspection de bâtiments érigés, des fouliles et des recherches documentaires et orales, dont la cible était les vestiges de l'atelier à bassin No 9 de Pilkingtons, sur le site de 'Hottie', à St Helens (NGR SJ 5135 9475). L'élément conique du complexe est toujours debout, et c'est un édifice impressionnant classé Grade II. L'atelier à bassin était un bâtiment qui avait été spécialement construit par Pilkingtons en 1887 pour la fabrication du verre de fenêtre, utilisant la méthode du cylindre soufflé, et il abritait un four à bassin à passage continu, mettant à bon escient la technologie de chaleur récupérée brevetée par les frères Siemens. Le site, qui est bordé au Nord par le canal Sankey, lequel date de 1757, avait préalablement été utilisé comme bâtiment de puits d'une mine de charbon, et, jusqu'en 1884-5 était occupé par l'usine de produits chimiques Bridgewater. L'histoire de ce lopin de terre illustre ainsi de façon superbe la progression industrielle de la ville qui commence par le charbon, puis passe aux produits chimiques, et ensuite à l'industrie du verre, laquelle domine toujours l'économie locale.

Déjà, en 1991, la zone de l'ancienne verrerie avait été sélectionnée pour régénération urbaine. L'édifice conique et ses environs immédiats furent achetés par une compagnie nouvellement créée, Hotties Science and Arts Centre Limited, ensuite appelée World of Glass Project (Projet Monde du verre), dont l'objectif était de documenter et de consolider les vestiges du four à verre, et éventuellement d'ouvrir le site sous forme d'un centre de visiteurs. Dans la même année, la LUAU reçut mission d'entreprendre la première de quatre phases de recherches sur le terrain. Cette phase 1 comprenait l'inspection de la structure de l'édifice conique, la planification des vestiges adjacents en surface, ainsi que la documentation archéologique d'un certain nombre de puits d'exploration géotechniques. Les recherches furent tout d'abord commandées et financées par le consortium Ravenhead Renaissance, puis par l'organisme English Heritage (patrimoine anglais). La seconde phase de recherches, de novembre 1991 à mars 1992, comprenait l'enlèvement de la couche de morts-terrains contaminée par les produits chimiques de toutes les zones autour du bâtiment à bassin, ce, jusqu'à une profondeur de 3,5 mètres, avec des fouilles préliminaires du réseau de tunnels souterrains situés en dessous du bâtiment. La troisième phase, effectuée en 1993, vit l'exécution de fouilles complètes à l'intérieur de l'atelier à bassin, y compris le déblaiement de nombreux tunnels et conduits de cheminée sous-jacents. Entre 1995 et 1997, les travaux de consolidation et de réparation des vestiges de l'atelier à bassin furent exécutés. La LUAU avait pour mission de surveiller ces travaux et également d'effectuer d'autres fouilles dans deux zones limitées.

Les investigations out révélé des vestiges au niveau de base d'un four à bassin à passage continu, ses chambres avec récupérateurs de chaleur et conduites de gaz étant encore largement intactes. Bien que les détails de la conception du four à bassin Siemens d'origine soient bien connus, dû à la survie des plans de brevet d'origine, les fouilles de l'atelier à bassin No 9 ont prouvé que des modifications importantes par rapport à la conception de norme avaient été effectuées par Pilkingtons. La plus notable était la division du four en deux parties distinctes et chauffées indépendamment: 'L'extrémité fusion' et l'extrémité travail', situées dans deux ateliers adjacents, chacun ayant son propre jeu de récupérateurs de chaleur. Cet agencement avait été développé afin de permettre de satisfaire le plus efficacement possible les diverses conditions nécessaires pour fondre et affiner le verre, et pour cueillir et travailler le verre, réduisant les coûts et améliorant la qualité.

Comme la sensibilité commerciale de conception de four assurait que peu de documents détaillés soient conservés, l'élucidation des modifiications a largement dépendu de l'analyse détaillée des éléments de l'atelier à bassin No 9 qui ont survécu. Le développement d'un four de conception normalisée par Pilkingtons fut primordial pour le succès commercial de la compagnie, et les recherches archéologiques donnent ainsi une idée précieuse des raisons de la prédominance de cette compagnie dans le commerce du verre de fenêtre en Grande-Bretagne, de la fin du dix-neuvième siecle à nos jours.

