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).

1746 Reverse osmosis (membrane separation) reported by Frenchman Abbé Jean Antoine Nollet, 1700-1770.

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).

1730 Claimed to be first cotton mill built, Gloucester, England.

1731, 1732, 1734 Water-driven mechanical thresher invented (1731 in DID), using rotary flails beginning in 1734, built by Scot Michael Menzies, ?? -1766.

1733 Flying shuttle, which led to automatic weaving, patent granted to John Kay, 1705-c.1764, England.

1733 Mercury thermometer invented by Frenchman Joseph-Nicolas Delisle, 1688-1768, in St. Petersburg, Russia. Conflict in information in different references (see 1714).

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.

1764 First modern greenhouse in the USA built in New York.

1768 Fanning mill for cleaning grain patented and manufactured by Scots Andrew Meikle, 1719-1811, and George Meikle, sons of James Meikle.

1769 Cast iron introduced for use in windmill construction by Englishman John Smeaton, 1724-1792, followed by other improvements in windmills.

1780 Flour mill that operated automatically invented in USA by Oliver Evans, 1755-1819.

1783 Improved hygrometer using a human hair as a sensing element developed by Swiss Horace Bénédict de Saussure, 1740-1790.

1786 Ice cream company established in the USA, New York.

1786 Cotton spinning jenny put in operation by Daniel Jackson, Providence, RI.
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.  
1789  Flour mill built, including elevators, conveyors and hoppers, designed by American Oliver Evans, 1755-1819.  
1789  Cotton mills established. Two locations claim to be among the earliest: Beverly Cotton Manufactory, Beverly, MA, and James Island, SC, by Frances Ramage.  
1791  Patent issued for a gas engine to John Barber, USA.  
1793  Wool-carding machine built by John and Arthur Scholfield, Newburyport, MA, and installed in Byfield, MA.  
1793  Considered first successful cotton mill built in USA, by Samuel Slater, 1768-1835, Pawtucket, RI. Earlier cotton mills not considered successful (see 1789).  
1794  Cotton gin, consisting of a wooden cylinder encircled with slender spikes, patented by Eli Whitney, 1765-1825.  
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.  
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.  
1800  Hygrometer built by Scot John Leslie, 1766-1832.  
1800  Farm wagon, considered one of the most successful, produced by the Studebaker Co., South Bend, IN.  
1801-1802  Sugar beet factory built in Silesia (Europe).  
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.  
1805  Development of an agricultural lawn mower credited to Englishman Thomas Pluckett.  
1805  Production of powdered milk (dry milk) undertaken by Frenchman Antoine Augustin Parmentier, 1737-1813. Industrial tests made by German Grunwald in 1855.  
1808  Machine for removing husks from rice developed by Jonathan Lucas, 1775-1822.  
1808  Leather-splitting machine patented by Samuel Parker, Billerica, MA, in which hides were fed into one end of the machine and two pieces emerged emerged from the other end.  
1810  Metal container of tin-coated sheet steel for heat treatment and preserving food patented by Peter Durand, Middlesex, GB (see 1812).  
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).
1812 Commercial cannery established by Frenchman Nicolas-Francois Appert, c. 1750-1841.  
1813 Vacuum pan invented and patented in England by Edward Charles Howard (see 1903).  
1814 Cottonseed-hulling machine invented and patented by John Lineback, Salem, NC.  
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.)  
1819 Successful commercial food canning operation, claimed to be the first, established by William Underwood, Boston, MA.  
1824 Concrete invented by Britisher Joseph Aspdin, 1799-1855.  
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.  
1827 Possibility of concentrated milk introduced by Frenchman Nicolas-Francois Appert, c. 1750-1841; a concentrated milk factory was established in 1858.  
1829 Cottonseed oil mill established by Francis Follet, Petersburg, VA.  
1830 Lawn mower introduced by two Englishmen, Edwin B. Budding, 1796-1846, and Mr. Ferrabee (credited with the design); manufactured in 1831.  
1831 Cheese factories established in USA.  
1833 Beginning of patenting and making of ice-making machines.  
1834 Method of evaporating milk invented by Frenchman Nicolas-Francois Appert, c. 1750-1841.  
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.  
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.  
1837 Fanning mill developed by twin brothers Hiram Avery Pitts, 1799-1859, and John A. Pitts, 1799-1859, USA.  
1838 Meat extract produced by reducing flesh to 15 percent of original bulk using desiccation by Baron von Liebig, 1803-1873, in Germany.  
1838 Sugar beet factory, claimed to be first built in USA, in Northampton, MA.  
1840ff. Corn shellers developed by American Rufus Porter, 1792-1884.
1842  Grain elevator (storage) in USA, claimed to be first, constructed by Jewett & Root Co. for Joseph Dart in Buffalo, NY.  
1842  Milk successfully shipped by railroad recorded for the first time in USA, shipping milk to New York City, NY.  
1843  Egg (chicken) incubator using steam heat patented and invented in USA by Napoleon E. Guerin, New York City, NY.  
1844  Compressed-air refrigerating machine, invented by John Gorrie, 1803-1855, patented in 1851.  
1844  Gas engine invented and patented by Stuart Perry in USA; used turpentine gases as fuel.  
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).  
1845  Combing machine invented for wool and other fibers by Englishmen Samuel C. Lister, 1815-1906, and brother John Lister, 1827-1912  
1848  Ice cream freezer patented by William G. Young, USA.  
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.  
1850s  Ether compressor used for making ice and cooling food developed by James Harrison of Glasgow, Scotland, who emigrated to Australia.  
1850  Regular shipment of milk by railroad practiced.  
1851  Yale Infallible Lock invented by Linus Yale, 1821-1868. His most important contributions were the cylinder lock and, in 1862, the combination lock.  
1851  Factory-produced ice cream, claimed to be the first in USA, made by Jacob Fussell.  
1851  Condensed milk produced by Gail Borden, 1801-1874, New York; patent issued in 1856.  
1851  Mechanical refrigeration patent issued to American John Gorrie, 1803-1855.  
1851  Factory system used to produce cheese by Mr. Williams, New York.  
1852  Movable-frame beehive invented by Lorenzo L. Lanstroth, 1810-1895, Oxford, OH.  
1854  Self-regulating windmill invented by Daniel Halladay, Ellington, CT, with large-scale production beginning c. 1873.  
1856  Butter manufacturing plant, claimed to be the first in USA, established by W. R. Woodhull, Campbell Hall, NY. Another early, USA, butter factory was one built in 1861 by Alanson Slaughter, Wallfill, NY.  
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.

