Feedback

80 Manufacturing
81 Management Science and Policy
82 Plant-Factory Operation
83 Manufacturing Processes
84 Design-Production Interface
85 Specialized Factory Tools and Systems
86 Agriculture-Food Production
87 Printing and Publishing Mechanization
88 Textile Industry Mechanization
89 Vehicle Production

* indicates ASME Landmark

Common Era	Event	
0	Fulling mills press fabric by foot. (France)	88
105	Paper invented. (Tshai Lun, China)	88
500 ca.	Earliest specimens of draw loom in western world: originally from Asia, unknown date. (Egypt)	88
800 - 1700	Plough with curved iron mould board (concave) guided and turned over heavy clay soil in a continuous-ribbon motion: 9th century in China, 1300-1700 in Europe, principle later used for wrapping and folding for machinery. (China)	86
1045 ca.	Movable type introduced in China. (Pi Sheng, China)	87
1150	Stamp mill used in paper making (not mentioned by L7) (E9 says 1144, Spain). (Italy)	82
1185 ca.	Earliest records of fulling mills in England, at Newsham (Yorkshire) and Barton. (Britain)	88
1225 - 1250	Water-driven machinery recorded: sketches of saw mills, including spring motion. (Villard de Honnecourt, medieval Europe)	82
1280 - 1299	Spinning wheels illustrated: primitive, spindle-on-an-axle type. (Europe)	88
1322 - 1328	Sawmill invented (Domesday Book mentions sawmills in 1076 -- H5). (Europe)	82
1400 - 1499	Holland adapts windmill for large-scale drainage (1439 for grinding grain -- Q9). (Dutch, Holland)	86
1400 - 1499	Improved loom advances weaving of elaborate silk fabrics. (John the Calabrian)	88
1439	Lead alloy used as printers' type: hand produced until 1820s. (Gutenberg, Germany)	87
1440	Earliest evidence of block book, SPIRITUALE POMERIUM: block-printed wood cuts. (Brussels)	87
1448 - 1455	Mainz printing office develops Gutenberg printing press: used movable and reusable type. (Gutenberg, Fust, Europe)	87
1500 ca.	Clear glass produced in large beehive furnaces fired by charcoal. (Europe)	83
1518	Tilting trough demonstrated: probably invented earlier. (Leonardo da Vinci, Italy)	86
1530	Foot-driven spinning wheel.	88
1586	Improved draw loom: use forbidden according to legend. (Dangon, France)	88
1589	First frame-knitting machine devised: leads to machine-knitting industry (1599 possible). (Wm Lee, Britain, then France)	88
1600 ca.	Mechanical hammer-type fulling mills appear in Europe (first illustrated 1607, Zonca). (Europe)	88
1604	Ribbon mill. (Europe)	88
1604 ca.	Bar loom invented: used to weave many ribbons simultaneously. (Willem	88

	Dierickzoon van Sonnevelt, France)	
1679	Steam digester invented: reduced bone to edible jelly, forerunner of autoclave, pressure valve invented to prevent explosions. (Denis Papin, London)	86
1687 - 1688	Cast plate glass: Saint Gobain factory established at Tourlaville to make mirrors. (Nicolas du Noyer, France)	83
1695 ca.	Lead rolling mills used in England (1730 in France). (Britain)	82
1700	Carding machine for wool. (Britain)	88
1700 - 1732	Silk-throwing mill develops rapidly in England: patent held. (Lombe's, Derby, Britain)	88
1701	Horse-drawn seed drill for planting seeds in rows developed. (Jethro Tull, Britain)	86
1730	Plow with four cutters invented: published 1731 but not widely used for many years. (Jethro Tull, Britain)	86
1733	Flying Shuttle for weaving loom invented: marks beginning of textile industry. (John Kay, Britain)	88
1746 - 1749	Lead-chamber process for sulphuric acid developed: used until 20th century, replaced by Messel. (John Roebuck, Britain)	83
1748	United Society for Manufactures and Importation, early US textile factory, uses hand looms. (Boston)	88
1764	Jenny invented for cotton spinning: eight spindles at once (patent 1770). (James Hargreaves, Britain)	88
1767	Yarn mass produced by spinning machine.	88
1769	Water-powered spinning frame patented: model for all later spinning machinery. (Richard Arkwright)	88
1775	Arkwright's carding machine patented: first successful cotton spinner. (Richard Arkwright, Britain)	88
1776	Laissez faire principles elaborated in THE WEALTH OF NATIONS, specifically mentions pin-factory management. (Adam Smith, Britain)	81
1779	Spinning mule perfected: based on jenny and water frame. (Samuel Crompton, Britain)	88
1785	First Watt steam engine to drive cotton mill operates in Arkwright'sfactory. (Arkwright, Nottingham)	88
1785 - 1787	Power loom in factory (1785--E2 I3): (looms not necessarily practical until 1785-88--L7). (Edmund Cartwright, Britain)	88
1787 - 1790	Soda-making process invented 1789: uses common salt. (Nicolas Leblanc, France)	86
1787 ca.	First high-pressure steam engine in US built. (Oliver Evans, Delaware)	88
1788	Drum thresher patented: invented 1784-86. (Andrew Meikle)	86
1790	Multistory factory blocks built, larger than country mills, represent new era in management.	81
1790	Wet-spun process using machine for spinning flax yarn patented and installed in factory. (Matthew Murray, Leeds, England)	88
1790	Sewing machine patented. (M Saint, Britain)	88
1790 - 1798	First US cotton mill built using powered machinery: built by Wm Almy and S Brown. (Samuel Slater, Pawtucket, RI)	88
1790 - 1840	Textile industry stimulates machine-tool growth; 1785 steam engine introduced into cotton industry. (US)	88
1791	REPORT ON THE SUBJECT OF MANUFACTURES written. (Alexander Hamilton, US)	81
1793	First important US water-powered woolen mill. (Scholfield, Newburyport, Mass)	88
1794	Whitney cotton gin patented: establishes Southern plantation wealth and influences manfacturing industries. (Eli Whitney, US)	86

1795	Advanced management practices implemented in Soho Factory: 2d generation (sons). (Boulton and Watt (sons), near Birmingham, Britain)	81
1795	THE YOUNG MILL-WRIGHT AND MILLER'S GUIDE published. (Oliver Evans, Wilmington, Del)	82
1797	Mechanized textile carding machine patented: used in early 1790s, spread to England. (Amos Whittemore, Hartford, Conn)	88
1798	Continuous paper-making machine invented: not commercial until 1800 with Bryan Donkin and John Gamble, Britain. (Nicholas LouisRobert, France)	85
1798	Lithography invented. (Alois Senefelder, France)	87
	19th Century	
1800 - 1828	Experimental social reform (employee welfare) tried in textile mills (personnel management). (Robert Owen, New Lanark, Scotland)	81
1800 - 1808	Clocks mass produced in New England: die-cut brass wheels used; first US clock factory. (Eli Terry, Plymouth, Conn)	82
1800 - 1811	Wilkinson textile mill*: important to steam power and machine tool development in US. (David Wilkinson, Pawtucket, RI)	88
1803 - 1805	Power loom developed: influenced British textile developments. (Johnson, Britain)	88
1803 - 1814	Large-scale cotton factory designed at Lowell: major step for textile industry. (Francis Lowell, Waltham and Lowell, Mass)	88
1804	Jacquard automatic silk loom invented: major improvement over draw loom, uses punch card system, in general use by 1810. (Joseph M Jacquard, France)	88
1805 - 1808	Steel check plate invented for paper-engraving process that made counterfeit notes difficult. (Jacob Perkins, Massachusetts)	87
1810	Tin-plate container patented: introduces tin cans made of sheet metal. (Peter Durand, Britain)	86
1810 - 1953	Chef wins award and builds first bottling and canning factory: House of Appert (1795). (Nicolas Appert, France)	86
