

## Part 3. Timeline in the Development of Farmstead, Electrification, and Processing Equipment

(also see the Home and Household Items timeline)

*Note: the italic letters at the end of each entry refer to the references.*

- 1626** First commercial flour mill built in colonies in New Amsterdam (New York).  
AOAA CLAA
- 1746** Reverse osmosis (membrane separation) reported by Frenchman Abbé Jean Antoine Nollet, 1700-1770.  
EAFBE GLSB
- 1714** Change from alcohol-filled to mercury-filled thermometer by Polish-Dutch- German Daniel Gabriel Fahrenheit, 1686-1736, who introduced the Fahrenheit temperature scale in 1717 (see 1733).  
BDPE BEST DSB EB MWBD WOI
- 1730** Claimed to be first cotton mill built, Gloucester, England. STF
- 1731, 1732, 1734** Water-driven mechanical thresher invented (1731 in *DID*), using rotary flails beginning in 1734, built by Scot Michael Menzies, ?? -1766. BDPE DID STF
- 1733** Flying shuttle, which led to automatic weaving, patent granted to John Kay, 1705-c.1764, England. SAID STF
- 1733** Mercury thermometer invented by Frenchman Joseph-Nicolas Delisle, 1688- 1768, in St. Petersburg, Russia. Conflict in information in different references (see 1714).  
CLAA DID DSB
- 1742** Centigrade (100 units between freezing and boiling of water) scale for thermometer introduced by Swede Anders Celsius, 1701-1744; in 1948 became known as the Celsius temperature scale and adopted by many as the official designation. BEST WOI
- 1764** First modern greenhouse in the USA built in New York. STF
- 1768** Fanning mill for cleaning grain patented and manufactured by Scots Andrew Meikle, 1719-1811, and George Meikle, sons of James Meikle. GH HT
- 1769** Cast iron introduced for use in windmill construction by Englishman John Smeaton, 1724-1792, followed by other improvements in windmills. BDPE DID
- 1780** Flour mill that operated automatically invented in USA by Oliver Evans, 1755-1819. BDPE CLAA
- 1783** Improved hygrometer using a human hair as a sensing element developed by Swiss Horace Bénédict de Saussure, 1740-1790. BDPE EB GLSB WWWS
- 1786** Ice cream company established in the USA, New York. STF
- 1786** Cotton spinning jenny put in operation by Daniel Jackson, Providence, RI. FFFR

- 1788** Threshing machine that threshed grain, blew away the chaff, and separated the grain and weed seeds by sieving invented by Andrew Meikle, 1719-1811, in England. *DID*
- 1789** Flour mill built, including elevators, conveyors and hoppers, designed by American Oliver Evans, 1755-1819. *BDPE FFFR*
- 1789** Cotton mills established. Two locations claim to be among the earliest: Beverly Cotton Manufactory, Beverly, MA, and James Island, SC, by Frances Ramage. *FFFR*
- 1791** Patent issued for a gas engine to John Barber, USA. *AGE*
- 1793** Wool-carding machine built by John and Arthur Scholfield, Newburyport, MA, and installed in Byfield, MA. *FFFR*
- 1793** Considered first successful cotton mill built in USA, by Samuel Slater, 1768-1835, Pawtucket, RI. Earlier cotton mills not considered successful (see 1789). *STF WWWW*
- 1794** Cotton gin, consisting of a wooden cylinder encircled with slender spikes, patented by Eli Whitney, 1765-1825. *ASABECaI CLAA EB FFFR HL1986 STF*
- 1796** Cotton gin, consisting of a device that substituted a circular saw for spikes, patent issued to Hogden Holmes, later annulled. Questions remain as to who was the first to invent the forerunner of the modern cotton gin. *EB*
- 1798** Threshing machine driven by steam engine designed by Scot Andrew Meikle, 1719-1811, following many inventions of hand-driven, horse-driven, and water-driven machines by many others in several countries. *BDPE DID*
- 1800** Hygrometer built by Scot John Leslie, 1766-1832. *WWWS*
- 1800** Farm wagon, considered one of the most successful, produced by the Studebaker Co., South Bend, IN. *AOAA*
- 1801-1802** Sugar beet factory built in Silesia (Europe). *FH*
- 1804** Factory opened in France to preserve food in glass containers by first heating, then sealing from air, by Nicolas-Francois Appert, c. 1750-1841, tested by French Navy. *BEST BF03 DDI MWBD*
- 1805** Development of an agricultural lawn mower credited to Englishman Thomas Pluckett. *WOI*
- 1805** Production of powdered milk (dry milk) undertaken by Frenchman Antoine Augustin Parmentier, 1737-1813. Industrial tests made by German Grunwald in 1855. *STF WABI*
- 1808** Machine for removing husks from rice developed by Jonathan Lucas, 1775- 1822. *BDPE DAB WWWW*
- 1808** Leather-splitting machine patented by Samuel Parker, Billerica, MA, in which hides fed into one end of the machine and two pieces emerged from the other end. *STF*
- 1810** Metal container of tin-coated sheet steel for heat treatment and preserving food patented by Peter Durand, Middlesex, GB (see 1812). *BF03 WABI*
- 1812** Tin cans developed in England for food preservation followed by development of food processing plant by Bryan Donkin, 1768-1855, and John Hall, based on purchase of patent by Peter Durand (see 1810). *BF03 FH STF*