1857 Oil lamp for burning kerosene developed by A. C. Ferris and Co.

1858 Concentrated milk plant, claimed to be the first established in the USA, begun by Gail Borden, Jr., 1801-1874.

1858 Joseph A. Campbell, ??-1900, USA, began canning foods commercially (see 1869, 1873).

1858 Corn husker invented by Samuel Johnston, 1835-1911.

1859 Refrigeration machine using ammonia as a refrigerant introduced by Frenchman Ferdinand Carré, 1824-1900 (see 1876).

1860 Vacuum milking machine invented by American L. O. Colvin. The continuous vacuum irritated the cow’s udder (see 1862).

1860-1864 Pasteurization of foods developed based on work of Frenchman Louis Pasteur, 1822-1895.

1860 Ammonia-absorption refrigerator invented by Frenchman Ferdinand Carré, 1824-1900.

1861 Condensed milk manufacture patented in USA by Gail Borden, 1801-1874.

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).

1864 Milk cooler introduced by Stuart Perry, 1814-1890, Worthington & Co., New York, NY.

1865 Sawmill developed by Stuart Perry, 1814-1890, Worthington & Co., New York, NY.

1865 Butter worker invented by Laroy S. Starrett, 1836-1922.

1866 Hay-baling press powered by a horse on a rotating sweep invented by George Ertel, Quincy, IL.

1867 Hay carrier for mowing hay patented by Henry W. Ferris.

1868 Lawn mower developed by Thomas Coldwell, 1838-1905, and others. Coldwell Lawn Mower Co. organized in 1891.

1868 Dynamite, a mixture of nitroglycerin and diatomaceous earth, introduced in USA by Alfred B. Nobel, 1833-1896.

1868 Refrigerated railroad cars used, patented by William Davis, widely used in the 1870s.

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.
1869  Margarine, then a white substitute for butter, patented by Frenchman Hippolyte Mège-Mouriès; first factory produced by Jan and Anton Jurgens in Holland.  