1814	First operating steam-powered newspaper press installed at THE TIMES in London. (Friedrick Konig, London)	87
1816	Cast-iron plow invented (first in US): patented 2/3/1819, adds mould board with interchangeable parts 1837. (Stephen McCormick, Virginia)	86
1819	Roving machine for cotton spinning patented: with differential mechanism. (Asa Arnold, NH or RI)	88
1820	Cultivator invented: first to be operated in North America. (Henry Burden, New York)	86
1820 - 1829	Revolving horse-drawn hay rake commercially available: displaces older forms by 1850s. (US)	86
1822 - 1825	Self-acting power loom demonstrated 1822: based on Wm Horrocks', for weaving intricately designed fabrics. (Richard Roberts, Manchester)	88
1823	Rubberized waterproof material manufactured for garments and air cushions. (MacIntosh, Glasgow)	83
1824	Better cement process invented: Portland cement concrete substituted for Portland rock. (Joseph Aspdin, Leeds)	83
1826	Powered printing press patented: perhaps first in US. (Daniel Treadwell, Massachusetts)	87
1828	Ring spinner patented: produces stronger, uniform yarn or thread at high speeds. (John Thorp, Providence, RI)	88
1828	Cap spinner. (Charles Danforth, Ramapo, New York)	88
1830	Self-acting mule perfected. (Richard Roberts, Manchester)	88
1831 - 1834	First mechanical reaper (patented '43) generally adopted: follows several British	86

	designs. (Cyrus McCormick, US)	
1832	ON THE ECONOMY OF MACHINERY AND MANUFACTURES extended Smith's work on management principles. (Charles Babbage, US and Europe)	81
1832 ca.	Soda water manufacturing begins in US. (John Matthews, New York)	86
1832	Mechanized type-casting machine introduced: capable of producing 20,000 letters a day. (Wm Church (US), Britain)	87
1833	Factory Act in England protects children under age of nine from employment. (Britain)	80
1833 ca.	Pin-making machine developed, with Robert Hoe; spun-head pin-making machines manufactured. (John I Howe, Salem, NY)	85
1833	Reaper with cutter sickle attains commercial success: before McCormick's. (Obed Hussey, US)	86
1835 - 1862	Horseshoe and railroad spike machines mass produce forged metal objects. (Henry Burden, Troy, NY)	85
1836	Fiberglass (check trademark) patented. (Dubus-Bonnel, Paris)	83
1837	Combined thresher and fanning mill built (check winnowing machine) (patented 1834 -- D2, X4). (Hiram and John Pitts, Winthrop, Maine)	86
1837	Plow with steel cutting edge and wrought-iron selfscouring mold board: dubbed singing plow. (John Deere, US)	86
1838	Process of vulcanizing rubber patented in Britain. (Hancock, Britain)	83
1838	Bruce's type casting machine. (US)	87
1840 - 1900	Rapid mechanization and heavy capital goods made of iron and steel: from coal fuel. (US)	80
1840 - 1849	Tin patterns for shoe making leads to standard sizes, right and left 'crooked' shoes and shoe boxes. (US (New England))	85
1840 - 1879	1819 siderographic printing device with geometric pattern lathe produces stamps. (Jacob Perkins, Britain)	87
1840	Self-acting mule for spinning cotton patented. (Wm Mason, Massachusetts)	88
1841	Vulcanization in US invented (1839--E2 X4; 1835--I3). (Charles Goodyear, Philadelphia)	83
1842	Powered carpet loom patented: makes hand weaving obsolete. (Erastus Bigelow, Massachusetts)	88
1843	Evaporator for sugar cane invented. (Norbert Rilieux, US)	86
1844 - 1852	Gun-manufacturing factory built by Robbins and Lawrence* (originally Robbins, Kendall, and Lawrence): first export of machine tools and guns with interchangeable parts, closed 1852. (Richard Lawrence, Windsor, Vt)	82
