INDUSTRIAL PERIOD 1750-1950

Industry is a term that describes a wide range of economic activities based on the sourcing, manipulation and movement of raw materials for commercial gain. In the modern era the term is used widely to describe activities as diverse as banking, computer software engineering and forestry, but in the period of industrial development between about 1750 and 1950 it is usually associated with the transformation of natural raw materials into useful products using water-power or coal as the primary source of energy. During the course of the 19th century, coal replaced water as the main power source of industrial Britain. The Great Northern Coalfield had long been the biggest producer of coal in the country, and a variety of other industries became established on the banks of the Tyne and Wear by taking advantage of the abundant supply of cheap fuel. However, despite the apparent advantages of the region in terms of its coal supplies and access to waterways, its industrial development was not rapid, and until well into the 19th century it lagged behind other parts of Britain, such as West Yorkshire, Merseyside and Clydeside in the crucial fields of iron production and engineering. Shipbuilding, too, was also held back by the terrible state of the rivers and by the continuation of the wooden shipbuilding tradition. The river improvements undertaken soon after the middle of the 19th century, allied to increasing iron (later steel) production in the region and the growth of iron shipbuilding from about 1850, were responsible for the transformation of the region into Britain's foremost industrial centre. This period of rapid growth in the 19th century, particularly after 1850, was fuelled, critically, by a dramatic increase in North-East coal production, from 4.5 million tons in 1800, to 10.5 million tons in 1850 and 45 million tons by 1900. The coal industry fuelled the development of Tyneside and Wearside as the major industrial centres of the 19th century and, along with ready access to sources of other raw materials, such as iron, and access to markets via river and sea, was the main factor in the industrial success of the region. The industrial development of the region was associated with large-scale social change. The recorded population of Newcastle rose from 28,000 in 1801 to 215,000 a century later, that of Wallsend from 3,000 to 30,000 in the same period, and the population of Gateshead from 15,000 to 50,000 in the half century after 1831. Large new housing developments grew alongside the major collieries, engineering and shipbuilding works, as well as in the commercial centres, while the new elite of industrialists built grand residences for themselves. The wealth of Tyneside contributed to the wholesale planned redevelopment of a large part of Newcastle city centre in the 1830s, an example of successful town planning which has survived to the present day.