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. 

1869  First transcontinental railroad in USA completed. 

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. 

1870  Grain cleaner and separator invented (pat. 1871) by Daniel Best, 1838-1923. 

1870  Commercial ice cream freezer (40 qt. capacity) patented by Thomas Mills and Brothers, Philadelphia, PA. 


1872ff.  Hundreds of small internal combustion engines developed and marketed, many by equipment manufacturers and other small businesses, in 1 1/2, 2, 3, 5, 6, and 8 hp sizes, used on the farm and home for driving pumps, generators, separators, etc. 

1873  First recorded tower silo built in USA for storing forage by Lewis (father) and Fred (son) Hatch, near Spring Grove, IL. 

1875  First widely publicized silos in USA built in Maryland and Michigan. 

1873  Soups of various vegetables offered for sale as a major product line in USA by Joseph A. Campbell, ?? -1900 (see 1858, 1869). 

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. 

1876  Widely successful compression refrigeration system using ammonia designed by German Karl Paul Gottfried von Linde, 1842-1934 (see 1859). 

1877  All-roller flour mill built in USA utilizing information from European mills, by Edward P. Allis, 1824-1889. 

1877  Flour-rolling mill invented by John Stevens, Neenah, WI, with patent in 1880. 

1877  Separator for continuous separation of cream from milk invented (patented 1881) by Elihu Thomson, 1853-1937. 

1877, 1886  Chicken incubators and brooders developed by Edward S. Renwick, 1823-1912. 

1878  Mechanical, continuous-flow centrifugal cream separator invented by Swede Carl Gustav Patrik de Laval, 1845-1913, licensed to International Harvester Co. in 1882. 

1878  Rotary hay feeder developed by Stuart Perry, 1814-1890.
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 WWWA

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

NC19:69

1885 Milk pasteurized on a commercial scale in Sweden and Denmark.  
MP

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.  

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.

1887  Machine to successfully manufacture glass bottles, called the Ashland machine, built in England (see 1886).

1888  Meat shipped in refrigerated railroad cars for the first time in USA.

1889  Vacuum milking device in which the vacuum was created by a column of water patented by William Murchland, Kilmarnock, Scotland.

1890  Continuous heater that momentarily heated milk to 85°C (185°F) for pasteurization developed in Denmark.

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).

1890  Disk centrifugal separator for milk introduced commercially in USA.

1890  Batch pasteurizer with a spiral heating coil, heating milk for 30 minutes at 84.4°C (184°F), constructed by Mr. Bittner.

1891  Method of destroying harmful bacteria in cow’s milk made practical, based on work of Louis Pasteur, 1822-1895.

1891  Milking machine using a pulsating vacuum presented by Scot Alexander Shields, Glasgow, Scotland.

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.

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.


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).


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).

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).


1895 Milk pasteurized commercially in New York.
1895 Early in-the-bottle pasteurization rapidly replaced with vat pasteurization.
1895 Milking machine with intermittent suction available (see 1891).
1897 Continuous, revolving, vertical-cylinder pasteurizer designed by Aage Jensen.
1897 Pasteurization of cream for butter making introduced by H. E. Schuknecht, Albert Lea, MN.
1899 Effect of high-pressure processing on food microorganisms (as a possibility for pasteurization) demonstrated by B. H. Hite, West Virginia University.
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).
1899 Gasoline-powered mower developed by Englishman Robert Ransome.
1899 Homogenizer patented in France by Auguste Gaulin (see 1902).
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 Rosenaus, thus establishing a scientific basis for holder (batch) pasteurization standards.
1900 Hershey chocolate bar produced by Milton S. Hershey, 1857-1945, Hershey, PA.
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 became a leader in the industry. The improved Merrell-Soule Co. process acquired by Borden, Inc. in 1927.
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.
1902 Commercially successful cylinder corn sheller introduced.
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).
1902 System for drying milk on a roller or drum patented by John A. Just, with a commercial plant built in 1903.
1902 Steel stanchions for dairy cattle introduced.
1902 Portable elevators for moving grain available.
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. Pascburg, 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 WWWA


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 WWWA

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.