- 1812** Commercial cannery established by Frenchman Nicolas-Francois Appert, c. 1750-1841. *MWBD STF WWWS*
- 1813** Vacuum pan invented and patented in England by Edward Charles Howard (see 1903). *HFP*
- 1814** Cottonseed-hulling machine invented and patented by John Lineback, Salem, NC. *AOAA FFFR*
- 1819** Canning introduced in the USA by Englishman Peter Durand. (Another 50 yr. passed until Pasteur discovered the connection between microorganisms and spoilage, the basis of the canning process.) *AOAA CLAA SI*
- 1819** Successful commercial food canning operation, claimed to be the first, established by William Underwood, Boston, MA. *AOAA CLAA*
- 1824** Concrete invented by Britisher Joseph Aspdin, 1799-1855. *BDPE GEA*
- 1825-1840** Inventions and patents by Rufus Porter, 1792-1884, for a corn sheller, churn, and washing machine. He also founded *Scientific American* in 1845 in New York, NY. *NC7:184*
- 1827** Possibility of concentrated milk introduced by Frenchman Nicolas-Francois Appert, c. 1750-1841; a concentrated milk factory was established in 1858. *DDI MWBD STF WABI*
- 1829** Cottonseed oil mill established by Francis Follet, Petersburg, VA. *FFFR*
- 1830** Lawn mower introduced by two Englishmen, Edwin B. Budding, 1796-1846, and Mr. Ferrabee (credited with the design); manufactured in 1831. *BDPE WABI WOI*
- 1831** Cheese factories established in USA. *FTA*
- 1833** Beginning of patenting and making of ice-making machines. *FH*
- 1834** Method of evaporating milk invented by Frenchman Nicolas-Francois Appert, c. 1750-1841. *MWBD STF*
- 1834** Patent for a mechanical refrigerating device, used initially for making ice, operated on the basis of expansion of a volatile fluid (ether) in a closed cycle using a compressor, patented by American Jacob Perkins, 1766-1849. *CLAA DAB DID FFFR  
STF YA1964 WWA*
- 1837** Buffalo Pitts thresher with endless-apron feed developed by twin brothers Hiram Avery Pitts, 1799-1859 and John A. Pitts, 1799-1859, who opened a factory in Buffalo, NY; claimed to be the first efficient and relatively inexpensive threshing machine. Numerous improvements followed. The Chicago Pitts thresher built in Chicago, IL, in 1852. *BDPE GH STF*
- 1837** Fanning mill developed by twin brothers Hiram Avery Pitts, 1799-1859, and John A. Pitts, 1799-1859, USA. *BDPE GH*
- 1838** Meat extract produced by reducing flesh to 15 percent of original bulk using desiccation by Baron von Liebig, 1803-1873, in Germany. *DID*
- 1838** Sugar beet factory, claimed to be first built in USA, in Northampton, MA. *STF*
- 1840ff.** Corn shellers developed by American Rufus Porter, 1792-1884. *BDPE NC7:184*

- 1842** Grain elevator (storage) in USA, claimed to be first, constructed by Jewett & Root Co. for Joseph Dart in Buffalo, NY. *AH(Jan1937) CLAA FFFR STF*
- 1842** Milk successfully shipped by railroad recorded for the first time in USA, shipping milk to New York City, NY. *CLAA DTE STF YA1922*
- 1843** Egg (chicken) incubator using steam heat patented and invented in USA by Napoleon E. Guerin, New York City, NY. *FFFR*
- 1844** Compressed-air refrigerating machine, invented by John Gorrie, 1803-1855, patented in 1851. *FFFR WOI*
- 1844** Gas engine invented and patented by Stuart Perry in USA; used turpentine gases as fuel. *FFFR*
- c. 1845** Churn in which cream agitated with rotary dashers comprised of wooden paddles set at an angle, patented; known as Dalphin American churn (see 1820). *FTA*
- 1845** Combing machine invented for wool and other fibers by Englishmen Samuel C. Lister, 1815-1906, and brother John Lister, 1827-1912 *BDPE MWBD WWWS*
- 1848** Ice cream freezer patented by William G. Young, USA. *WWWA*
- 1850** Early milk cooling system, consisting of cold water pumped through pipes counter flow to milk flowing down over the pipes, invented by American Lawrence. *FTA WABI*
- 1850s** Ether compressor used for making ice and cooling food developed by James Harrison of Glasgow, Scotland, who emigrated to Australia. *FH*
- 1850** Regular shipment of milk by railroad practiced. *MMP*
- 1851** Yale Infallible Lock invented by Linus Yale, 1821-1868. His most important contributions were the cylinder lock and, in 1862, the combination lock. *BDPE FFFR STF*
- 1851** Factory-produced ice cream, claimed to be the first in USA, made by Jacob Fussell. *BF03*
- 1851** Condensed milk produced by Gail Borden, 1801-1874, New York; patent issued in 1856. *FFFR*
- 1851** Mechanical refrigeration patent issued to American John Gorrie, 1803-1855. *BDPE CLAA*
- 1851** Factory system used to produce cheese by Mr. Williams, New York. *MMP*
- 1852** Movable-frame beehive invented by Lorenzo L. Lanstroth, 1810-1895, Oxford, OH. *HFP*
- 1854** Self-regulating windmill invented by Daniel Halladay, Ellington, CT, with large-scale production beginning c. 1873. *AH(Apr1963) CLAA*
- 1856** Butter manufacturing plant, claimed to be the first in USA, established by W. R. Woodhull, Campbell Hall, NY. Another early, USA, butter factory in was one built in 1861 by Alanson Slaughter, Wallfill, NY. *CLAA FFFR STF YA1963*
- 1856** Canned sweetened condensed milk using a vacuum and heat process, invented and patented by Gail Borden, Jr., 1801-1874, followed by establishment of the New York

- Condensed Milk Co. in 1858. *CLAA HFP MMP STF*
- 1857** Oil lamp for burning kerosene developed by A. C. Ferris and Co. *FFFR*
- 1858** Concentrated milk plant, claimed to be the first established in the USA, begun by Gail Borden, Jr., 1801-1874. *CLAA NC7:306 STF WABI*
- 1858** Joseph A. Campbell, ??-1900, USA, began canning foods commercially (see 1869, 1873). *AFF BF03*
- 1858** Corn husker invented by Samuel Johnston, 1835-1911. *NC24:75*
- 1859** Refrigeration machine using ammonia as a refrigerant introduced by Frenchman Ferdinand Carré, 1824-1900 (see 1876). *DID STF SWABI WOI*
- 1860** Vacuum milking machine invented by American L. O. Colvin. The continuous vacuum irritated the cow's udder (see 1862). *WOI*
- 1860-1864** Pasteurization of foods developed based on work of Frenchman Louis Pasteur, 1822-1895. *BDHT BEST EB MP*
- 1860** Ammonia-absorption refrigerator invented by Frenchman Ferdinand Carré, 1824-1900. *BDPE DID*
- 1861** Condensed milk manufacture patented in USA by Gail Borden, 1801-1874. *FTA*
- 1862** Working model of a hand-operated vacuum milking machine built by American L. O. Colvin. Scot William Murchland developed a permanent milking machine installation in 1889 (see 1860). *FTA STF WABI*
- 1864** Milk cooler introduced by Stuart Perry, 1814-1890, Worthington & Co., New York, NY. *BDPE DAB*
- 1865** Sawmill developed by Stuart Perry, 1814-1890, Worthington & Co., New York, NY. *BDPE DAB*
- 1865** Butter worker invented by Laroy S. Starrett, 1836-1922. *DAB NC18:428*
- 1866** Hay-baling press powered by a horse on a rotating sweep invented by George Ertel, Quincy, IL. *CLAA*
- 1867** Hay carrier for mowing hay patented by Henry W. Ferris. *NC24:302*
- 1868** Lawn mower developed by Thomas Coldwell, 1838-1905, and others. Coldwell Lawn Mower Co. organized in 1891. *NC8:65*
- 1868** Dynamite, a mixture of nitroglycerin and diatomaceous earth, introduced in USA by Alfred B. Nobel, 1833-1896. *HFP*
- 1868** Refrigerated railroad cars used, patented by William Davis, widely used in the 1870s. *CLAA YA1966*
- 1869** Joseph Campbell Preserve Co. (Joseph A. Campbell, ??-1900, with Abraham Anderson), a leader in canning food in Camden, NJ, then expanded by John T. Dorrance, 1873-1930. John T. Dorrance and Joseph A. Campbell formed the foundation of an established industry, becoming Campbell Soup Co. in 1922. Company led by Arthur Dorrance in 1897, then by Arthur C. Dorrance as president in 1930. *AFF ANB BDPE BF03 WWWW*

- 1869** Margarine, then a white substitute for butter, patented by Frenchman Hippolyte Mège-Mouriès; first factory produced by Jan and Anton Jurgens in Holland. *BF03 HT*
- 1869** Wheel lawn mower invented by Everett G. Passmore, manufactured by Graham, Emlen & Passmore, Philadelphia, PA. Their company became Philadelphia Lawn Mower Co., the world's leading company for manufacture of lawn mowers, under the direction of Walter E. Graham, 1866-1927. *NC21:319*
- 1869** First transcontinental railroad in USA completed. *CLAA EB*
- 1869** Twin-screw extruder developed by Follow and Bates for the sausage industry, later used for macaroni products, and by mid-1940s single-screw extruders were also used for a variety of food products. *WEFST*
- 1870** Grain cleaner and separator invented (pat. 1871) by Daniel Best, 1838-1923. *NC40:544*
- 1870** Commercial ice cream freezer (40 qt. capacity) patented by Thomas Mills and Brothers, Philadelphia, PA. *AIM*
- 1872** Dried-milk process of atomizing and desiccating product patented by Samuel R. Percy, New York. *FFFR MMP*
- 1872ff.** Hundreds of small internal combustion engines developed and marketed, many by equipment manufacturers and other small businesses, in 1<sup>1/2</sup>, 2, 3, 5, 6, and 8 hp sizes, used on the farm and home for driving pumps, generators, separators, etc. *AGE*
- 1873** First recorded tower silo built in USA for storing forage by Lewis (father) and Fred (son) Hatch, near Spring Grove, IL. *FFFR HL1984*
- 1875** First widely publicized silos in USA built in Maryland and Michigan. *CLAA YA1960*
- 1873** Soups of various vegetables offered for sale as a major product line in USA by Joseph A. Campbell, ?? -1900 (see 1858, 1869). *AFF STF*
- 1876** Pit silo, believed to be the first in USA, for corn silage built and used by Francis Morris at Oakland Manor (now in area of Columbia), MD. *HL1976 TDC*
- 1876** Widely successful compression refrigeration system using ammonia designed by German Karl Paul Gottfried von Linde, 1842-1934 (see 1859). *HFP STF WOI*
- 1877** All-roller flour mill built in USA utilizing information from European mills, by Edward P. Allis, 1824-1889. *NC7:546*
- 1877** Flour-rolling mill invented by John Stevens, Neenah, WI, with patent in 1880. *FFFR*
- 1877** Separator for continuous separation of cream from milk invented (patented 1881) by Elihu Thomson, 1853-1937. *BDPE WWWW*
- 1877, 1886** Chicken incubators and brooders developed by Edward S. Renwick, 1823-1912. *BDPE NC11:103*
- 1878** Mechanical, continuous-flow centrifugal cream separator invented by Swede Carl Gustav Patrik de Laval, 1845-1913, licensed to International Harvester Co. in 1882. *CLAA FH FTA OYIH STF WABI*
- 1878** Rotary hay feeder developed by Stuart Perry, 1814-1890. *BDPE MEA*

