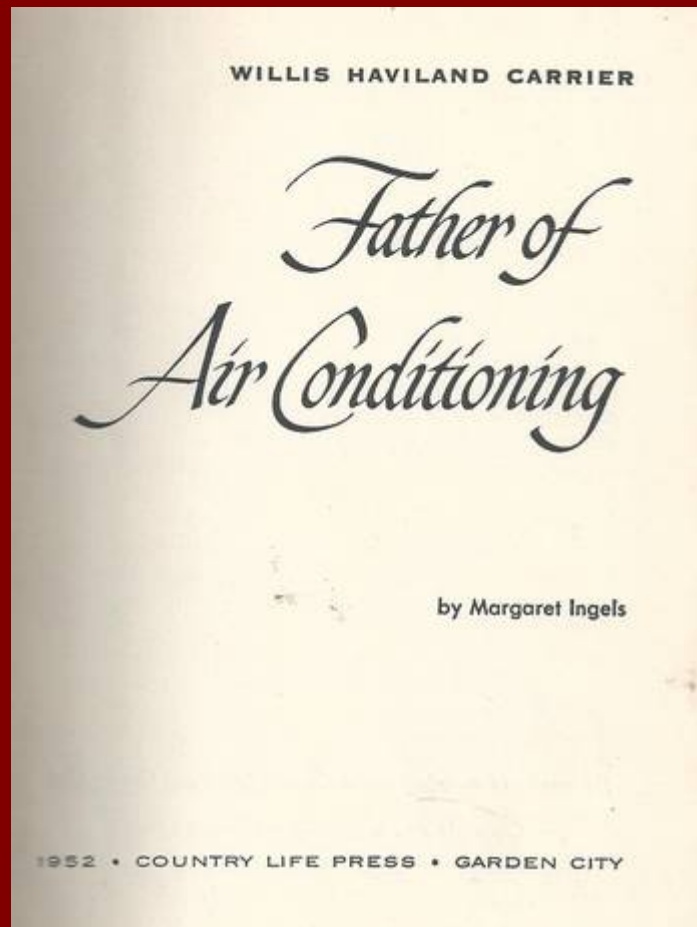


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AIR CONDITIONING HISTORY: 1500-1897



CHRONOLOGICAL TABLE OF EVENTS WHICH LED TO MODERN AIR CONDITIONING

1500-1952

"Air conditioning is the control of the humidity of air by either increasing or decreasing its moisture content. Added to the control of humidity is the control of temperature by either heating or cooling the air, the purification of the air by washing or filtering the air, and the control of air motion and ventilation."

WILLIS H. CARRIER
FEBRUARY 28, 1949.

RELATED DEVELOPMENTS AND THEORIES	HEATING AND VENTILATING FANS, HEATERS, HEAT PUMPS	REFRIGERATION (NOT INCLUDING COMMERCIAL EQUIPMENT AS DOMESTIC REFRIGERATORS, ETC.)	AIR CLEANING, HUMIDIFYING, PURIFYING. WASHERS, HUMIDIFYING UNITS OR HEADS, ODOR ABSORBERS, ETC.	AIR COOLING. FAN-ICE, COOLING-COIL AND FAN-COOLING-COIL UNITS AND SYSTEMS	AIR CONDITIONING. SPRAY TYPE CENTRAL STATION APPARATUS AND CHEMICAL DEHUMIDIFIERS
YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
1500 (Circa) Leonardo de Vinci (1452- 1519) Devised instru- ment for measuring changes in moisture in air. (1) Devised instru- ment for measuring wind velocities. (1)	1500 (Circa) Leonardo de Vinci. Built ventilating fan, water driven to ventilate bou- doir of wife of his patron. (1)				
1607 Galileo Galilei (1564-1642) In- vented a thermometer. (2)					
1643 Torricelli (1608- 1647) Invented a barometer. (2)					
1659 Robert Boyle (1627-1691) Brit- ish Scientist. Discov- ered relationship be- tween density of air and its temperature. (2)	1660 Sir Christopher Wren (1632- 1723) English Archi- tect. Designed gravity exhaust ventilating sys- tem for House of Par- liament. (3)				

1714 Gabriel Daniel Fahrenheit (1686-1736) German Physicist. Introduced Fahrenheit thermometer. (2)

1730 (Circa) Henri Y. Pitot (1695-1771)

Invented Pitot tube. (4)

1742 Andres Celsius (1701-1744) Introduced Centigrade thermometer. (2)

1783 Antoine Laurant Lavoisier (1743-1794) Established true nature of atmospheric air. (2)

1797 Benjamin Franklin asked, "Whence comes the dew that stands on the outside of a tankard that has cold water in it in summertime?" from: "Benjamin Franklin" by Carl Van Doren, Viking Press, New York, 1938, pg. 77

1800 John Dalton (1766-1844) English Chemist and Physicist. Formulated laws of pressure of water vapor in air. (2)

1820 Wollmann or Kallstenius probably employed an anemometer for measuring air flow. (10)

1736 Dr. J. T. Desagulier (1683-1744)

French Naturalist. Designed centrifugal blowing wheel, manually operated. Connected it to gravity exhaust ventilating system in House of Commons. (5) For manually operated fan, "An ordinary able-bodied man can easily exert 3000 ft. lb. per min." (6)

1812 Daniel Pettibone, Philadelphia. Invented means for "Warming Rooms by Rarefied Air." No patent number. May 12, 1812.

1814 Marquis of Chambannes. Wrote "On Conducting Air By Forced Ventilation." Stated he hoped to be known as author of forced ventilation. (5)

1775 Dr. William Cullen (1710-1790) Scottish Physician, University of Edinburgh. Wrote "Essay on Cold Produced By Evaporating Fluids." (8) Reduced atmospheric pressure in a vessel of water with air pump to produce vacuum and freeze the water. (9)

1785 J. & E. Hall, Ltd., Dartford, Kent, England. Established in 1785. Began selling refrigerating machines in 1881.

1823 Sir Humphrey Davy (1778-1829) and Michael Faraday (1791-1867) Demonstrated that gases could be liquefied by pressure. (9)

1771 G. Bacarria

Recorded observations on electric discharge through smoke filled gases. (7)

1819 Rafinesque

Wrote article on electrical precipitation in American Journal of Science and Arts. Theory applied in 1880 by K. Moeller of Brachwede, Germany, but not successfully. (7)

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
<p>1836 James Apjohn (1796-1886) Irish Chemist. University of Dublin. Propounded theory of adiabatic absorption of moisture by air but was unable to establish its correctness. (13)</p> <p>1843 David B. Van Tuyl, Dayton, Ohio. Invented "Instrument for Regulating Temperature." No patent number. October 12, 1843.</p> <p>1847 James Glaisher (1809-1908) Engineer, Astronomer, Meteorologist. Computed reliable stationary hygrometer tables. (Made balloon ascents 1862-1866 to obtain meteorological data.) (17)</p>	<p>1824 Nicholas Leonhard, Sadi Carnot (1796-1832) French Physicist. Propounded theory of heat pump. (11)</p> <p>1832 George Harley and John Sedgwick, Philadelphia. Invented "air or ventilator pump." Listed in U. S. inventions 1790-1847. No patent number—papers destroyed in patent office fire 1835.</p> <p>1839 M. Combe. Designed multi-blade centrifugal fan with curved blades for ventilating Belgian mines. (15)</p> <p>1847 W. Buckel. Presented design data for fans before Institute of Mechanical Engineers. (18) Data continued in use by many engineers as late as 1900. (19)</p>	<p>1824 Heat pumps, (see Column 2) 1824.</p> <p>1824 John Vallance, Brighton, Sussex, England. Patented sulphuric acid absorption process of refrigeration. (8)</p> <p>1834 Jacob Perkins (1766-1849) Newburyport, Mass. First in America to patent a refrigerating machine (sulphuric ether, closed cycle, compression.) Machine not commercial success. (8) U. S. Patent #6662 issued August, 1834.</p> <p>1849 Dr. John Gorrie. (See Column 5, 1833). Invented ice machine. Forerunner of today's compressed air refrigerating machines. U. S. Patent #8080. Issued May 6, 1851. (8) (9) (12)</p>	<p>1824 Hohfield Suggested use of electricity to precipitate dust in atmosphere. (7)</p> <p>1838 Dr. David Boswell Reid (1805-1863) Added moisture to air with perforated pipes in forced ventilating system of House of Commons. He recommended 30 cfm of air per person, also recommended a cloth filter to clean air drawn from outdoors. (14)</p>	<p>1833 Dr. John Gorrie (1803-1855) American Physician, Charleston, S. C. Hung buckets of ice in hospital rooms, blew air over ice to cool rooms for malaria and yellow fever patients. (Statue in U. S. Hall of Fame, Washington, D. C.) (12)</p> <p>1845 Prof. R. Ogden Dbremus (1824-1906) Professor of Chemistry, College of City of New York. Wrote article on cooling hospitals. (16)</p> <p>1848 Dr. David Boswell Reid. (See column 4, 1838) Suggested circulating artesian well water through steam heating pipes to cool House of Commons in summer. (14)</p>	

1850 Several countries established a network of weather stations. Meteorological offices in London 1854. (2) In United States 1870. (20)

1850 Guiyard
Observed wire charged with static electricity plunged into smoke filled jar, cleared the air in the jar. (7)

1851 Taylor Instrument Companies, Rochester, New York. Established 1851.

1851 Ferdinand P. E. Carré, France. Designed first ammonia absorption refrigerating machine. (2) U.S. Patent #30201. Issued October 2, 1860. (8)

1853 Alexander C. Twining (1801-?) New Haven, Connecticut. Invented sulphuric ether compression refrigerating machine. U.S. Patent #10221. Issued November 8, 1853. Was reported in 1856 as making ice at rate of 2000 lbs. in 24 hrs. (8)

1853 Frick Company, Waynesboro, Pennsylvania. Established in 1853.

1854 (Circa) Lord Kelvin (William Thomas) (1824-1907) British Physicist. Further advanced theory of heat pump advocated by Carnot 1824. (11)

1854 Heat Pump (See preceding column.)

1855 J. R. Barry. Invented railroad car ventilator. Fan blew air across tank of water for cleaning. U.S. Patent #12851. Issued May 15, 1855.

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
	1857 Prof. (William John Macquorn) Rankine (1820-1872) Scottish Engineer and Physicist. One of the founders of modern science of thermody- namics. Designed fan with spiral or scroll shape housing. (18)	1856 Au Sieur Baude- lot à Harancourt. Invented Baudelot coils for a refrigerating sys- tem. Coils were later employed to chill water for air-conditioning systems. (See Carrier Patents, U.S. #1,078,- 608, January 19, 1912.) Baudelot coil, French Patent #16,167 was de- signed to chill all liquids, especially beer. (21)		1856 Azel S. Lyman, New York. In- vented "Method of Cooling and Ventilat- ing Rooms." Air blown over ice in racks at ceiling of room. U.S. Patent #14,510 issued March 25, 1856. Ex- tended, then reissued 1874. (See below, 1874.)	
	1860 B. F. Sturtevant Company (now Sturtevant Division, Westinghouse Electric Corporation), Boston, Massachusetts. Began building centrifugal fans. Issued catalogue in 1866. Published rat- ing tables for various operating conditions of fans in 1876 1862 Hon. Henry Rut- tan, Ruttan Warming and Ventilat- ing Company, Chicago. Wrote "Warming and Ventilation of Build- ings," copyrighted 1888.		1860 T. E. McNeil. Invented air moistening or humid- ifying arrangement. Pans of water in hot air registers. U.S. Pat- ent #27461. Issued March 13, 1860. 1861 G. E. J. Colburn. Invented air moistener for floor type hot air registers. U.S. Patent #31,152. Issued January 22, 1861. 1861 F.H. Furness. Invented railroad car ventilator with scrubbing vanes. U.S. Patent #33,302. Issued September 17, 1861.		

1865. William Edson, Boston, Massachusetts. Invented a "Hygrodeik," an instrument for measuring moistness and dryness of air. Consisted of wet- and dry-bulb thermometers and chart for reading "the state of the air we breathe." Instrument mentioned in Oliver Wendell Holmes' "Guardian Angel" 13th Chapter.

1865 Guibal
Designed multi-blade centrifugal fan with chimney or discharge tube, a feature used in mine ventilation as late as 1915. (18)

1866 Thaddeus Lobieski Constantine Lowe. (1832-1913) American aeronaut, interested in ballooning. Developed closed cycle carbon dioxide refrigerating machine. "Mode for Manufacturing Ice." U.S. Patent #63,413. Issued April 2, 1867. Installed machine on freighter "Taber" 1867. (8)

1867 The Vilter Manufacturing Company, Milwaukee, Wisconsin. Established in 1867. Began selling refrigerating machines in 1885.

1866 J. D. Whilpley and J. J. Storer, Boston, Massachusetts. Invented "Apparatus for Removing Dust from Air." U.S. Patent #53,068. Issued March 6, 1866.

1866 Dr. Joseph Lister (1827-1912) English Surgeon. Noted that carbonic acid was used to deodorize sewage in Carlisle. Adapted practice to purify air in operating rooms. Later, 1869, sprayed watery solution of carbonic acid in air of operating rooms. Procedure led to antiseptic practices. (22)

1867 D. E. Somes, Washington, D.C. Invented "Air Moistening, Cooling and Warming" apparatus. U.S. Patent #61,886. Issued February 5, 1867.

1865 N. S. Shaler, Newport, Kentucky. Invented "Air Cooling Apparatus." U.S. Patent #47,991. Issued May 30, 1865.

1870 B. F. Sturtevant, Jamaica Plain, Massachusetts. Invented "Improvement in Compound Air-heaters and Steam Condensers." Centrifugal type fan and coil unit heater. U.S. Patent #100,241. Issued February 22, 1870.

1870 Franz Windhausen, Brunswick, Germany. Designed compressed air refrigerating machine. (8)

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
		<p>1870 U.S. Census reported four plants in United States making ice. Total investment \$434,000, payroll \$40,000 annually, business \$258,230. (8)</p> <p>1872 David Boyle (1837-?). Johnstown, Scotland and Mobile, Alabama. Invented ammonia compression refrigerating machine. Called "Father of ammonia compression refrigeration." Produced commercial ice October, 1873. (8) U.S. Patent #128,488. Issued June 25, 1872. Prices of complete machines and ice plants of that period:</p> <p>1 ton capacity = \$ 4,000.00</p> <p>10 ton capacity = 16,000.00</p> <p>30 ton capacity = 40,000.00</p> <p>A 30 ton plant was considered large up to 1890. (23)</p>	<p>1871 James G. Weldon, Pittsburgh, Pennsylvania. Invented method to introduce steam in air passages of air furnace to moisten air. U.S. Patent #119,955. Issued October 17, 1871.</p> <p>1872 Levi K. Fuller, Brattleboro, Vermont. Invented ventilator and dust arrestor. Fan—blades dipping in water tank—blew air across turbulent surface for cleaning action. U.S. Patent #131,266. Issued September 10, 1872.</p> <p>1872 G. M. Parks, Fitchburg, Massachusetts. Started firm which became G. M. Parks Company in 1901 and in 1918 purchased Stuart W. Cramer interest to form Parks-Cramer Company, Fitchburg, Mass. and Charlotte, N. C.</p>	<p>1871 Andrew Muhl, Waco, Texas. Invented "Apparatus for Cooling the Air in Buildings." Blew air from forced ventilating system through "conduits or tubes" over refrigerated coils placed near ceiling in each room. U.S. Patent #146,267. