Industrial for spinning (1769) this device was used

INDUSTRIAL STUDIES ASSIGNMENT NO 1Development of Engineering since the Industrial RevolutionThe Main Outcomes of the Industrial RevolutionThe Industrial Revolution had a huge impact on society. The major effects were socially and economically. It is rather difficult to date the start of the industrial revolution but history books of today suggest the onset during the 18th century.

The change from agriculture to industry was vast and it must be remembered that England was the first country to undergo this profound change. The initial effect on engineering industries arising at the start of the Industrial Revolution were due partly to the geographical location of the resources i. e. coal iron and water. The inventiveness of our ancestors in these as well as other industries such as textiles chemical electrical and transportation contributed greatly to the Industrial Revolution. The first two of these coal and iron provided the capital infrastructure and options for future development, whilst textiles supported and encouraged developments.

Coal was originally mined by small group’s even families, using the long wall system. * SEE DIA 1. This technique was changed dramatically with the invention of the Commen engine. * SEE DIA 2. (named after its inventor THOMAS NEWCOMMEN) This was a pump that pumped the water out of coalmines allowing deeper more productive mines to be worked by more people.

This in turn had effects on the production of ironIn the early 1700s iron was produced by burning vast quantities of wood. The production techniques

were crude. Technology had already provided machines like the newcommen engine; this pumping device allowed ABRAHAM DARBY II to fill a millpond to power a water wheel for a blast furnace. This enabled the production of better quality pig iron. This technique provided the iron for the manufacture of one of the major symbols of the industrial revolution the Ironbridge over the river seven.

* SEE DIA 3. A water wheel also played a major part in one of the first inventions within the textile industry. RICHARD ARKWRIGHT invented the water frame for spinning (1769) this device was used by local man JEDEDIAH STRUTT in a mill at Cromford. The changes within the textile industry from wool to cotton called for more and more mechanisation.

The mechanisation of the industry also led the setting up of the first factories; some of the first major mechanical devices were to be used in these factories. Such as JOHN KAY'S Flying Shuttle (1733), JAMES HARGEAVE'S Spinning Jenny (1764), SAMUEL CROMPTON'S Spinning Mule (1779), and EDMUND CARTWRIGHT'S Power Loom (1785). To name a few. Cotton was being imported from the America's in the early 1700s. This material made the cities of Manchester and Nottingham increase in size over cities like Exeter and Norwich as they relied on wool. These increases in sizes in our industrial towns coincided with an explosion in population, which has not been fully understood or explained since.

All of these factors paved the way forward for a rapid rate of economic and social growth. Which spurred on the industrialisation of our country. Development of New Energy Conversion MachinesThe very first machines to

be produced at the start of the industrial revolution were used in the textile industry. These machines utilised the waterpower from rivers and millponds to drive the various mechanisms employed. The first powered invention was the steam engine, originally the invention of THOMAS NEWCOMMEN (1705) but later developed by JAMES WATT (1769) Watt eventually went into partnership with MATHEW BOULTON to produce a rotary engine. This very important invention was used by mill owners to drive SAMUEL Compton's mule.

They were also used in waterworks and breweries. After this came the non-condensing steam engine by RICHARD TREVITHICK whom in 1801 was the first to put into operation an engine carrying passengers. And then in 1804 he made the first application to the hauling of heavy loads along a railway.

His locomotive carried 10 tons about 91/2 miles. He is considered by many to be the real inventor of the steam locomotive whereas GEORGE STEVENSONS first locomotive The BULCHER was first demonstrated in July 1814. His ROCKET of 1829 achieved 29 miles per hour.

This is another great symbol of the Industrial Revolution and was the starting point of the modern railways. Later developments were the use of diesel and electricity. The first machine for producing electricity was invented in 1672 by OTTO VON GUERICKE. A French scientist CHARLES FRANCIOS DU CISTERNAY DU FAY discovered the two types of electrical charges around 1745. In 1879 JOSEPH SWAN developed the electric light bulb. He together with THOMAS EDDISON began light bulb manufacture in Gateshead. In 1884 CHARLES PARSON'S steam turbines (another Gateshead invention) were

being utilised all over the country to produce electricity to provide light in factories and to power electric trams. These powerhouses as they were called were in the private sector of the industry and remained highly competitive.

The major power producing company of that time was the Newcastle upon Tyne Power Company. The use of electricity led to the development of electrical motors to power early machines like trams, hoovers, sewing machines and countless other inventions. In 1926 the central electricity board established the national grid, this standardised electrical outputs and voltages across the country whereas before there had been chaotic variations in voltages and frequencies of supply and use. The use of electricity in factories after this standardisation led to the increased production of the new transport industries. The manufacture of bicycles, aircraft, and most predominantly the motor car increased with the utilisation of all forms of electrically powered machines. There were also increases in all forms of electrical engineering from light bulbs and radios to generating plant and machinery. Natural Resources e. g.