- 1878** Test for determining butterfat content of milk proposed by Stephen M. Babcock, 1843-1931, at University of Wisconsin, Madison, WI (see 1890). *FTA NC22:16*
- 1880** Hedge-trimming machine made of metal and drawn by horses invented by Englishman R. Hornsby. *WABI*
- 1880** Butter press introduced used to form butter into neat blocks. *FTA*
- 1880** Incubator using hot water for heat invented by Frenchman Budin. *SWABI*
- 1881** Milking device in which the milk is obtained from cows by the action of small rollers, called by some a lactator, invented by Mr. Cress. *FTA*
- 1881** Commercial milk pasteurizer introduced by Albanian Fresca, in Germany. *MP*
- 1881** Centrifugal separator manufactured in USA by David H. Burrell, 1841-1919, New York. *NC19:126*
- 1882** Farm cream separator invented in Europe; manufactured by Sharples Separator Co., West Chester, PA (Philip M. Sharples, 1857-1944). *NC47:166 WWWW*
- 1882** First central electric generating system went into operation in USA, the Pearl Street generating station (direct current), and the first street lighting application, in New York City, NY. *CLAA YA1960*
- 1882** Cream separator, invented by Swede Carl Gustav Patrik de Laval, 1845-1913, brought to USA. It became the basis of a new industry into which International Harvester Co. entered. *CLAA FH FTA STF WABI*
- 1883** Hay carrier for moving hay to mow patented by Henry L. Ferris, 1850-1932, Harvard, IL. He had over 200 patents related to hay handling, feed carriers, stanchions, stalls, ventilation, and windmills. The company he formed later became Starline, Inc., Harvard, IL. *NC24:302*
- 1884** Hay unloaders with accompanying tracks manufactured (pat. 1883), by Philip A. Myers, 1853-1932. He also developed a double-action force pump that led to F. E. Myers & Bros. Co., Ashland, OH. *DAB NC27:392*
- 1884** Tobacco press invented by John P. Parker, 1827-1900, black inventor. *ANB BDPE BI*
- 1884** Evaporated milk process for evaporation and sterilization of milk patented by Johann B. Meyenberg, 1847-1914, St. Louis, MO. He formed Helvetia Milk Condensing Co., Highland, IL, in 1885 for commercial production, which later became Pet Milk Co. *DTE FFFR NC41:94*
- 1885** Cotton dryer invented by John H. Lorimer, 1846-1918, produced by Lorimer Machinery Co., Philadelphia, PA. *NC19:69*
- 1885** Milk pasteurized on a commercial scale in Sweden and Denmark. *MP*
- 1885** Manufacture of dairy processing equipment by D. H. Burrell & Co. (David H. Burrell, 1841-1919), which become the Whitman & Burrell Co. (Rodney S. Whitman) (see 1881, 1905, 1911). *NC19:126*
- 1886** Commercially successful glass milk bottle invented by Harvey D. Thatcher with the first milk bottle filler patented by Dr. Stone in USA. *MP*

- 1886** Electric resistance welding patented in USA by Elihu Thomson, 1853-1937.  
*BDPE HFP NC27:28 WWWW*
- 1887** Manufacture of several food products patented by William Horlick, Jr., 1846-1936, with brother James Horlick, 1844-1921; originated malted milk, leading to numerous milk products and infant foods.  
*DMMP MWBD*
- 1887** Machine to successfully manufacture glass bottles, called the Ashland machine, built in England (see 1886).  
*STF*
- 1888** Meat shipped in refrigerated railroad cars for the first time in USA.  
*STF*
- 1889** Vacuum milking device in which the vacuum was created by a column of water patented by William Murchland, Kilmarnock, Scotland.  
*FTA*
- 1890** Continuous heater that momentarily heated milk to 85°C (185°F) for pasteurization developed in Denmark.  
*MP*
- 1890** Babcock method of determining butterfat in milk, by Stephen M. Babcock, 1843-1931, University of Wisconsin, Madison, WI, perfected and widely adopted (see 1878).  
*BDPE CLAA DTE FFFR NC22:16*
- 1890** Disk centrifugal separator for milk introduced commercially in USA.  
*DTE*
- 1890** Batch pasteurizer with a spiral heating coil, heating milk for 30 minutes at 84.4°C (184° F), constructed by Mr. Bittner.  
*MP*
- 1891** Method of destroying harmful bacteria in cow's milk made practical, based on work of Louis Pasteur, 1822-1895.  
*BDPE FTA*
- 1891** Milking machine using a pulsating vacuum presented by Scot Alexander Shields, Glasgow, Scotland.  
*FTA*
- 1892** Commercial milk pasteurization plant (using a German pasteurizer), claimed to be first operated in USA by L. B. Halsey, Sheffield Farms Co., Bloomville, NY.  
*MP*
- 1893** Congress appropriated \$10,000 to USDA to study improved road building. Several farm mechanics and agricultural engineering organizations initiated or enlarged projects in rural road building.  
*CLAA*
- 1893** Shredded Wheat, a ready-to-eat breakfast cereal, developed by Henry D. Perky and William H. Ford, Watertown, NY, manufactured by Cereal Machine Co., Denver, CO.  
*BF03FFFR STF*
- 1894** Milk pasteurizer designed by J. H. Monrad and sold by David H. Burrell and Co. (David H. Burrell, 1841-1919), an early leader in equipment for milk processing (see 1905).  
*MP NC19:126*
- 1894** Granose Flakes introduced as the first flaked breakfast cereal, produced by John Harvey Kellogg, 1852-1943, and his brother Will Keith Kellogg, 1860-1951, who organized W. K. Kellogg Co., Battle Creek, MI. In 1896 corn flakes produced by W. K. Kellogg Co. followed by many varieties of cereal foods.  
*BDPE DAB BF03 HL2008 MWBD WWWW*
- 1895** Corn mill built by New Holland Co., New Holland, PA. The company expanded into haying machinery, tractors, and a full line of implements, eventually forming Ford New Hol-