1845 - 1846	Charleston COURIER publishes arguments for a Southern (US) textile industry (mill established). (Wm Gregg, Graniteville, SC)	88
1845 - 1851	Power carpet loom invented. (Erastus Bigelow, Massachusetts)	88
1846	Method of evaporation in multiple effect patented for sugar refining. (Norbert Rillieux, Louisiana)	86
1846	Steel mould boards (plow). (John Deere, US)	86
1846	Type-revolving 'Lightning' invented: credited with revolutionizing newspaper printing. (Richard M Hoe, Philadelphia)	87
1846	Sewing machine patented: developed 1845, has eye-pointed needle and shuttle. (Elias Howe, Massachusetts)	88
1847 - 1848	Factory built for mass production of McCormick's reaper: mechanizes agriculture industry. (Cyrus McCormick, Chicago)	86
1851	Household sewing machine patented and manufactured. (I Singer, Wilson)	88

1854	Four-motion feed patented: fundamental to sewing machine development. (Allen B Wilson, Connecticut)	88
1855 ca.	Norris Locomotive Works advances management practice: workers' manual published, master file kept. (Norris, Philadelphia)	81
1856	Condensed milk canned. (Gail Borden, US)	86
1857	Penn Railroad establishes modern management structure. (Pennsylvania)	81
1857	Drawing glass directly from furnace patented. (Wm Clark, St Helens, Britain)	83
1861	First (US) successful flat knitting machine patented: improved by 1865. (Isaac W Lamb, Michigan)	88
1865	Harvesters patented (1/31) with Rufus Howard; combined rakes and reels patented (2/7). (Samuel Johnston, New York)	86
1868	Positive-motion loom, with belt attached to shuttle carriage, patented: for cotton industry. (James W Lyall, New York)	88
1870	Celluloid patented (created 1869); factory established 1872 in Newark; machines developed 1875-78. (John Hyatt, New Jersey)	83
1874 - 1887	Industrial tempered glass manufacturing process developed and factories established. (R Royer, France)	83
1875	Contact process for manufacturing sulphuric acid patented: replaces Roebuck's method (1749). (Rudolph Messel, W S Squire, Germany)	83
1877 - 1886	Incubators and chicken brooders patented: credited with creating chicken-farm industry. (Edward S Renwick, New York)	86
1878 - 1879	Cream separator invented. (Karl G P de Laval, Sweden)	86
1879	First US dobby loom patented. (Horace Wyman, Massachusetts)	88
1880 - 1910	Rumors of oversupply of technical graduates (in Germany) feeds fears of employment glut. (US)	81
1880 - 1920	Towne, Metcalfe, and Halsey promote managerial principles on manufacturing and economics. (Henry R Towne, US)	81
1880	Isoprene isolated from rubber to create synthetic rubber; 1884, Tilden expands production. (G Bouchardat, France)	83
1880 - 1889	Cotton-seed-oil mill is built and operates in Georgia: expands throughout South. (Erwin Wm Thompson, Thomasville, Ga)	88
1881	Labor organization founded: later becomes AFL in 1886, gives direction to labor movement. (Samuel Gompers, US)	81
1881	First automatic buttonhole machine patented. (J Reece)	88
1881	Willcox and Gibbs trimmed-seam machine patented. (Charles Willcox)	88
1883	Production engineering is developed as profession. (Henry R Towne, US)	81
1884	Pyrex invented by Carl Zeiss in Jena Germany; later improved by Corning (1916). (Zeiss, Corning, Jena, Germany; US)	83
1884	Direct-casting linotype patented (1885, linotype with justification patented). (O Mergenthaler, Baltimore, Ohio)	87
1885	Paper bag manufacturing machine patented (first patent). (Wm Henry Honiss, Hartford, Conn)	85
1886	'The Engineer as an Economist' published in ASME TRANSACTIONS. (Henry Towne, New York)	81
1887	Book-sewing machine patented: used at Smyth Manufacturing Company. (Arthur Jacobs, Hartford, Conn)	85