Les vestiges de l'atelier à bassin No 9 offrent un témoignage unique sur une époque qui connut un développement technologique rapide au sein de l'industrie du verre, période se caractérisant par des conceptions innovatrices, mais de courte durée. Il n'existe aucun autre site comparable avec four à bassin à passage continu en Angletarre. Cannington Shaw Bottle Shop (l'atelier de bouteilles Cannington Shaw), également situé à St Helens, représente un deuxième bon exemple de survie d'un four à verre de la fin du dix-neuvième siècle, mais il avait été construit pour la fabrication des bouteilles, plutôt que pour celle du verre de fenêtre, et il est moins développé sur le plan technique. Le projet Monde du verre a réussi à assurer la conservation d'un monument industriel rare. Construits

de l'autre côté du canal, le centre de visiteurs et le musée, d'un coût de plusieurs millions de livres sterling, offrent désormais au public une image représentative du développement technique et du patrimoine de l'industrie du verre, les vestiges archéologiques survivant en étant l'élément essentiel.

Zusammenfassung

Von 1991 bis 1997 führte die Lancaster University Archaeological Unit (LUAU) eine Untersuchung an stehenden Gebäuden, Ausgrabungen sowie mündliche und dokumentarische Untersuchungen in Form eines Phasenprogramms durch, die auf die Überreste von Pilkingtons Wannenhaus Nr. 9 auf dem „Hotties"-Gelände in St Helens (England) (NGR SJ 5135 9475) gerichtet war. Das konische Hauselement des Komplexes steht noch und ist ein eindrucksvolles denkmalgeschütztes Gebäude der Klasse II. Das Wannenhaus wurde 1887 von Pilkington als Zweckbau zur Herstellung von Fensterglas mit dem Zylinderglasverfahren errichtet. In diesem befand sich ein Durchlaufwannenofen, der auf regenerative Technik, einem Patent der Gebrüder Siemens, beruhte. Das Gelände, das im Norden vom Sankeykanal von 1757 begrenzt ist, wurde früher als das Schachtgebäude einer Kohlengrube und bis 1884-5 von der Firma Bridgewater Chemical Works benutzt. Die Geschichte dieses Grundstücks zeigt daher sauber den industriellen Fortschritt der Stadt von Kohle über Chemikalien bis zur Glasherstellung, die noch heute in der lokalen Wirtschaft dominiert

1991 wurde das Gelände des früheren Glaswerks für die Städtesanierung vorgesehen. Das konische Haus und seine direkte Umgebung wurden von der neu gegründeten Hotties Science and Arts Centre Ltd. erworben, die später den Namen World of Glass Project erhielt. Sie hatte das Ziel, Aufzeichnungen über den Glasofen zusammenzustellen, seine Überreste zu konsolidieren und schließlich das Gelände für Besucher zu öffnen. Im gleichen Jahr erhielt die LUAU den Auftrag, die ersten vier Phasen der Außenarbeiten auszuführen. Phase 1 bezog sich auf eine Untersuchung der Struktur des konischen Hausgebäudes, die Planung der benachbarten Oberflächenreste und die archäologische Registrierung mehrerer geotechnischer Schürfgruben. Die Untersuchungen wurden in erster Linie vom Ravenhead-Renaissance-Konsortium in Auftrag gegeben und finanziert und später von English Heritage. In einer zweiten Untersuchungsphase von November 1991 bis März 1992 wurde der chemisch kontaminierte Abraum bis auf eine Tiefe von 3,50 m von allen Flächen um das Wannenhaus abgetragen und eine vorläufige Ausgrabung des unterirdischen Tunnelsystems unter dem Gebäude vorgenommen. In der dritten Phase, die 1993 durchgeführt wurde, fand die gesamte Ausgrabung des Wannenhaus-Inneren statt, einschließlich der Räumung der zahlreichen darunter befindlichen Tunnel und Rauchzüge. Von 1995 bis 1997 wurden Bauarbeiten zum Konsolidieren und Ausbessern der Wannenhausüberreste ausgeführt. Die LUAU wurde mit der Kontrolle dieser Arbeiten beauftragt und ferner mit weiteren Ausgrabungen in zwei begrenzten Bereichen.