- land in 1988 and later Case New Holland (CNH). *FT1975*
- 1895** Commercial production of canned vegetables initiated by Henry J. Heinz, 1844-1919, and his relatives, Pittsburgh, PA. The H. J. Heinz Co. organized in 1888 (see 1887). *BF03 MWBD*
- 1895, 1903** Automatic machine to make glass bottles invented and designed by Michael J. Owens, 1859-1923. Owens Bottle Machine Co. formed in 1903. *ANB MWBD  
NC28:145 STF*
- 1895** Milk pasteurized commercially in New York. *FFFR*
- 1895** Early in-the-bottle pasteurization rapidly replaced with vat pasteurization. *MP*
- 1895** Milking machine with intermittent suction available (see 1891). *CLAA*
- 1897** Continuous, revolving, vertical-cylinder pasteurizer designed by Aage Jensen. *MP*
- 1897** Pasteurization of cream for butter making introduced by H. E. Schuknecht, Albert Lea, MN. *MP*
- 1899** Effect of high-pressure processing on food microorganisms (as a possibility for pasteurization) demonstrated by B. H. Hite, West Virginia University. *EAFBE*
- 1899** Concrete grain elevators began to be built in large numbers by Maurice A. Long, 1875-1938, who formed his own company, M. A. Long Co. (see 1842). *NC27:38*
- 1899** Gasoline-powered mower developed by Englishman Robert Ransome. *WOI*
- 1899** Homogenizer patented in France by Auguste Gaulin (see 1902). *DTE*
- 1900ff.** Tuberculosis and other pathogens in milk destroyed at 60°C (140°F) for 20 minutes as reported by Theobald Smith, Russell and Hastings, and Rosenhaus, thus establishing a scientific basis for holder (batch) pasteurization standards. *MP*
- 1900** Hershey chocolate bar produced by Milton S. Hershey, 1857-1945, Hershey, PA. *NC33:23 BF03*
- 1901** Drying milk in a heated chamber patented by German Robert Stauf, Posen, Germany. In 1905 rights to the patent purchased by the Merrell-Soule Co. (L. C. Merrell and F. C. Soule) and process improved to become a leader in the industry. The improved Merrell-Soule Co. process acquired by Borden, Inc. in 1927. *IB*
- 1902** Chicken incubator with automatic controls invented and successfully sold by Samuel B. Smith, 1871-1937. In 1922 he established Smith Incubator Co., Cleveland, OH. *NC29:478*
- 1902** Commercially successful cylinder corn sheller introduced. *LP*
- 1902** Homogenized milk, then called “fixed milk” or “micronized milk,” invented by Frenchman Auguste Gaulin, introduced in Paris. Introduced in the USA in 1904 (see 1899, 1919, 1927, 1932). *MMP NC41:172*
- 1902** System for drying milk on a roller or drum patented by John A. Just, with a commercial plant built in 1903. *DTE*
- 1902** Steel stanchions for dairy cattle introduced. *LP*
- 1902** Portable elevators for moving grain available. *LP*

- 1902** Steel bins built for farm storage of grain by Emanuel E. Norquest, 1874-1948, working with Charles R. Butler and Newton W. Butler, eventually incorporated as Butler Manufacturing Co., Kansas City, MO. *NC37:409*
- 1903** Vacuum pan for removing moisture from liquid food products invented by E. Passburg, USA. Much of the early research and development work on drying fluid food products done on milk and adapted to other liquid food products (see 1813). *DMMP*
- 1903** First commercially operated dry milk plant operated in USA by Rosemary Creamery Co., Adams, NY. *JDS(1956)*
- 1904** Automatic glass bottle making machine patented by Michael Joseph Owens, 1859-1923, produced by Libbey Glass Co., Toledo, OH. *HFP WWWW*
- 1905** Pneumatic milking machine introduced in USA by David H. Burrell, 1841-1919, who later formed a company for manufacturing a full line of creamery equipment. Loomis Burrell, 1872-1972, was with D. H. Burrell Co. (1895-1928) and with the Cherry-Burrell Co., manufacturers of dairy equipment (1928-1954) (see 1911). *NC19:126 WWWW*
- 1906** First recorded rural electric power line constructed at Hood River, OR (see 1923). *AH(Jan1954) CLAA*
- 1906** Decaffeinated coffee introduced by Ludwig Roselius, marketed as Sanka. *BF03*
- 1906** Freeze-drying invented by Frenchman Jacques Arsène d'Arsonval, 1851-1940, and associate Georges Bordas, developed commercially after World War II. *BDPE STF*
- 1906** Paper milk bottle invented but not used commercially until about 1929, and use greatly expanded after World War II for many food products. *MP*
- 1907** Continuous holding system of pasteurization, reported to be first in USA, installed at Sheffield Farms, Slawson Decker Co., in New York, by Joseph Willmann. *MP*
- 1907** Spray drying of precondensed milk patented and became known as the Merrell-Merrell-Gere process. *IB*
- 1907** Automatic milk bottling machine patented. *MP*
- 1910** Fluorescent light tube patented by George Elmer Inman, USA; produced commercially by General Electric Co. in 1935. As early as 1859 Antoine Becquerel built a primitive fluorescent light. *MWBD BF03 WOI*
- 1910** Glass-lined railroad tank car for transporting milk built by Pflaudler Co., Rochester, NY, for the Whiting Milk Co., Boston, MA; introduced by Pflaudler Co. for tanker trucks in 1914. *DTE FFFR*
- 1911** Chlorine used as a sanitizing agent for dairy equipment; calcium hypochlorite used to sterilize milking machine rubber by Loomis Burrell, 1872-1975, who also served with D. H. Burrell & Co. and as president of Cherry-Burrell Co., 1928-1954. *MP NC19:126 WWWW*
- 1912** Automatic, individual drinking trough (cup) for animals manufactured by the Rassman Co. of Beaver, WI. *CLAA WABI*
- 1913** Unconfined stalling or "loose housing" of dairy cows initiated by S. B. Buckley, University of Maryland, followed by J. R. Dice, North Dakota State College, in 1934, and later by Stan A. Witzel, University of Wisconsin, providing an environment for higher productivity

- as compared with dairy cows tied in stalls. *WABI*
- 1913** First highway paved with concrete, in Arkansas; previously only streets in towns had been paved with concrete. *GEA*
- c. 1914** Pulsed electric fields for food preservation considered. *EAFFE*
- 1916** Spray nozzle leading to spray drying invented by I. S. Merrell, 1875-1959. *DMMP  
WWWA*
- 1916** Successful artificial hay dryer developed by Arthur John Mason, 1857-1933. *NC29:22*
- 1916** Electric-powered lawn mower introduced by Ransomes, Sims & Jeffries, Ltd., in England. *BF03*
- 1917** Process for flash-freezing food in small packages for retail invented and developed by Clarence Birdseye, 1886-1956, leading to the formation of General Seafoods Co., and later General Food Co. (see 1924). *GEA MWBD STF WWWA*
- 1917** Milking machine design patented by Meredith Leitch and de Laval Separator Co. in Sweden; marketed in USA in 1918. *ASABECaI WOI*
- 1917** Beltless electric motor-driven devices developed by Robert D. Eaglesfield, 1887-1946, beginning with the Vonnegut Machinery Co., Indianapolis, IN. *NC35:315*
- 1917** Early drying and evaporation apparatus patented by C. E. Rogers; the C. E. Rogers Co. incorporated in 1883 in Michigan following the work of his father, Charles T. Rogers, in the 1830s, and headed by sons of the Rogers family. Now located in Mora, MN. *DMMP*
- 1919** Homogenized milk first adopted and produced commercially in USA by George Weirgold, 1871-1951, Torrington, CT (see 1902). *NC41:172*
- 1919** Basis for using high-temperature, short-time (HTST) pasteurization standards developed based on work of A. K. Anderson and R. Finkelstein. *AI MP*
- 1919** Electro-Pure process as a preservation method of liquid food products studied in detail in USA by A. K. Anderson and R. Finkelstein. *EAFFE JDS1919*
- 1920** Continuous Rotary Pressure Sterilizer introduced by what is now Food Machinery Corp. (FMC), San Jose, CA (now Madera, CA) by Albert R. Thompson. *ASABECaI HL1992*
- 1920** Hammer mill for feed preparation introduced for farm use. *LP*
- 1920** Farm Specialty Co. formed by Bruno Frederick Arps, 1890-1965, New Holstein, WI; incorporated in 1923 as Arps Corp. (see Implements section, 1920). *NC51:689*
- 1920s** Windmills used to drive generators (3 kWh) to charge batteries and supply electricity for farmstead and household marketed by Parris-Dunn and Jacobs Wind Co. *GEA*
- 1922** Electrically heated and regulated chicken incubator for hatching chickens patented by Ira M. Petersime, USA. *CLAA STF YA1975*
- 1922** Venturi-Flume Water-Stage-Recording Instrument, known as the Parshall Flume, patented by Ralph L. Parshall, 1881-1959, Colorado State University and USDA. *ASABECaI HL1985 BDPE*
- 1923ff.** USDA research on moisture measurement of grain by David A. Coleman, 1892-

- 1938, used as a basis of commercial trade and grain standards. Work led to the development (1934) of the widely used Tag-Heppenstall moisture meter. *NC29:415*
- 1923** Red Wing Project on Utilization of Electricity in Agriculture established with the support of Northern States Power Co., Burnside and Red Wing, MN, to evaluate the use of electricity for the farm. E. A. Stewart, University of Minnesota, had a leading role in the project. *HL2009*
- 1923** Regenerative HTST plate pasteurizer for liquid food products introduced by Sedwick in England. *MP*
- 1924** Industrial freezing of fish and other foods in ready-to-eat form introduced by Clarence Birdseye, 1886-1956 (see 1917). *CLAA WABI*
- 1925** Magness-Taylor pressure tester introduced; became the standard instrument for measuring ripeness of apples. *CLAA*
- 1925** Stainless steel used in dairy equipment by D. H. Burrell & Co. in the manufacture of a two-compartment milk weigh can (see 1905). *MP*
- 1926** Patent filed to quickly freeze food for preservation and defrosting, by Clarence Birdseye, 1886-1956. Birdseye set up company in 1924 to make equipment, sold to Postum Co. in 1929, later became General Foods Corp. (see 1917, 1924). *BDPE BF03*
- 1926** Electric-powered lawn mower introduced by Ransomes & Co., UK. *WOI*
- 1927** Homogenized milk successfully introduced commercially in Ottawa, Canada (see 1899, 1932). *DTE*
- 1927** Welded, stainless steel milk transportation tank made by Heil Co. (formed in 1906), Milwaukee, WI (Julius Peter Heil, 1876-1949). *MP NC40:194 WWWW*
- 1927** Vogt Continuous Freezer introduced, became a product of Cherry-Burrell Co. *DTE*
- 1928** Freon refrigerant (CFC) synthesized for Frigidaire by General Motors Research Laboratory, used widely in mechanical refrigeration systems. *GEA*
- 1928** Machine that sliced and wrapped bread developed by Otto Frederick Rohwedder, Battle Creek, MI. *BF03*
- 1928** Plate heat exchangers introduced into USA, used for continuous flow for heating fluid food products, followed by development of controls and flow diversion valves and introduced in 1938 for HTST pasteurization systems. *EAFBE*
- 1930** Early milk drying apparatus patented by David D. Peebles, followed by many innovations in drying. *DMMP*
- 1930** Starline Co. established; devoted to hay handling, manure handling, silo equipment, and livestock feeders, with developments led by Robert G. Ferris, 1905-1970. *NC55:576*
- 1930** Quick-freeze of vegetables, fruit, and fish patent issued to Clarence Birdseye, 1886-1956, became widely available commercially. Business sold to Postum Co. (1929), which later became General Foods Corp. (see 1917, 1924, 1926). *BF03 RS(Oct2007)*