Coal

Coal had been extracted from outcrops or shallow seams in the valleys of the Tyne, Derwent and Wear since the earliest times, and increasingly so from the 13th century. However, these outcrops were quickly worked out and new workings were opened further from rivers and mined to greater depths. This was certainly occurring in the Whickham and Dunston areas by the mid-16th century. Such changes demanded a better form of transport to carry coal to the rivers and better drainage and winding machinery in the mines. The first waggonways were built in Tyne and Wear in the 1620s, having been introduced to the region in the early 1600s at sites on the river Blyth in south-east Northumberland. This had an immediate effect, leading to an estimated rise in coal shipments through the Tyne from 35,000 tons in 1565 to 400,000 tons by 1630. As the coalfields expanded in the 17th and 18th centuries, with the Wear also becoming important for coal shipments at this time, so did the network of waggonways, allowing coalmines to be worked further from the navigable rivers. As more of the shallow coal deposits became worked out on Tyneside, in the late 17th and early 18th century there was a steady drift of mines towards Newcastle itself. The introduction of the Newcomen pumping engine to North-East coalmines in the 18th century helped to ease the problems caused by flooding. This, along with other improvements, including innovations in shaft and tunnel construction, saw the depth at which coal could be mined increased from 300 feet in 1700, to around 600 feet in the middle of the century and up to 1000 feet by 1800. This led to the opening of new mines at Jesmond, Heaton and Byker in the 1720s, all linked by waggonway to staiths on the river. Although the mines to the west of Newcastle were in decline by the end of the 18th century, this was balanced by the opening of deeper mines exploiting the High Main seam between Newcastle and the coast, notably at Walker in 1758, Wallsend in 1780 and Percy Main in 1785. The pits along the Tyne corridor reached their zenith at the turn of the 19th century. There were new sinkings at Wideopen and Gosforth in the 1820s, and the use of steam power to power cages allowed coal to be worked at ever greater depths. At Monkwearmouth a new shaft was sunk to 1,700 feet in 1846. However, even the deeper mines began to be exhausted later in the 19th century and other parts of Northumberland and south-east Durham began to overtake Tyneside in terms of output. Although mining was hugely profitable for the coal owners, it was from the earliest times extremely hard work for miners, carried out in dreadful and often dangerous conditions for extremely low wages. The main problems and dangers faced by miners stemmed from lack of ventilation, which could lead to gas explosions, poisoning or suffocation. Although partial solutions to the problem of ventilation were known, coal owners often refused the extra costs of installing the necessary extra ventilation shafts. The risk of explosion was reduced by the invention by Sir Humphrey Davy of a safety lamp in 1815, allowing miners to illuminate the coal face without having to use exposed flames. Ironically, however, this encouraged mine owners to re-open dangerous workings previously abandoned due to the risk of explosion, and to sink shafts to even greater, more dangerous depths. Other potential dangers included the lung disease ‘pneumoconiosis’, drowning, being crushed by wagons or rock falls, falling down the mine shaft and being hit by coal falling from buckets in the shaft. One of the most dangerous jobs was ‘robbing’, which involved removing the supporting pillars of coal from mines at the end of its working life. Major accidents continued to occur: in 1812, 92 men and boys were killed by an explosion at Felling; and in 1835, 102 men were killed by an explosion at Wallsend. Publicity surrounding the working conditions of the mining industry, its treatment of women and children and the frequency of fatal accidents led to governmental enquiries and the setting up of institutions such as the Institute of Mining and Mechanical Engineers, based in Westgate road, Newcastle. In 1842, Parliament published a report about the state of coal mining - the Mines Report - and its contents shocked the nation. The report informed the public that children under five years of age worked underground as trappers for 12 hours a day and for 2 pennies a day, while older girls carried baskets of coal which were too heavy for them and caused deformities. Children had to work in water that came up to their thighs while underground; and heavily pregnant women were expected to work up to and immediately following labour. There were strikes in the coalfield in 1765 and 1810, and further strikes associated with unsuccessful attempts to set up unions in the 1820s and '40s, before finally the Durham and Northumberland Miners' Unions were set up in the 1860s. Throughout the 19th and early 20th centuries coal production in the North-East continued to expand, peaking at over 56 million tons in 1911, with a total workforce of over 200,000. However, much of this increased production had been caused by the expansion of the coalfield into rural east Durham and parts of Northumberland, particularly the south-east of the county north of the Tyne, and the North Tyne valley. The demand for this coal came increasingly from the industrial sector, rather than from the London domestic fuel market, as had been the case up to the mid-19th century. Iron-using heavy industry accounted for the bulk of this increase in demand.

Coal Transport

Although the early coal industry persisted with the use of horse-pulled carts on 'wains' or trackways until well into the 18th century, the introduction of railways enabled coal production to keep pace with demand, particularly when industrial use increased n the 19th century, and in consequence rail transport had become inextricably linked with the coal industry. The first railways, or 'waggonways' were introduced from the early 17th century and were largely responsible for a considerable increase in coal production during the early 18th century. The earliest waggonways used timber tracks and wagons pulled by horses. Various adaptations and improvements were made, including the clever use of inclines or gradients, allowing empty wagons to be pulled uphill using the energy of fully laden wagons going downhill. Many advanced engineering projects were undertaken on waggonway routes, not least the construction of what is probably the oldest railway bridge in the world, Causey Arch at Tanfield, built in 1727. By the late 18th century stationary steam engines had begun to be used to haul wagons up steep inclined, for the first time replacing the horse as the means of traction. Then, early in the 19th century the first steam traction engines came into use. A locomotive was used on the Kenton-Coxlodge waggonway in 1812; in 1813, William Hedley designed the first of several engines used to pull wagons from Wylan colliery to Lemington staithes; and in 1814, George Stephenson designed a locomotive for the Killingworth Colliery Company. By the time the early locomotives began to replace stationary engines and horses, wooden rails had been replaced by iron. Through its extensive waggonway system and, later, pioneers of locomotive transport such as the Stephensons, the North-East had a particular role in the development of the railways, initially for industrial use, later for passenger traffic. The first passenger railways were built in the 1830s, including the North Eastern Railway, Sunderland and Tynemouth branches (HER 2289 and 1186), and the Newcastle and Carlisle Railway (HER 3292), which received Royal Assent in 1829 and was opened to passenger traffic on 9th March 1835. Many other railways opened in the following 40 years or so, including the York, Newcastle and Berwick (HER 1063), the Tynemouth and Newcastle (HER 1086), Derwent Valley (HER 1019) and Blyth and Tyne lines (HER 1049), many incorporating spectacular feats of engineering. (see Bridges of Tyne and Wear). Most of the commercial wagonways and railways led to the banks of the navigable rivers where structures known as staithes were constructed in order to off-load the coal into boats known as keels. These were double-ended craft which were sailed or rowed down-river to industrial plants or, more often, bigger collier boats used for export. Staithes are known to have been present on both the Tyne at Lemington (HER 4036) and the Wear at Sunderland by 1600. Many others were built subsequently, notably at Wallsend, Willington, North Shields, Dunston and Swalwell on the Tyne and Derwent, and at Sunderland and Hylton on the Wear. These structures were built on an increasingly large scale during the 19th century, culminating in the huge drops at Tyne Dock, Jarrow, built in the 1850s, and the even larger Dunston Staithes (HER 1001), constructed in 1890 by the North Eastern Railway Company.