Bei den Untersuchungen wurden die noch bestehenden Überreste des Durchlaufwannenofens auf Basisniveau gefunden, wobei die Regenerativkammern und Rauchzüge der Gasversorgung noch weitgehend erhalten geblieben waren. Obgleich die ursprüngliche Konstruktion des Siemens-Wannenofens allgemein bekannt war, weil es noch die ursprünglichen Patentzeichnurigen gab, wurden nach den Ergebnissen der Ausgrabung des Wannenhauses Nr. 9 sehr bedeutende Änderungen an der Standardkonstruktion durch Pilkingtons vorgenommen. Am bemerkenswertesten war die Unterteilung des Ofens in zwei getrennte und unabhängig voneinander beheizte Teile, die Schmelzwanne und die Arbeitswanne, die in zwei benachbarten Gebäuden untergebracht waren. Jede hatte einen eigenen Generatorsatz. Diese Anordnung wurde entwickelt um die verschiedenen Bedingungen zu erzeugen, die zum Schmelzen und Läutern sowie zum Auffangen und Bearbeiten von Glas erforderlich waren um diese Arbeiten mit optimaler Effizienz auszuführen, die die Kosten senkte mid die Qualität verbesserte. Da die kommerzielle Empfindlichkeit der Ofenkonstruktion gewährleistete, dass nur wenige genaue Unterlagen geführt wurden, war die Klärung der Änderungen weitgehend von der genauen Analyse der noch vorhandenen Elemente des Wannenhauses Nr. 9 abhängig. Die Entwicklung der Standard-Ofenkonstruktion durch Pilkingtons war wesentlich für ihren kommerziellen Erfolg und die archäologischen Untersuchungen haben uns wertvolle Einsichten in die Gründe für die Dominanz des

Unternehmens in der britischen Fensterglasherstellung von Ende des neunzehnten Jahrhunderts bis auf den heutigen Tag vermittelt.

Die Überreste des Wannenhauses Nr. 9 stellen ein einzigartiges Beispiel für das Überleben aus einem Zeitalter rapider technischer Entwicklungen in der Glasindustrie bis zu einer Zeit dar, die durch innovative aber kurzlebige Konstruktionen gekennzeichnet ist. In England gibt es nirgendwo ein Gelände mit einem vergleichbaren Durchlaufwannenofen. Cannington Shaw Bottle Shop, ebenfalls in St Helens, ist ein zweites ausgezeichnetes Beispiel für Überreste eines Glasofens aus dem späten neunzehnten Jahrhundert, der jedoch zur Herstellung von Flaschen und nicht von Fensterglas gebaut wurde. Seine technische Entwicklung ist nicht so hochgradig. Das World of Glas Project war erfolgreich bei dem Versuch, die Erhaltung eines seltenen Industriebauwerks zu gewährleisten. Das Visitor Centre und Museum, die mit Kosten von mehreren Millionen Pfund Sterling über dem Kanal erbaut wurden, führen heute der Öffentlichkeit die technische Entwicklung und Tradition der Glasindustrie vor Augen, indem sie die archäologischen Überreste als wesentlichstes Element benutzen.

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Many people have contributed to the archaeological recording programme at 'The Hotties' over the ten year life of the project. For the early phases particular mention must be made of Andrew Paterson (formerly of Ravenhead Renaissance) for his generous assistance and unbridled enthusiasm over the four years that he was associated with the scheme. Mike Davies (Carmichael Project Management) has seen the project through all its phases and has made a significant contribution towards ensuring cohesion between many people from diverse disciplines. During the later phases encouragement and assistance was provided by Frank Green (World of Glass Project Co-ordinator) and Dr David Martlew (Pilkington plc), who also provided valued technical advice and direction in the specialised field of furnace design. The contribution made by several English Heritage officers is also gratefully acknowledged, particularly Gerry Friell, Stephen Johnson, Frank Kelsall, Chris Scull, Tim Williams, and the project monitor, Tony Wilmott; their support was essential, both to the completion of the fieldwork programme, and to the production of this report.

