Historic England

Education

Teacher's Kit

Industrial Heritage - The Glass Industry

Background

Glass production in Britain in the sixteenth century lagged behind that of many European countries. In order to address this issue the government encouraged the immigration of glass makers from abroad which greatly improved the quality of British glass including window glass. The British glass industry expanded rapidly during the seventeenth century, making use of coal as its major fuel source and setting the industry far in advance of its European counterparts. The industry relocated from woodland areas to areas where coal was plentiful such as the west midlands, north-east England, Bristol, London and south-east Scotland.

Excise Act

The Excise Act of 1745 taxed glass according to the weight of materials used by the manufacturer. This tax, which was increased twice in the late-eighteenth century, created a significant barrier to the expansion for the British glass industry. Ireland was not the subject of taxation laws until 1825 and used this advantage to develop successful glass production areas in Cork, Dublin, Belfast and Waterford.

Glass production

In order to produce glass, a source of silica, such as sand, crushed flint or quartz is fused with fluxes, for example lead oxide or alkali fluxes derived from plant ash. Early glass tablewares were hand blown and had a distinctive greenish or brown colour due to traces of iron oxide in the sand. In the seventeenth century George Ravenscroft's experiments with crushed flint as a source of silica and the addition of lead oxide produced lead crystal, a revolutionary clear glass. Some of the best examples of lead crystal were produced in Waterford in Ireland in the eighteenth century.

Windows were made from crown glass. During this process a bubble of glass was blown then rotated on a pontil rod near the mouth of the furnace. The glass opened into a circular disc which was then cut into panes. Glass made using this technique has the characteristic 'bull's eye' at the centre where the glass was attached to the rod. Another method for producing window glass was to swing a bubble of glass to elongate it into a cylinder, which was then cut, opened out and flattened.

Glass workers

The raw materials used in glass production were melted and fused together in crucibles or pots. The glass makers then worked in teams around the main furnace, inside the glass cone. The glass was 'gathered' from the furnace and blown by the servitor, small lumps of glass were collected by the foot maker. Both were presented to the gaffer who sat in the glass maker's chair, which had long arms suitable for rolling the pontil rod to form different shapes. Once the gaffer had shaped them into vessels they were taken to the furnace by the taker-in, the fourth member of the team. After annealing the glass was taken to the engravers or decorators in another part of the site.

The glass works

The glassworks included a furnace and its cover building as well many smaller buildings and rooms to accommodate the raw materials, workshops where the crucibles were made and the chambers where the finished glass was allowed to slowly cool (anneal). The use of coal in glass furnaces was only possible by having large underground flues to feed air to the furnace and a large conical cover building.

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Nineteenth and twentieth century developments

Nineteenth century innovations in glass production made some of the architectural achievements of the Victorian age possible. The Crystal Palace (the venue for the 1851 Great Exhibition), railway station roofs and the large greenhouses of botanical gardens and country estates would not have been possible without developments in the production of flat glass.

Crown and cylinder glass was replaced by cast and sheet glass with continuous glass casting possible from the 1920s. In the 1950s Pilkington's of St Helens invented the process of floating glass onto a bath of molten tin to ensure perfect surfaces on both sides. This development led to the architectural achievements of the twentieth and twenty first centuries.

Surviving examples

There are few surviving structures from the glass industry. Like many structures subject to intense heat, glass furnaces were often built and rebuilt and as such were unstable and liable to collapse.

Only four intact glass cones now survive in the UK and these can be found at:

- The Red House Glass Museum at Stourbridge in Worcestershire – Lying in the heart of the Stourbridge glassmaking industry, the site explores 200 years of glassmaking history. (dudley.gov.uk/see-and-do/museums/red-house-glass-cone/)
- Catcliffe near Sheffield – dating to 1740, the cone has been conserved. (pastscape.org.uk/hob.aspx?hob_id=316337)
- Lemington near Newcastle-on-Tyne. (en.wikipedia.org/wiki/Lemington_Glass_Works)
- Alloa in Scotland. This web page has many historic photographs and diagrams of the glass cone: (canmore.org.uk/site/47211/alloa-glasshouse-loan-alloa-glass-works-glass-cone)

The World of Glass at St. Helens, near Liverpool, conserves the remains of a Siemens regenerative furnace as well as many other artefacts relating to this important centre of the industry and also demonstrates glass blowing. (worldofglass.com/)

Sources

Dodsworth, R. (2003) *Glass and Glassmaking* (Shire Publications)

Palmer, M, Nevell, M, Sissons, M. (2012) *Industrial Archaeology: A Handbook*, Council for British Archaeology Practical Handbooks.

britishpathe.com/video/the-glass-makers-of-murano-venice/query/work

The glass industry is also considered in *Archaeological Evidence for Glassworking, Guidelines for Best Practice* (2013). (historicengland.org.uk/images-books/publications/glassworkingguidelines/)

Activities – The Glass Industry

Curriculum Links.

History: Chronological understanding – Understanding progression and change in the development of the glass industry. Knowledge and understanding of key events, people and changes in the past – A study of the key glass making innovators and inventions. Historical interpretation and enquiry – Examining primary and secondary source materials, investigating past events, understanding change and continuity.

Geography: Use Ordnance Survey maps to investigate evidence of glass making locally. Identify functional and design led use of glass as a building material locally, nationally and internationally.

Science: Investigate materials and their properties. Sort and classify materials and investigate their origins, uses and how they respond to change.

Design & Technology: Explore how products have been designed and made in the past. Identify how products contribute to lifestyles and consumer choices. Explore the impact of ideas, design decisions and technological advances.

Art & Design: Use first-hand observation to explore and develop ideas. Try out tools and techniques and apply these to materials and processes.

English: Through role play and examining a range of historical sources pupils will demonstrate the core skills of reading, writing and speaking and listening.

ICT: Gather, analyse and present information about the development of the glass industry using a variety of media..

Activities – The Glass Industry

Activities – use the images in the pack to assist you with the following activities:

- Role play a team of glass makers at work. Using the interactive whiteboard, show a short film of glass makers at work. Write a short description of the roles of 'gatherer', 'servitor', 'gaffer' and 'taker-in', ask pupils to come up and write a word on the board which describes or relates to each activity. Divide the class into teams and practice the action the member of the glass making team would perform.

- Use ICT, books, photographs, census returns and Ordnance Survey maps to identify evidence of glass making locally in those areas where it took place.

- Investigate the process of glass making. Examine the materials needed to make glass and explain how these materials respond to heat. Investigate the properties of glass and discuss some of its uses. Compare glass to other materials such as wood and metal and discuss similarities and differences. Research early innovations in glass additives to change the colour of glass. Examine the compounds used today which can be added to glass to change its colour. Use ICT (internet) to research history of glass making and communicate your findings. Use Word processing, Excel, Power Point for presenting your findings.

- Examine the historical uses of glass as a packaging material. List the reasons glass is used by food and beverage manufacturers. Design a food or beverage container using glass. Use ICT (Word processing, Excel, Power Point) to present your findings. Use CAD software to model, prototype and test your design.

- Examine the use of glass as a building material. Think about the functional and design led reasons for using glass. Research the use of glass in the Victorian period (railway stations, Crystal Palace). Compare the use of glass in the Victorian period with prominent modern buildings using glass. Examine local buildings and look at prominent national and international examples (Burj Khalifa – Dubai, Shard-London).

- Illustrate the decorative uses of glass. Make a stained glass window picture using a cut out design on black paper or colour a window design on acetate

Images – The Glass Industry

Red House Glassworks, High Street, Wordsley, West Midlands

This is the glass cone at Stuart and Sons, Red House Glassworks, now a museum (2013). It is made of brick and is over 50 ft high. It was built at the end of the eighteenth century and was used for the manufacture of glass until 1936. It is the only complete glass cone in the area and one of only four left in the United Kingdom.

Images – The Glass Industry

The Glassworks Cone, Catcliffe, South Yorkshire

This cone shaped building was built in 1740 for William Fenney. He had previously managed a nearby glasshouse owned by his mother-in-law. Eventually the Catcliffe Glasshouse passed into the hands of Henry Blunn before its closure in 1884-1887. It then re-opened briefly in 1900. The cone is now the oldest surviving structure of its type in Western Europe and one of only four to remain in the United Kingdom.

Images – The Glass Industry

Osram Glassworks, Newcastle upon Tyne, Tyne and Wear

This early picture of the glassworks gives an impression of the pollution that must have been created by the factory. The works were situated at Lemington-on-Tyne, to the west of Newcastle.

Images – The Glass Industry

Glass blowing, Osram Glassworks, Newcastle upon Tyne, Tyne and Wear

The method of forming hollow vessels by blowing a blob of molten glass through a pipe dates to about 50 BC. The procedure was honed in the Middle Ages, especially in Venice. This man is following in a long tradition of glass blowers. This photograph was taken c1950.

Images – The Glass Industry

Moulding glass, Osram Glassworks, Newcastle upon Tyne, Tyne and Wear

Here a glass vessel is being formed in a mould. This method of glass manufacture has a history going back about 5,000 years. Glass production is often centred around areas rich with fuels such as coal. It was taken c1950.

Images – The Glass Industry

Workers at Osram Glassworks, Newcastle upon Tyne, Tyne and Wear

This period picture shows workers clearing the broken glass and debris from machines at the plant while the apprentices look on. Note how young the apprentices seem to be. It was taken c1950.

Images – The Glass Industry

Checking glass vessels, Osram Glassworks, Newcastle upon Tyne, Tyne and Wear

As methods of glass production progressed it became possible to make many identical, highly accurately calibrated transparent glass vessels. This photograph was taken c1950.

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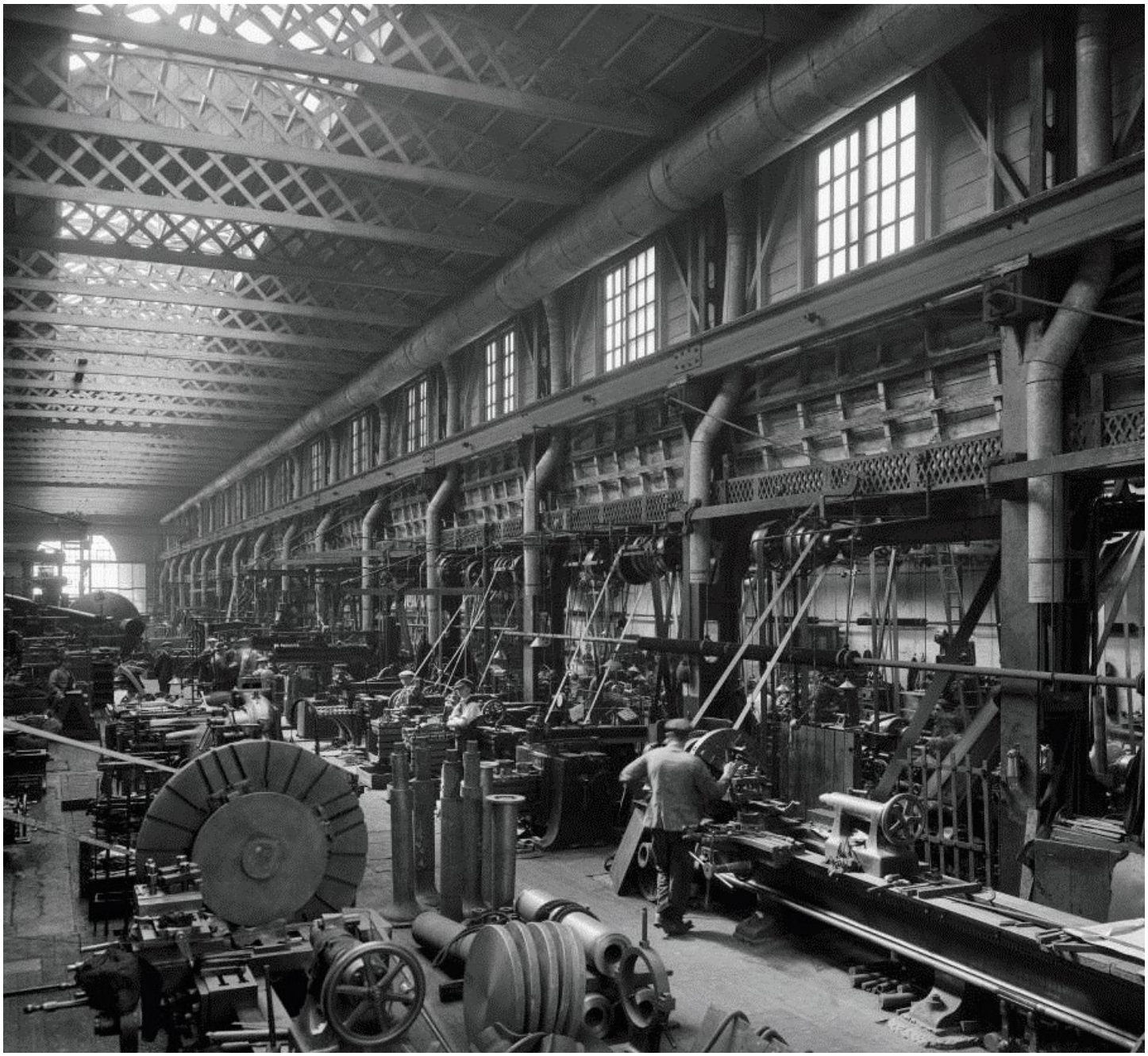
Images – The Glass Industry



Chance's Glassworks, Machine Workshop, Smethwick, West Midlands

An interior view of a large workshop at the Chance Brothers' glassworks, showing workers at various types of machinery used in the glassmaking and finishing processes. The glassworks was established in the early nineteenth century, and produced window, optical and specialist glass of all kinds, including window glass for the Houses of Parliament in London. This photograph was taken in July 1920.