Dunston Staithes - Europe's Largest Wooden Structure

Dunston, between Whickham and Gateshead, is located at the point where the River Team enters the River Tyne adjacent to the impressive pier-like structure of Dunston Coal Staithes, reputedly the largest wooden structure in Europe and possibly in the world. The staithes were constructed for the purpose of loading north Durham coal into ships. They protrude into the River Tyne for 1709 feet and run parallel to the river bank, forming a large tidal basin in which ships once moored. Several railway lines ran along the top of the coal staithes from the river bank and rose at a gradient of 1 in 96 from west to east, enabling locomotives to shunt coal waggons to an appropriate height for loading ships anchored alongside the staithes. Coal waggons fitted with trapdoors were shunted along the staithes and lined up with hoppers in the staithes floor. Gangs of men called ‘teemers’ would then release these trapdoors and teem the coal into the hoppers. This was not an easy task as often the coal would jam or freeze in the wagon or hopper so that men would have to jump in to free the coal and run the risk of falling through and sustaining serious injuries. The hoppers in the staithes were linked to coal chutes called spouts and the teemers had the task of adjusting these spouts according to the height of the ships they were loading. Once coal or coke had been loaded from the chute into the holds of the ships, gangs of men called ‘trimmers’ were set to work to level out the coal in the ships, which was important in order to maintain the stability of the vessels during ocean voyages. stability. At its peak in the 1920s, Dunston staithes were shipping an average of 140,000 tons of coal per week on vessels bound for both London and the continent, but by the 1970s the weekly figure had fallen to 3000 tons. In 1980 the staithes were finally closed, but survive as a listed building. In addition to railways, the roads also improved greatly from the middle of the 18thcentury when their condition was generally poor. In 1751 the Military Road was constructed from Newcastle to Carlisle, and this was followed in the later 18th century and early 19th century by the construction of a large number of private 'turnpike roads', for each of which an Act of Parliament was granted to allow tolls to be collected. In addition to the Newcastle-Carlisle road, other turnpike roads included the Great North Road, a route of medieval and possible Roman origins, and the Newcastle-Ponteland and Newcastle-North Shields routes (HER 1191). The development of the railways for passenger and commercial traffic from the 1830s led to a decline in use of the turnpike system.

Iron and Steel

The local availability of iron ore, in conjunction with coal, provided the lifeblood for the giant nineteenth and early twentieth century industries of shipbuilding, locomotive engineering, civil engineering and armament manufacture. Indeed, the rapid rise in iron and steel production in the second half of the 19th century was, after coal, the second major element in the economic development of the region. The raw material of the iron and steel industry, iron ore, was quarried from a number of places locally and imported by sea from Yorkshire. In c.1682 Sir Ambrose Crowley opened an iron manufactory at Sunderland (HER 4437), and in 1691 another at Winlaton Mill (HER 1006). The large Tyne Iron Works opened at Lemington in 1797 (HER 4346) and the nearby Spencer’s Steel Works, developed in the latter part of the 19th century from a small forge site that had operated from c.1810. Other firms which came into existence in the early to mid-19th century included Losh, Wilson and Bell at Walker Iron Works, and the Gateshead firms of Hawks Crawshay & Co. and John Abbott & Co. Such companies never grew to the size of the Derwent Iron Company at Consett, Bolckow & Vaughan on Teeside, or the earlier Bedlington Iron Works in south-east Northumberland. However, in association with shipbuilding, important ironworking concerns formed part of coherent industrial complexes on the lower Tyne, as at Jarrow under Charles Palmer, whose colliers returning from London brought in ironstone from Staithes.In addition to industrial ironworks, a large number of smaller forges and smithies continued to operate for local use in the villages of Tyne and Wear. Examples include works at Blaydon Burn (HER 3431), Lamesley (HER 5141) and Whickham (HER 3718).