- 1932** USDA reported results of extensive research on use of carbon dioxide environment for retarding the decay of fruits and vegetables, enhancing storage and transportation of these products (see 1940). *CLAA YA1935*
- 1932** Homogenizer used commercially for milk in USA by W. A. McDonald, Flint, MI. (see 1899, 1927). *DTE*
- 1932** Hammer mills with heavy steel hammers and steel sieves operating at 2000 rpm., belt-driven by 15-30 hp tractors, introduced by International Harvester Co. (see 1920). *OYIH*
- 1933** The Suter-Webb cotton fiber meter invented and patented by USDA and issued as a public service patent. *CLAA*
- 1934** Work on mow hay finisher (drying) initiated at Tennessee Valley Authority (TVA), led by George W. Kable, 1888-1950. *NC39:497*
- 1934** Tag-Heppenstall moisture meter for grain measured using electric conductivity based on research of David A. Coleman, 1892-1938 (see 1923ff.). *NC29:415*
- 1935ff.** Grain elevators, flour mills, and grading and cleaning equipment manufactured by Superior Separator Co., Minneapolis, MN, under direction of James A. Vaughn, 1882-1941. *NC34:325*
- 1936** Pure-Pak paper milk container entered the market and used extensively for other liquid products. *MP*
- 1937** Technique for spray drying produced soluble coffee perfected by Max Mortgenthaler of Swiss Nestle Co., launched and patent filed. Introduced in USA in 1938 (see 1965). *STF BF03 WABI*
- 1937** Automatic barn cleaner for dairy barn gutters introduced commercially. *HYMP*
- 1938** Small engine-powered reel-type lawn mower, called the Rocket, introduced by Eclipse Lawn Mower Co., Prophetstown, IL. Designed by Lester B. Roth, 1899-1945. *NC36:79*
- 1938** Hand and power mowers introduced by George William Davis, 1867-1948. *NC27:422*
- 1939** Drum dryer patented by C. O. Lavett. *DMMP*
- 1939** Cleaning-in-place (CIP) of product lines installed in processing plant, Oakland, CA, followed by widely accepted CIP of pipelines and equipment in 1952 and automation of CIP in 1953. *DTE*
- 1940** Bulk milk handling on the farm began in California, with rapid adoption of bulk milk handling in USA, followed by refrigerated bulk milk tanks on farms after WWII, utilizing both direct-expansion (DX) and ice-bank (IB) systems of cooling bulk milk tanks. *MP*
- 1940** Commercial controlled atmosphere (CA) for apple storage constructed in New York state, resulting in extending the marketing time of fresh apples by months. By the 1960s the principle, called modified atmosphere (MA), in which different concentrations of oxygen, carbon dioxide, nitrogen, carbon monoxide, or ethylene is used to extend shelf life, was used for packaging of various foods. *CLAA YA1970*
- 1941** Windmill electric generator with 200 ft. diameter sails, claimed to be among the first wind-powered public electricity supply systems in the world, was erected at Grandpa's Knob, Rutland, VA. *DID*

- 1941-1951** Loose housing of dairy cattle was researched by agricultural engineers led by S. A. Witzel, and by dairy scientists and U. S. Steel Co.; later developed as a major method of housing dairy cows. *SDCA*
- 1944** Frozen orange juice became commercially available (see 1947). *CLAA*
- mid-1940s** Pole frame building introduced by Bernon G. Perkins, Doane Agricultural Services, Prophetstown, IL, revolutionized method of building barns and similar buildings. *HL1995*
- 1945** In-the-mow hay finishers (dryers for limited moisture removal) commercially available. *HYMP LP*
- 1945** There were 834 milk drying units located in 499 plants in USA. *JDS1956*
- 1946** Silo unloaders introduced. *HYMP LP*
- 1946** Freeze-dried food developed by American E. W. Flosdorff, 1904-1958, based on earlier developments of several people for different applications. *STF WABI*
- 1947** Frozen orange juice concentrate first produced commercially by a cooperative in Lake Wales, FL, based on earlier work by J. L. Heid, and applied to other fruit juices (see 1944). *WABI*
- 1948** Grain aeration systems adapted for forced distribution of fumigants to provide more effective control of insects in large bulk storage of grain. *HL2001 CLAA*
- 1948** Ultra-high temperature (UHT) pasteurization introduced (see 1952, 1969). *MP*
- 1948** Fibrometer introduced by USDA to measure quality of asparagus based on resistance of stalks to cutting. *CLAA YA1960*
- 1948** Pipeline milking equipment installed widely followed by refrigerated bulk handling and storing of milk on the farm. *HYMP*
- 1949** Slotted-inlet ventilation for animal housing in barns and sheds developed by William F. Millier and C. N. Turner, Cornell University, Ithaca, NY. *HL1998 RS(Mar2000)*
- 1949** Dehydrofreezing process patented (conceived in 1945) by American L. B. Howard, used primarily for fruits and vegetables, in which 50 to 70 percent of the moisture is first removed, then product is frozen. *AI WABI*
- 1949** Portable batch-heated air grain dryers available from several manufacturers. *HYMP*
- 1949ff.** Grain aeration systems developed at Kansas State University, Iowa State University, Purdue University, USDA researchers, and Producers Rice Mill, Stuttgart, AK. Studies began in Kansas in 1930. *HL2001*
- 1950** Concentrated milk marketed in Wilmington, DE, by the National Dairy Products Corp. under the name Sealtest. *FFFR*
- 1951** Spray drying apparatus using low temperature to minimize heat effects on the food product patented by J. J. Mojonier (patent 2,562,473). *DMMP*
- 1952** Uperisation, an ultra-high-temperature (UHT) treatment of milk at 150°C (302°F) for 0.75 sec., introduced in Bern, Switzerland (see 1948, 1969). *MP*