Coal PetrochemicalsThe British coal industry was the major contributor to the Industrial Revolution. The industry utilised the first steam powered engines of Newcommen and many more that followed. As production grew from these applications the new railways were used to transport the vast amounts of coal being produced. In 1830 steam power could wind men and coal up and down a few hundred feet.

By the 1860s there were pithead engines of 1500 hp. For 100 years from 1850 coal made up more than half of the railways freight. In 1913 one out of every 14 British workers was employed at a coalmine. In the same year there were 3, 289 pits. Coal was used to power the giant iron works and the textile industry. The gasworks of the early 1800s were burning thousands of tons per year. The coal used in these gasworks was roasted and this resulted in coke as a waste product. This coke was then sold on to the ironworks.

In the 1860s British engineers were still improving the steam engine. But there French and German counterparts were short of steam coal so they turned there attention to gas. A Frenchman ETIENE LENOIR made the first internal combustion engine. Cont'dAfter the first oil wells were sunk in America it was possible to use petrol vapour instead of gas. In about 1885 two Germans KARL BENZ and GOTTLEIB DAIMLER fitted such an engine to a horseless carriage. That was the start of the motor car industry.

Petrol was bought from the USA but this was expensive. Oil refineries were built around the coast to make petrol from the oil we bought from the Arab countries. Oil refining gave us the raw materials for man- made fibres such as rayon, nylon, and terelene. The Arabs raised the price of their crude oil when Britain gave its support to Israel.

Britain had fortunately found oil recently of the coast in the North Sea. This oil and later gas was pumped ashore by private companies. The Change from Agriculture To Industry Britains change from an agricultural society to the industrial nation it became was an extremely necessary development.

In the 1700s there were only 5 million people in the whole country. The vast majority of these people using their local environment to support themselves. Britain was a nation of villages relying on home-grown produce and livestock. As the population expanded at a remarkable rate our productivity had to improve.

Our ability to manufacture goods from the raw materials we were importing from our colonisation of the world prepared our nation for the tremendous changes. The merchants that prospered in these times spent their money on the luxuries of large houses and carriages, although some of their wealth was lent to manufactures to start up new industries. They also set up or started their own banks. With the help of these banks the various industries expanded. The need for workers to build equip and run the new factories in the ever growing industrialised towns and cities changed the nation as a whole.

These new industries in Britain gave the people better standards of living and some if only a little disposable income to spend on consumer goods. All of these factors paved the way forward for a rapid rate of growth, which spurred on the industrialisation of our nation. Emergence of New Crafts, Skills, And Professions in Engineering. With the onset of the Industrial Revolution new industries created the needs for new skills, workers of the day had to adapt and train to the new methods and working patterns. One of the greatest engineers of the Industrial Revolution was ISAMBARD KINGDOM BRUNEL (1803-1859).

He designed and oversaw the building of the Great Western Railway and the first transatlantic steamship The Greatwestern. (sadly the last ship built on the Thames). Brunel as engineer had to take on many duties covering many aspects of his projects. At one time he took overall charge of 4, 000 men and 300 horses working around the clock on a tunnel building project. Engineers were very skilled and highly competent men able to take on the roles of: – landsurveyer, carpenter, mason, brickmaker, boatmaker, paymaster and supervisor. One industry that had a major influence over the working patterns at the start of the Industrial Revolution was the pottery industry, a man called JOSHUA WEDGEWOOD built a factory in Staffordshire and trained his workers in separate skills or tasks.

There were different jobs created such as throwers, turners, pressers, dippers, brushers, placers, colour grinders, and modellers. No longer did a single person make a single product from beginning to end. In the early 1790s weekly wages in his factories ranged from 1s for a boy who helped handle horses to 42s (2. 10) for a skilled hand painter. The skills required in precision engineering were to brought to the industry by two great engineers BOULTON and WATT, they combined the precision skills of the watch and clockmakers (These highly skilled craftsmen worked with brass in almost microscopic detail.

) with the skills of millwrights. Cont'dBOULTON and WATT created the jobs of fitters to enable the production of their engines. In 1812 the development of the machine tool industry was particularly associated with HENRY MAUDSLEY and his invention of the first screw cutting lathe. (And its associated invention the Micrometer) made possible the absolutely accurate machining

of parts, from now on machines could reproduce themselves and be constructed in ever more complexity. The skills of the 18th century clockmaker were no longer an expensive skill, but part of the conventional wisdom of mechanical engineering. Technological developments in Manufacturing and Production, Standardisation, Mass Production, Automation, Communication and Micro Technology.