1913 First highway paved with concrete, in Arkansas; previously only streets in towns had been paved with concrete.  

1914 Pulsed electric fields for food preservation considered.

1916 Spray nozzle leading to spray drying invented by I. S. Merrell, 1875-1959.

1916 Successful artificial hay dryer developed by Arthur John Mason, 1857-1933.


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).

1917 Milking machine design patented by Meredith Leitch and de Laval Separator Co. in Sweden; marketed in USA in 1918.

1917 Beltless electric motor-driven devices developed by Robert D. Eaglesfield, 1887-1946, beginning with the Vonnegut Machinery Co., Indianapolis, IN.

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.

1919 Homogenized milk first adopted and produced commercially in USA by George Weigold, 1871-1951, Torrington, CT (see 1902).

1919 Basis for using high-temperature, short-time (HTST) pasteurization standards developed based on work of A. K. Anderson and R. Finkelstein.

1919 Electro-Pure process as a preservation method of liquid food products studied in detail in USA by A. K. Anderson and R. Finkelstein.

1920 Continuous Rotary Pressure Sterilizer introduced by what is now Food Machinery Corp. (FMC), San Jose, CA (now Madera, CA) by Albert R. Thompson.

1920 Hammer mill for feed preparation introduced for farm use.

1920 Farm Specialty Co. formed by Bruno Frederick Arps, 1890-1965, New Holstein, WI; incorporated in 1923 as Arps Corp. (see Implements section, 1920).

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.

1922 Electrically heated and regulated chicken incubator for hatching chickens patented by Ira M. Petersime, USA.

1922 Venturi-Flume Water-Stage-Recording Instrument, known as the Parshall Flume, patented by Ralph L. Parshall, 1881-1959, Colorado State University and USDA.

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 WWWWA

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).

1932 Homogenizer used commercially for milk in USA by W. A. McDonald, Flint, MI. (see 1899, 1927).

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).

1933 The Suter-Webb cotton fiber meter invented and patented by USDA and issued as a public service patent.

1934 Work on mow hay finisher (drying) initiated at Tennessee Valley Authority (TVA), led by George W. Kable, 1888-1950.

1934 Tag-Heppenstall moisture meter for grain measured using electric conductivity based on research of David A. Coleman, 1892-1938 (see 1923ff.).


1936 Pure-Pak paper milk container entered the market and used extensively for other liquid products.

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).

1937 Automatic barn cleaner for dairy barn gutters introduced commercially.

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.

1938 Hand and power mowers introduced by George William Davis, 1867-1948.

1939 Drum dryer patented by C. O. Lavett.

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.

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.

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.

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.
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. Mojonnier (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**

**RS(May2000)**

**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**

**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**

**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.  

1964  Air-inflated, double-layer, polyethylene greenhouse developed by William J. Roberts, Rutgers University, NJ.  

1964  Blow-mold plastic milk bottles introduced and became widely used for milk, milk products, and other food products.  

1965  Freeze-dried instant powdered soluble coffee introduced by Nestle (see 1937).  

1965  Reverse osmosis research reported in use for concentration of fruit juices and milk products.  

1966  Sterile concentrated milk commercially marketed, mostly in paper cartons.  

1969  Ultra-high-temperature (UHT) pasteurization standards published.  

1970  Gas chromatography-mass spectrometry techniques developed for analyzing flavor of fruits and juices.  

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.  


1978  Heat-cool process for peeling tomatoes developed by USDA researchers.  

1979  Bulk handling standardized system for handling apples based on research of B. R. Tennes.  

1979  Computerized cattle-herd management using a computer system developed by American firm Agri Electronics.  

1987  Ninety percent of breakfast cereals were classified as ready-to-eat (RTE).  

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.  

1993  Remote-sensing technology in use to measure surface soil moisture, temperature, and other landscape and building characteristics.  

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.  

2009  Pressure-assisted thermal sterilization (PATS) approved by Food and Drug Administration (USA) for a mashed potato product.