Warm thanks must go to everyone who worked on the site, both local people and Lancaster University Archaeological Unit (LUAU) personnel; the bulk of the excavation and tunnel clearance was conducted by supervisors David Hodgkinson and Ian Scott, sometimes working with a team of former coal miners, often in extremely difficult conditions of chemical contamination. A significant contribution was also made by LUAU project assistants David Johnson, Malcolm Harrison, Richard Danks, and Chris Wild (latterly as a supervisor), and Chris Howard-Davis examined and commented on the finds. Jamie Quartermaine fulfilled the role of Field Officer during the early phases of work; subsequently, the project was directed in the field by Mick Krupa, who, through dedication and attention to detail, rapidly acquired an unrivalled understanding of this complex site. Jason Wood managed the 'Hotties' project for LUAU for the majority of its active life, and organised a very successful seminar funded by English Heritage on the theme of the glassmaking industry; the conclusion of the assessment, and the analysis phase, were managed by Alan Lupton. Analysis and report writing were conducted by Richard Heawood and Jo Bell, with the considerable assistance of Mick Krupa and David Martlew; the report drawings were designed by Chris Wild, and prepared by Chris Wild and Emma Carter, the volume being type-set with much patience by Andrea Scott. External reading of the text was performed by David Crossley and David Martlew, and the final draft was edited by Rachel Newman.

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The work at 'The Hotties' was initially financed by the 'Hotties' Science and Arts Centre Ltd. English Heritage became involved in 1993, when the extent and importance of the buried remains was recognised, and its subsequent large-scale funding has been crucial to the success of the project. English Heritage grants have made possible the Stage 3 excavation in 1993, the further excavation and monitoring carried out in 1995–7, the assessment of the project archive in 1998, and the programme of analysis and publication conducted between 1999 and 2001, of which this volume is the culmination.

Glossary

Alkali	Some form of alkali is required to reduce the melting temperature of the raw material mixture or batch. In the 1870s, glassmakers depended on alkali produced by the notorious Leblanc process. Sodium chloride (salt) was treated with sulphuric acid to produce sodium sulphate (known as 'saltcake') and hydrochloric acid gas (discharged to the atmosphere). A second treatment — calcining with coke and limestone — was needed to yield the desirable sodium carbonate (known as 'soda ash'). However, this was expensive, and the furnace on the Hotties site used sodium sulphate (saltcake) as the alkali source. This ingredient was sometimes termed 'soda', although modern usage of 'soda' usually refers to sodium carbonate, or sodium oxide. The glass industry was still a major user of Leblanc sodium sulphate in 1926 (Dick 1973).
Annealing	The process of reheating and gradually cooling finished glass, usually in a dedicated chamber or *lehr* close to the furnace. Without annealing, inequalities of tension between the surface and interior of the glass make it exceptionally brittle and prone to breaking.
Batch	The mixture of raw materials with which the glass-making process begins.
Broad glass	A term for *cylinder glass* used particularly in the eighteenth century and before. See *cylinder glass*, *German glass*, *muff glass*, *sheet glass*, and *spread glass*.
Cone	A distinctive cooling tower first built over early glass houses, but which remained in use until the end of the nineteenth century. Heat from the furnace was drawn upwards by the cone and dissipated, creating a more tolerable working environment for the glass blowers.
Continuous production	A method devised by Siemens which allowed a *tank furnace* to be simultaneously charged with raw materials at one end and have molten glass drawn off at the other. This meant that a single furnace could be worked without stoppage for several months.
Crown glass	Window glass produced by taking a gather of molten glass on the end of a blowing iron, blowing a sphere, and then spinning it out to form a thin circular sheet or table. The table is then cut into small panes and the central 'bullseye' used as *cullet* or upper window glass. The technique dominated the window glass market in the early nineteenth century, because glass manufacture was taxed on the weight of glass melted rather than the weight of saleable ware produced, and *crown glass* could be made with less waste than *cylinder glass*. It remained tax efficient until the 1840s.
Cullet	Broken or imperfect glass, which could be recycled as an important ingredient of the *batch*. When recycled, cullet requires less energy to fuse than is required to bring about the chemical reactions which convert raw materials into molten glass.
Cylinder glass	A general term for window glass produced by blowing or drawing a long tube of glass, splitting it open, and flattening it to produce sheets. The method was in general use until the late eighteenth century, when it was temporarily supplanted by *crown glass*; glass production was taxed on the total weight of glass melted until 1845, and in these circumstances, cylinder glass was not tax efficient. From the 1830s cylinder glass was revived to meet the growing need for larger panes of glass, and remained in general use until the early twentieth century. See also *broad glass*, *German glass*, *muff glass*, *sheet glass*, and *spread glass*.
Drawn glass	A term used for glass which was not blown by hand on the end of a tube, but drawn vertically from a pool of molten glass. The means to do this were the subject of experimentation in the late nineteenth and early twentieth centuries, in the hope of bypassing the expensive and time-consuming hand-blowing process. Initially, large cylinders of glass were drawn vertically, but by 1913, Pilkingtons' foreign competitors were able to draw flat sheet glass straight from the tank. The latter was sometimes termed 'direct drawn' glass; its quality was at first unreliable.
English bond	A brick bond consisting of alternate rows of headers and stretchers.
English garden wall bond	Brick bond employing one course of headers to three or five of stretchers.
Flint glass	A high quality glass manufactured to deliver uncoloured transparency, so called because it was originally made with crushed flints instead of sand. It has applications in the manufacture of certain types of containers, vessels, and optical glasses.

Frit	The part-fused or sintered mixture of materials which results from an initial heating of the *batch*, and in which chemical reactions essential to the melt begin.
German glass	A term for *cylinder glass* used around the 1830s. See *cylinder glass*, *broad glass*, *muff glass*, *sheet glass*, and *spread glass*.
Lehr	An annealing furnace, usually in the form of a long narrow structure close to the furnace.
Metal	Glass in its fully molten state.
Muff glass	A nineteenth century name for *cylinder glass*, on account of its similarity to the ladies' clothing accessory. See *cylinder glass*, *broad glass*, *German glass*, *sheet glass*, and *spread glass*.
Plate glass	Thick, high quality glass used for mirrors and stagecoach windows. From the early eighteenth century it was usually made by casting the molten glass on a table, and polishing it with sand and rouge (iron oxide).
Pot furnace	The type of furnace which, in various forms, was used to melt glass from the earliest times to the late nineteenth century. Clay pots or crucibles containing *frit* were arranged on a stone or fire-brick floor, above a furnace fuelled with wood or coal. Cooler or separate chambers allowed preliminary heating of the *batch* and post-production *annealing* of the product, whether for window- or vessel-glass.
Regenerative principle	A design developed by Siemens in the 1850s, which allowed waste heat from a furnace to be re-used, enormously increasing efficiency. The design was first applied to furnaces in the iron industry, but was transferred to the pot furnaces used for glassmaking following the introduction of remote gas producers in 1861, an innovation that allowed fuel gas to be generated away from the furnaces (Douglas and Frank 1972, 114–5). The technique was combined with the newly invented tank furnace in the 1870s and revolutionised glassmaking technology; as well as saving fuel, use of waste heat to preheat the combustion gases allowed higher furnace temperatures to be achieved. The regenerator itself is defined below.
Regenerator	One of a series of chambers sited below or adjacent to a furnace, containing a honeycomb arrangement of refractory bricks. Exhaust fumes were passed through the chamber, and heat absorbed by the bricks. The flow of gases was then switched, and instead of exhaust, either gas or air was now directed towards the furnace through the warmed regenerator, with the refractory bricks preheating the gas/air. When the bricks had cooled, exhaust was once again passed through, the fuel gases now being warmed by adjacent regenerators.
Sheet glass	Window glass made either as *cylinder glass*, or as *drawn glass*: the term was used from the 1830s until the *drawn glass* process became obsolete in 1959. See *cylinder glass*, *broad glass*, *German glass*, *muff glass*, and *spread glass*.
Spread glass	Window glass made by the cylinder method. A term thought to belong to the late eighteenth and early nineteenth centuries. See *cylinder glass*, *broad glass*, *German glass*, *muff glass*, and *sheet glass*.
Tank furnace	A furnace where glass is melted in, and drawn from, a single large container or tank, rather than a number of smaller pots. The use of a tank presented technical problems which were not overcome until the 1870s. The combination of the tank form with the principles of *regenerative* heating and *continuous* production allowed the window glass industry to expand hugely at a time of great demand.
Tank house	The building or buildings housing a tank furnace and its fixtures. In the case of No 9, the tank house was composed of two separate structures housing the melt and working ends, joined where the furnace passed from one to the other; the characteristic brick cone stood over the working end.