Shipbuilding and Engineering

Engineering developed in the North-East region, particularly on Tyneside, hand in hand with the coal and (later) shipbuilding industries, which not only supplied cheap fuel, but also a source of demand for engineering products. Although the North-East was not at the forefront of British engineering in the early 19th century, a number of enterprises were established, notably in the field of locomotive production, where the Stephensons and the Hawthorn brothers were active. The second half of the 19th century was the main period of expansion in the engineering industry, led by pioneers such as W. G. Armstrong, who established and ran his Elswick factory throughout most of the second half of the century, developing it into a huge integrated complex incorporating shipbuilding, marine engineering, armaments production and various other engineering enterprises. The engineering industry led to innovation and commercial success, but also caused social change. Many innovations were exhibited at institutions such as the Newcastle Literary and Philosophical Society, whose members came from the entrepreneurial elite whose members had been propelled into the higher ranks of society by their commercial successes. The industrial workers, meanwhile, were housed in vast estates of terraced housing which grew around the main industrial areas and swallowed what had previously been small rural settlements, such as Elswick and Wallsend. Schools, churches and other public buildings and services not previously provided for the working classes were built in association with the new housing developments, often paid for by the major employers. The engineering workers were relatively prosperous and, by the 1870s, very numerous, allowing them to gain reduced working hour on both Tyneside and Wearside in 1871.Shipbuilding on both the Wear and the Tyne had continued from the medieval period through the post-medieval period –a craft guild of shipwrights existed on the Tyne by the beginning of the 16th century. Shipbuilding techniques changed little while the construction of wooden ships continued, which it did on both rivers until the second half of the 19th century. At the beginning of the 19th century there were about 1000 shipwrights on the Tyne, and 500 on the Wear, most engaged in the construction of small wooden vessels used in the coal trade to London. By the 1830s, however, Lloyd's Register recognised Sunderland as 'the most important shipbuilding centre in the country'. A large number of wooden shipbuilding yards are recorded from historic map evidence, amongst which those at Hylton (e.g. HER 2640-1 and 2672) are relatively unusual in that they were not subsequently replaced by iron shipbuilding yards. The real growth in shipbuilding occurred following improvements carried out to the rivers, including straightening, narrowing and deepening by dredging, and the adoption of iron. The first iron vessel was built at South Shields in 1839, but it was not until 1852 that the first commercially successful iron vessel was built. This led to the construction of specialised construction facilities on both the Tyne and the Wear, and within 10 years there were over 10 yards building in iron on the Tyne, employing over 4,000 men. Change was slower on the Wear, but Pile's, the largest yard on the Wear, converted to iron in the early 1860s. Iron, in turn, was replaced by steel as the major building material well before the end of the century. A large number of yards have been recorded on the Tyne and Wear, with those on the Wear concentrated towards the mouth, while those on the Tyne are distributed along both banks of the river between Elswick and Shields. Major sites include Palmer's yards at Hebburn (HER 2510) and Jarrow (HER 2534), Pickersgill's at Southwick (HER 2771), Laing's at Deptford (HER 2801), Armstrong's of Scotswood (HER 4305) and Swan Hunter's of Wallsend (HER 5201).