The developments in the various fields of manufacturing were born out of necessity for change and the need for the standardisation of production techniques. Taking the industries as they developed chronologically, the production of coal in the early 1700s was usually carried out by small groups of three people working the long wall system. The coal produced then was generally used for heating homes in major towns like London. The only way to produce more coal was to dig deeper mines, The use of steam powered winding gear enabled them to be dug.

These mines flooded and were drained with the use of newcommens engines. one of the biggest dangers in deep mines was gas, this was easily ignited by the candles miners uesd to illuminate the pits. In 1815 after the Felling colliery disaster in which 92 men and boys died, HUMPHREY DAVY a well known scientist was asked to recommend a safe way of lighting mines. He invented the DAVY LAMP, * SEE DIA 4 a safety lamp that used gauze around the flame.

At the same time another mining engineer GEORGE STEVENSON developed the GEORDIE LAMP which worked just as well. Explosions still happened sometimes ignited by the spark from a pick or shovel. Another development

was the use of ventilation shafts to expel the stale air and gas from the mines, a series of doors were opened and closed usually by young boys allowing movement of air and creating a safer environment. Steam powered devices developed from the very simple pumping engine, (Newcomen) later improved upon by James Watt.

He realised whilst repairing one that it was using twice as much coal as necessary, he made a machine with a separate condenser with John Roebuck as a partner but this partnership held him back for seven years. He eventually joined with MATHEW BOULTON (1728-1809) and together they made more efficient engines asking customers for a third of the cost of the saved fuel by using their engine as opposed to a Newcomen. In 1781 Watt worked out the sun and planet motion which meant his engines could turn a wheel. This was rotary power, one of histories greatest inventions after the wheel itself. A driving belt could work a machine without muscle, wind or waterpower. The steam engine was born. With the use of steam to drive a wide range of machinery, production increased in almost every area of manufacture. The steam turbine of 1884 was used to generate electricity.

As the use of this power increased electrical engineers developed machines for both domestic and industrial use. Factories could do away with steam power and use electricity to drive all their machinery. This automation went further still with motor car industry utilising the production line technique, where items were passed along a conveyor system and were added to as they progressed down the line to achieve the end product.

As already discussed with electricity some standard measures have to be taken to ensure compatibility. This is also true in engineering. as developments allowed increased production of various items and components the need for uniformity of these arose. Standardisation came from mass production. ELI WHITNEY an American inventor stimulated the textile industry in America by inventing the Cotton Gin (1793).

*SEE DIA 5 Cont'dHe also made a very important contribution to Standardisation by developing the idea of interchangeable parts for firearms, this idea was also applied to the manufacture of timepieces from about 1820. By the middle of the 19th century American factories had developed the mass production of standardised parts. Manufactures like SAMUEL COLT's firearms and ISAAC SINGER's sewing machines used what was known then as the " American System". This was soon adopted in Britain, firstly by the same industry of arms manufacture at Enfield and the Birmingham Small Arms Company.

The founders of the cycle assembly industry employed these same techniques of manufacture in Nottingham at Raleigh Cycles. The Standardisation bodies like the International Standards Organisation became the suppliers and overseers of the necessary guidelines for the manufacture of countless nuts, bolt, fasteners, sizes and tolerances and many other measures being applied to everyday living and working. The technological developments in communication and micro-technology arose from the increased availability of electricity and the production of standardised equipment for use in the communications industry. Telegraphy, telephones

and radio were the first of this new generation of equipment to become readily available to the general public.

In the 1860s there were 1900 post offices using telegraph wires usually run alongside railway tracks, in 1876 ALEXANDER BELL sent the first voice message down a telegraph wire in America. In 1897 GUGLIELMO MARCONI formed his own company to run wireless stations (originally invented to keep in touch with ships that could not be connected to wires). In 1914 Marconi made wireless sets for the forces. After that he set up station 2LO. Listeners bought sets to listen to this station. Later Marconi and five others set up the BBC this was ran by charging 10s at the post office for a license to listen to programmes.

Around 1924 JON LOGIE BAIRD sent the very first television picture, the BBC used the Baird system initially but EMI came up with a system that had much clearer pictures. The first television pictures were broadcast in 1936 and by 1939 there were nearly 80’000 sets picking up daily programmes in Britain. This stopped the day war broke out. The BBC kept its monopoly until 1954 when ITV was formed to oversee regionally advertised broadcasting. In 1980 there were four channels and the new development of teletext (pages of information sent to television sets). Nowadays there are hundreds of TV channels available to view and with the use of computers and the Internet the amount of information available is endless. The Main Branches of IndustryEngineering industryLight engineering heavy engineeringMechanical electrical/electronic mechanical electricalTooling The Broad Divisions of Heavy and Light IndustryHeavy industry can be divided into different sectors of production the mains ones being machinery, chemical, steel, vehicle, and

shipping. The companies involved in this type of industry are usually very large, with a large amount of labour, plant and equipment and a very large annual turnover.