- 1952** Powdered butter invented at Institute of Margarine, Moscow, USSR. *WABI*
- 1952** Mechanical harvesting of grapes in California first publicized. *CA10(1956) CLAA*
- 1952** Chilling of tomatoes with water used to improve quality during handling and transportation resulting in better ripening and less decay. *CLAA*
- 1953** Light transmission used for detecting blood spots in eggs by USDA, later reported to detect hollow heart in potatoes, water core in apples, and ripening of fruit. *CLAA*
- 1952, 1953** Farmers with dairy herds and milk processing plants rapidly began to convert to bulk handling and mechanical cooling of milk, including milk tanker pick-up. *DTE MP*
- 1954** Carnation Co. introduced instant non-fat dry milk solids to commercial market. *JDS1956*
- 1955** Pasteurization of milk at 93.3°C (200°F) with a holding time of 3 sec., as represented by the Roswell pasteurizer, accepted by the U. S. Public Health Service (USPHS). *MP*
- 1955** Study of tobacco leaf response to environmental conditions set stage for adoption of automatic harvesting and bulk curing in 1960, by F. J (Pat) Hassler of North Carolina State University and W. H. Johnson and W. H. Henson of USDA. *RS(May2000)*
- 1956** Revolving head ventilator developed by Robert G. Ferris, 1907-1970, Starline Co. *NC55:576*
- 1956** An improved water bowl for watering individual livestock, particularly large animals, developed by Robert G. Ferris, 1907-1970, Starline Co. *NC55:576*
- 1957** Commercial production of potato flakes began. *CLAA YA1968*
- 1957** Herringbone milking parlor system introduced in USA from New Zealand. *CLAA YA1960*
- 1957** Tang (named after tangerine) became an orange-flavored drink, formulated by William A. Mitchell for General Foods Corp., now Kraft Foods, Inc., marketed in 1959ff in powdered form. *TANG*
- 1957** Skid-steer loader designed and built by Cyril and Louis Keller, with rights to manufacture purchased by Melroe Manufacturing Co., Gwinner, ND. *HL2004*
- 1958** Electric lawn mower with a rotating blade launched by Wolf Co., designed by William H. Coldwell, Coldwell Lawn Mower Co., Newburgh, NY. *WABI WOI*
- 1958** Instantized milk powder process (also called agglomeration process) patented by D. D. Peebles, and applied to other dried food products. *FT(Sept1989)*
- 1959** Agglomeration process and apparatus patented by Henry L. Griffin, followed by many others working on the improvement of agglomeration of spray-dried milk and other food products, which contributed to “instant” processes. *DMMP*
- 1960** Fluidized bed drying of food products intensively researched that led to commercial use for drying and agglomeration. *FBD*
- 1960** Commercial freeze-drying plant for food opened in USA. *FT(Sept1989)*

- 1960** Membrane processing developed primarily for production of potable water, use extended to concentration of liquid foods, primarily dairy products and fruit juices. *WEFST*
- 1964** Air-inflated, double-layer, polyethylene greenhouse developed by William J. Roberts, Rutgers University, NJ. *ASABECal HL2004 RS(2000)*
- 1964** Blow-mold plastic milk bottles introduced and became widely used for milk, milk products, and other food products. *MP*
- 1965** Freeze-dried instant powdered soluble coffee introduced by Nestle (see 1937). *BF03 WABI*
- 1965** Reverse osmosis research reported in use for concentration of fruit juices and milk products. *EAFBE FT1965*
- 1966** Sterile concentrated milk commercially marketed, mostly in paper cartons. *MP*
- 1969** Ultra-high-temperature (UHT) pasteurization standards published. *DTE*
- 1970** Gas chromatography-mass spectrometry techniques developed for analyzing flavor of fruits and juices. *FTSept(1989)*
- 1970ff.** Nondestructive quality evaluation utilizing electronic instrumentation to measure near-infrared reflection characteristics and relate these to quality readings, such as for proteins and oil content, of agricultural products, led by Karl Norris, Fred McClure, et al., USDA. *RS(May2000)*
- 1971** Sweep-shuttle feeder patented/designed by Robert G. Ferris, 1905-1970, manufactured by Starline Co. *NC55:576*
- 1977** Atlas automated milking machine patented by Swedish firm Alpha-Laval. *SWABI*
- 1978** Heat-cool process for peeling tomatoes developed by USDA researchers. *AR(Jan1978) CLAA*
- 1979** Bulk handling standardized system for handling apples based on research of B. R. Tennes. *CLAA TASAE*
- 1979** Computerized cattle-herd management using a computer system developed by American firm Agri Electronics. *WABI*
- 1987** Ninety percent of breakfast cereals were classified as ready-to-eat (RTE). *WEFST*
- 1990** High-pressure processing (HPP) commercial processing of foods introduced for high-acid fruit products by Japanese company Meidin-ya and expanded to a variety of products in 1991ff. *WEFST*
- 1993** Remote-sensing technology in use to measure surface soil moisture, temperature, and other landscape and building characteristics. *AI*
- 2009** Pulsed electric field technology (PEF) as a non-thermal method of food processing summarized as a process to inactivate microorganisms while being less deleterious to the product compared to conventional and methods. *RS(Mar2009)*
- 2009** Pressure-assisted thermal sterilization (PATS) approved by Food and Drug Administration (USA) for a mashed potato product. *RS(Oct/Nov2009)*