The Lime Industry

Lime production was important from the early post-medieval period, particularly at Sunderland, which was the only exporter of lime between the Humber and the Forth. Examples of important works there include the Bishopwearmouth limekilns (HER 2834), the Sheepfold Lime Works (HER 2753) and the Fulwell Limekilns (HER 2695). The interconnected nature of the industries of the region may be illustrated by the example of North Shields Lime works (HER 5488), which may have been stimulated by accessibility to the materials carried by the Whitley Wagonway, built in 1811, which carried coal from Cullercoats Main Colliery and limestone from Whitley quarries. The lime kiln, crushing mill and Whitening Works (where lime was made into a bleaching agent) may, in turn, have prompted the development of the iron foundry (HER

2054) on adjoining ground to the north and east, since lime could be used as a flux in iron and steel making. It was also an important commodity in the tanning industry (see HER 2051).

Quarrying

A very large number of quarries are listed in the County Heritage Environment Record (HER). Most were used for the extraction of stone, but clay, gravel and coal can also be quarried. The stone quarried may be further divided into those sourcing grindstones, as at Springwell quarry near Gateshead (HER 2598), building stone (usually sandstones), and those quarrying limestone for the lime industry. In the latter case the quarries, particularly those of the 19th century, are often associated with lime kilns or with waggonways leading to kilns, as at Sunderland Town Moor (HER 4456) and Fulwell quarry (HER 2691).

Pottery making

The development of the pottery industry in the region was facilitated by the availability of cheap coal, ballast cargoes (including Cornish clay and flint for glazes) and local brown earths. These factors meant that most potteries were located on the riverside, where raw materials and finished products could be loaded directly onto ships. The pottery industry developed strongly from the mid-18th century, notably at Sunderland (HER 4452), Carr Hill (HER 5653) and Sheriff Hill in Gateshead, and, a little later, in the Ouseburn area east of Newcastle (HER 4968 and 5280-3), where many potteries operated in the 19th century. The number of potteries in Newcastle grew from six in 1801 to over 20 in 1827, and the Wearside pottery industry was exporting some 300,000 pieces annually by 1818. In 1868 there remained six major pottery works on Wearside, but by the end of the century this had declined to three, still producing a mixture of decorated ‘fine’-wares, made from imported clays, and coarser ‘brown’ wares made for culinary use from local clays. Most of the potteries in this area had closed by the early 20th century, but the famous Maling and Sons works (HER 4344) in Walker Road, Newcastle survived until 1963.

Brick and tile-making

Brickmaking became established in the 18th century (e.g. HER 4455) and flourished in the 19th and early 20th centuries, when local brown earths were used to produce building bricks and fireclay from the coal seams was used to produce heat-resistent firebricks, used for the construction of kilns and furnaces in various local industries. Many early brickworks and even some 19th century ones were small-scale, short-lived operations, sometimes connected to collieries and lime works. However, the general trend was towards larger works, amongst which Cowen’s brickworks at Blaydon (HER 3434) and the Lilley brickworks at Rowlands Gill were two of most important in the later 19th and 20th centuries.

Glass making

In the middle part of the 19th century the glass industry of Tyneside and Wearside produced the greater part of the national output, making this the greatest period in the long history of glass making in the region. One of the most important producers was Swinburne’s (HER 2340), successor of the Cookson’s works near South Shields, where a number of other works operated between the early 18th and late 20th centuries (e.g. HER 2359 and 2565) notably the Hartley Wood works (HER 1917). Among the most important sites on the Wear were the Wearmouth Crown Glass Works, started in 1786 (HER 2772) and the Southwick bottleworks, dating from 1846 (HER 2766). Production also continued on the Ouseburn into the early or mid-19th century (HER 1913-1916), having peaked there in the 17th and 18th centuries. Lemington Glass Works, opened in 1787 by the Northumberland Glass Company was also an important producer from the late 18th to late 20th centuries. Initially, flat glass was produced from 4 large glass cones, but after 1906 the works was expanded and fitted it out for production of light bulbs and tubes. The remaining cone at Lemington stands 120 feet high. Glassmaking fell into deep decline in the depression of the 1880s and the following decades.

Chemicals

The chemicals industry always exploited riverside locations and was important from the mid-18th century. On the Wear, the first copperas works was established at Hylton c.1750 and another at Deptford c.1760 (HER 2793). The production of alkali for use as a bleaching agent in the textile industry was carried out at various locations, including Hebburn (HER 2503) and Jarrow (HER 2279). Alkali works produced a variety of by-products, some of them useful but others, such as hydrochloric acid gas were extremely noxious and polluted the surrounding areas. There was also a guano processing works at North Shields (HER 5489). Other chemicals works were spread along the major rives, at Newburn (HER 4951), on the lower Ouseburn (HER 5573), Wallsend (HER 2088), Hebburn (HER 2232) and Jarrow (HER 2267 and 2277). However, the chemical industry on Tyneside became uneconomic in the latter part of the19th century in the face of competition from South Durham and Teeside, which came to dominate the industry.