1890	Financial-sharing incentive plan introduced into Canadian Rand Drill to increase productivity. (Frederick Halsey, Quebec, Canada)	81
1890 - 1914	Rise of labor unions as factories as factory production grows and scientific management forms. (US and Europe)	81

1892	Pneumatic seed cotton machine patented: adopted worldwide. (Robert S Munger, Birmingham, Ala)	86
1892	Viscose rayon produced: earliest cellulose fibers for textile industry. (C F Cross and E JBevan)	88
1895 - 1903	Automatic bottle-making machine* conceived and built (patented 1895). (Michael Owens, Toledo, Ohio)	86
1895	Self-threading automatic loom with weft-fork mechanism and warp let-off and warp stop motions. (J H Northrup, Hopedale, Mass)	88
1896 - 1927	Record production of Ford Model T: 15 million sold; first in 1896; assembly line introduced 1914. (Henry Ford, Detroit, Mich)	89
1897	Monotype printing established in US. (US)	87
1898 - 1901	Bethlehem Steel introduces F W Taylor's scientific management system. (F W Taylor, Pennsylvania)	81
	20th Century	
1900 ca.	Pro-labor policies re-emerge from business leaders: Filenes in Boston and John H Patterson, NCR. (Boston, Dayton)	81
1900 - 1925	Rise of giant multi-unit corporations changes managerial structures: broadens management program. (au A D Chandler, US, Europe, Japan)	81
1900	Cow-milking machine patented: bucket type (releaser developed in 1920).	86
1900 - 1917	First tractors powered by internal combustion engine appear: grow into common use.	86
1901	Wage-and-bonus paper published: introduces humanist approach to industrialism. (Henry Gantt, New York)	81
1901	Sheet glass produced directly from furnace: patented 1901 and perfected 1913. (Fourcault)	83
1903	Machine-drawn glass cylinders produced. (John Lubbers, US)	83
1904	Wage and efficiency principles published. (Harrington Emerson, New York)	81
1905 - 1935	Antitrust legislation (Sherman Act enforcement) stabilizes rapid manufacturing expansion. (US)	80
1905	Rayon yarn manufactured commercially through viscose process.	83
1907	Bakelite invented: commercially produced 1909, marks beginning of plastic-age mass production (simultaneous development by James Swinburne in England). (Leo H Baekeland, New York)	83
1908 - 1912	Cellophane manufacturing process invented by Edwin Bradenberger: perfected in 1910. (Bradenberger, Switzerland)	83
1908	Conveyor-belt assembly for automobile production begun: includes continuous-feed plate glass and high-speed metalwork. (Ford Factory, US)	89
1909	Triplex produced as safety glass for windshields: uses celluloid between sheet glass. (E Benedictus, France)	83
1911	Scientific management principles published (1910 -- E3, U3). (F W Taylor, Philadelphia)	81
1912 - 1929	Published texts that influence industrial economics; most notable is kilo-man-hour studies. (Leon Alford, New York)	81
1912 - 1920	Two-apron drafting system developed: cotton textile manufacture. (F Casablancas)	88
1913	'Principles of Industrial Organization' used in management training programs through 1950. (Dexter Kimball)	81
1913 - 1920	Cooker with reel and spiral invented to sterilize food in canning; pressure-lock valve 1920. (A R Thompson, San Jose, Calif)	86
1915 - 1924	Lillian and Frank Gilbreth establish basic elements of motion studies: especially	81

	flowchart process. (Gilbreths, New York or RI)	
1916	ADMINISTRATION INDUSTRIELLE ET GENERALE published on management theory. (Henri Fayol, France)	81
1918	Mass production of gas-powered track-type tractor. (Benjamin Holt, Stockton, Calif)	86
1920 - 1929	Hawthorne experiments on worker fatigue and productivity conducted at Western Electric. (Elton Mayo, Chicago)	81