The companies within heavy industry can produce products that are so large and time consuming that they often have a stronghold over their chosen market. Light industry on the other hand is diverse in its extremely varied products and applications, these can be an object so small that the human eye cannot see to large scale manufacture of extremely accurate components. The companies in this sector of engineering can vary from large multinationals producing thousands of different items to one man operated businesses producing one off products to the specific requirements of their customers. The Structure of Industry ? Nationalised Industries, Monopolies, Co-operatives and Small Firms. Britains first industries were nationalised by the conservatives before the war. These were the National Grid, London Transport and two airline companies. After the war the Labour party added to these with B. E.

A. and the Bank of England, these were small steps in comparison to the eventual nationalisation of the coal, steel, electricity, gas, and transport industries. In nationalising these various important industries the government didn’t expect the boards who oversaw these giants to make big profits. The main reason for nationalisation was to see that these industries were modernised. Before the nationalisation of the National Grid there were 500 separately owned power stations providing electricity to the National Grid. Nationalisation of the coal industry gave the chance to end the long running disputes between miners and their owners, and also made it

possible to mechanise the smaller pits. The companies nationalised were by coincidence the major suppliers of their products, when this occurs within industry the companies concerned are said to be monopolies. Monopolies are formed when a manufacturing or supplying company has is the sole supplier of the product or service.

These monopolies have the power to dictate to customers rather than the other way around. British gas had the monopoly on the gas supplies, British Telecom the monopoly on the supply and use of the telephone and ancillary equipment, as did the very large companies within the electricity distribution sector. Co-operatives. In 1844 a small group of Rochdale weavers found 28 people to pay 1 each to start the Rochdale equitable pioneers, they used the money to decorate an old warehouse in Toad Lane and to buy goods and open a shop.

Customers were given a dividend on each article they bought. The idea quickly spread through the north of England, in just seven years there were 130 shops owned by the co-operative societies, in 1863 there were enough societies to start there own suppliers, the co-operative wholesale society (C. W. S.). In 1872 the CWS began to make its own biscuits, boots and soap and a wide range of own brand goods, the CWS improved living standards of millions who went there for their shopping, insurance and the first dignified funerals working class people could afford. small firms within the engineering industry are usually supported by the needs of the larger engineering companies, small specialist firms can produce items or components that might be one off’s or long run’s of intricate design, these items can be bought by the larger companies cheaper than it would cost them to set up

their own production. The Role of Trade Unions and Employer OrganisationsThe role of the trade unions in the early stages of the coal mining industry was to try to promote safety and get better deals for its members.

The early trade unions were known as trade societies, these societies helped members who were out of work by using letters or tickets to help them obtain work from other societies outside their own towns. Sometimes society men would combine against an employer or master. They would use this and another method called tuning out or striking to try to pursuade their masters to agree to a rise in wages or stop new machinery entering their workshops.

When the masters found these combinations were siding together on them they went to the parliament for help, in 1797 parliament passed a law prohibiting these combinations in 40 trades. These laws didn’t work and the societies grew and multiplied in number. Other groups often organised themselves to attempt to stop the use of machines, the often used force and smashed up the machinery that they thought threatened their livelihoods, they were known as the LUDDITE’S.

Parliament passed a bill to make this smashing of machines punishable by hanging and in many counties in the north of England Luddites were hanged for their offences, The first national trade union was the A. S. E. the Amalgamated Society of Engineers. Their membership was made up of skilled people and journeymen who paid a weekly subscription of 1/-, the A. S. E. offered pensions and benefits for sickness and death, and it also built up a sizeable strike fund.

It could afford a headquarters in London and a full time official to put members views across to M. P’s newspaper editors and anyone else who might support their cause. Employer organisationsAs the power of the trade unions grew a counterforce was required by the employers. In 1870 the national federation of employers associated was founded. By 1936 there were a total of1820 employers organisations registered, they mainly dealt with wage bargaining and labour questioning in general.

A forum was created for the exchange of technical ideas and development. Pressure groups encouraged favourable legislation. In today’s industry, employers’ organisations fall into two categories: 1. Those concerned with the common interest of a particular trade or technology.

The engineering employers federation in London co-ordinates the engineering employers association, this operates at local level and is largely concerned with wage bargaining and representing engineering employers interests locally and nationally. 2. General groups of employers, for example, the confederation of British industry, this balances the role of the TUC this also acts as a pressure group encouraging favourable government response to the requirements of British industry at home and abroad. There are also technical development associations, providing a forum for technical exchange, carrying out fundamental research on behalf of their member companies, one of these being the copper development association (C. D. A.

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