Agriculture

Agriculture became ‘industrialised’ from about the end of the 18th century, in the sense that major changes were made in order to improve production levels and efficiency. The medieval open fields were gradually enclosed during the 18th and 19th centuries, creating more manageable areas for ploughing and raising stock and reducing the number of small farmers working the land, many or those remaining now became employees rather than tenant farmers. Allied to this process of land reform was the introduction of new machinery, notably the barn threshing machine which became available from 1786. The threshing barn was attached to a gin-gang or wheel house which provided the horse power, but from the mid-19th century, stationary steam engines powered from engine houses were used to drive the thresher. Also around this time came the introduction of planned farms, designed for better farm management. Although many of the planned farms in Tyne and Wear have since been partially or wholly redeveloped, often for residential use in the late 20th century, some survive relatively unscathed, while many individual components survive on the redeveloped sites. The most impressive example of a planned farm in the county is New Horton Grange, near Dinnington (HER 5084), while Gosforth Home farm (HER 4639) provides an example of a farm where the motive power for the threshing machine changed from the gin0gan to the steam engine. Survivals of individual components in otherwise redeveloped sites include an early 19th century dovecote at Axwell Park House Farm (HER 1935) and a threshing barn complete with waterwheel pit at Path Head Farm, Blaydon (HER 3423).The above represent only some of the more important of the many industrial practices carried out on the banks of the Tyne and Wear, amongst which may also be mentioned leadworks, cokeworks - such as Whinfield Coke Ovens (HER 1004), the last working beehive coke ovens in the country (worked until 1958) - and ropemaking, which was practiced at a large number of sites from at least the later 18th century. Willington Quay ropery (HER 1179), established in 1789, was centred upon a building approximately 440 yards long, while the Deptford Patent Ropery or Webster's Ropery (HER 2799), opened in 1797, is probably the oldest factory building in the region and the earliest patent ropery, and survives as the oldest factory building in Sunderland. Such industries formed giant industrial complexes, the Tyne complex being described as follows in 1860: "The whole distance betwixt Blaydon and the sea, on both sides of the river, forms one huge manufacturing town, so thickly are the factories and with works strewed overall the district." The same description could at the same time have been made about the lower Wear. These industries, individually and collectively provided large profits and social prestige for the employers, and employment for thousands of workers. This, in turn brought into being new or much-expanded communities, some of which remain while others have disappeared, surviving only on historic maps or in place-names. The early 20th century was a highpoint for the coal mining and heavy industries of the north-east of England, but massive decline set in with the Great Depression of the 1920s and '30s and, although World War II gave a temporary reprieve to these industries, the post-war years saw further decline. There is now very little shipbuilding and no deep coalmining in Tyne and Wear. Related industries, such as chemicals manufacture, have all but disappeared, although traces remain, such as the Alkali public house near Tyne Dock in Jarrow.

Industrial Pioneers

The expansion of such great industrial developments on Tyneside were only made possible by the investment and foresight of some of the greatest industrial pioneers the world as ever seen, such as George Stephenson, William Armstrong, Charles Parsons and Joseph Swan, all Tynesiders by birth or adoption. Some of these great industrial figures were great friends and would often meet to discuss their industrial and technological developments at the Literary and Philosophical Society of Newcastle upon Tyne, one of the greatest local institutions of Victorian Britain, which still functions as a private library with a very famous lecture hall. It was here that Joseph Swan first demonstrated his electric light bulb, and where George Stephenson exhibited a miner's safety lamp which made deep mining practicable.

George and Robert Stephenson

George Stephenson (1781-1848), the 'Father of the Railways', is the most widely known of the great industrial pioneers of Tyneside. He was born at Wylam on Tyne where his father was the engineman at the Wylam Colliery winding house. Aged 14 George became an assistant to his father and later followed in his footsteps to become the engineman at Killingworth colliery, north of Newcastle, where he developed one of the earliest locomotives, the 'Blucher', which ran on the Killingworth colliery railway in 1814. From the period 1814 to 1826 Stephenson was virtually the only engineer building and developing new locomotives. In 1819 Stephenson became involved in a project to build a railway for Hetton Colliery near Houghton le Spring. This railway was in its time the largest in the world and served as a prototype for Stephenson's Stockton and Darlington Railway of 1825. In 1824 George Stephenson with his son Robert opened an engineering business and workshop in Forth Street Newcastle, specifically to build locomotives. It was there that Stephenson's most famous locomotive, the Rocket, was built, famous for achieving a world record speed of 36 miles per hour at the Rainhill Trials held near Liverpool in 1829.In 1830 the Liverpool to Manchester railway opened. Between 1825 and 1835, Parliament agreed to the building of 54 new rail lines, and in the years 1836 to 1837, a further 39 new lines. In 1838 Robert Stephenson, son of George, completed the London to Birmingham rail line, and in 1841 Isambard Kingdom Brunel completed his London to Bristol line, the Great Western Railway. By 1900, Britain had 22,000 miles of rail track. Robert Stephenson (1803-1859), son of George, played a very important role in many of the projects associated with his father, including the construction of the 'Rocket'. Robert is better known, however, for his work in the field of civil engineering, where his best known achievements are the tubular bridges over the Menai Starits in Wales and over the St Lawrence River in Canada. Closer to home Robert constructed the Royal Border Bridge near Berwick and the High Level Bridge in Newcastle.

William Armstrong

William George Armstrong (1810-1900) was a scientist, scholar and engineer who was also an enterprising industrialist. He was born in the Shieldfield area of Newcastle on 26th November 1810, son of the proprietor of a corn merchants business on the Newcastle Quayside who was a member of the Literary and Philosophical Society. Armstrong trained to be a solicitor but had interests in the field of science and engineering. Around 1846 he persuaded wealthy Newcastle businessmen to back him in the development of hydraulic cranes for Newcastle which were powered with the assistance of the town's Whittle Dene Water Company. The scheme was such a success that in 1847, Armstrong gave up his legal practice to establish the Newcastle Cranage company at Elswick, which later became known as 'Armstrong's Factory'. Following the Crimean War in the 1850s Armstrong became increasingly involved with the manufacture of armaments - his eighteen pound breach loading gun was one of many world class Armstrong weapons ordered by armies and navies from Russia and Japan to the United States (indeed, Armstrong supplied both sides in the American Civil War). From 1863 Armstrong became less and less involved in the day to day running of his company affairs and began to pursue other interests, such as landscape gardening, initially carried out in Jesmond Dene, later at Cragside near Rothbury, the first house in the world to be lit by Hydro Electric power.

Charles Parsons

Sir Charles Algernon Parsons, son of the Third Earl of Rosse (a famous astronomer), began his career as an apprentice to William Armstrong. Later he became a partner in the Tyneside firm of Clarke Chapman with whom, in 1884, he developed the steam turbine for the generation of electricity. The first vessel to take advantage of such an engine was the 'Turbinia' built by the Parson's Marine Steam Turbine Company at Wallsend in 1897. Later ships to use the Parsons Turbine included the Wallsend built ‘Mauretania’ of 1907, a liner which for 22 years held the Blue Riband for the fastest crossing of the Atlantic. Charles Parson's Turbine is important in the history of shipping, and is recognised as one of the greatest steps forward in the development of electric power generators.

Joseph Swan

Joseph Wilson Swan was born in Sunderland on October 31st 1828, and began his career as an apprentice to a local chemist. In 1862 he moved to Gateshead and, as a member of the Newcastle Literary and Philosophical Society of Newcastle upon Tyne, expressed a strong desire to research and experiment in the field of chemistry. Some of Swan's earliest developments were in the field of photography, where he perfected the carbon process of photographic printing and developed the rapid photographic plate. He also patented the first Bromide paper in 1879, allowing photography to become a popular pass-time. Swan is better known, however, for his development of the incandescent filament electric lamp, the first practical electric light bulb, first demonstrated by its inventor at the Literary and Philosophical Society on February 3rd, 1879. Following this successful demonstration, he established at Benwell the world's first electric light bulb factory. Later Swan went on to light up Mosley Street in Newcastle City Centre, the first street in the world to be lit by electric light.