1920	Continuous ribbon production for glass manufacturing invented by Ford Motor Company.	83
1920 - 1933	Tank-furnace and ribbon production for flat-glass manufacturing developed: also grinding and polishing. (Pilkington Brothers, St Helens, Britain)	83
1921	Ribbon machine for high-speed production of light bulbs developed. (Will Woods, D Gray, Corning, NY)	85
1921	First automatic chassis factory begins production (1930, full production). (A O Smith Corporation, Milwaukee, Wis)	89
1924	Series of landmark publications appear: includes design, manufacturing, and control of standard machinery. (Ralph Flanders)	81
1925	Individual-section (IS) machine developed for bottle making, replacing Owens' rotary system.	86
1926 - 1949	De-airing pug mill introduced: increases workability of plastic masses, especially affects ceramic whiteware.	82
1927	'Time Study and Formulas for Wage Incentives': pioneered management texts (with S J Stegemerten). (Maynard, Lowry)	81
1927	Model T removed from production. (Henry Ford, US)	89
1930 - 1939	Labor strikes and demonstrations reflect changing management policies and economic depression. (especially Renault, worldwide, especially France)	81
1930 - 1935	Suter-Webb comb sorter introduced: measures cotton fiber length and length distribution.	88
1931	ORGANIZATION ENGINEERING published: fundamental management exposition. (Henry Dennison, US)	81
1931	Neoprene developed at du Pont de Nemours. (Wallace Carothers, Wilmington, Del)	83
1933	National Labor Relations Act (1933). (US)	81
1935	Nylon patented for du Pont: introduced 1938, first major synthetic fiber. (Wallace Carothers, US)	83
1936	Baby harvester, marketed by Allis Chalmers, brings mechanization to small US farms, eventually European farms. (US, then Europe)	86
1938	Fiberglas produced by Owens Corning Fiberglas Company. (US)	83
1938 - 1946	Pilot plant developed for continuous processing of chemical pulp for paper making. (Kamyr AB, Sweden)	88
1939	Polyethelene invented: polytetraethelene invented and produced in 1954?. (Roy Plunkett)	83
1939	Polythene commercially made by International Chemical Industries. (Britain)	83
1940 ca.	Plastics like PTFE discovered to have lower coefficient of friction than journal metals.	83
1940 ca.	Pressley bundle test introduced: measures cotton fiber strength.	88
1941	Polyurethanes commercially produced by I G Farbenindustrie (discovered 1937-39 by Bayer). (Germany)	83
1941	Dacron developed by ICI in Britain in 1941: introduced in US in 1953. (du Pont, US)	83
1943	Silicone manufactured commercially (discovered 1904 by Kipping). (Dow Corning	83

	Corp, US)	
1944	Polysar plant begins production of synthetic rubber. (Sarnia, Ontario, Canada)	83
1946	Fruit juice extractor* with 24-head rotary action operates experimentally: uses grapefruit. (Sunkist, Tempe, Ariz)	86
1946	Micronaire method of measuring diameter of cotton fiber introduced.	88
1948	Teflon produced commercially: PTFE discovered by Roy Plunkett in 1938. (du Pont, US)	83
1950	Sulzer's shuttleless automatic loom produced commercially. (Sulzer)	88
1950 ca.	Clamp technology, electronic controls, and hydraulic and pneumatic operation affect garment manufacturers.	88
1950 - 1955	Wool scourer improved: Wool Industry Research Association -- Petri improved scourer.	88
1952	Float glass process developed for flat-glass manufacturing. (Pilkingtons, St Helens, Britain)	83
1954 - 1957	Polypropylene invented: replaces jute and hemp. (Natta, Milan)	83
1955 - 1959	Model developed for correlating how new technology relates to productivity. (W E Salter)	81
1957	Phototypesetting process makes it possible to eliminate metal typesetting.	87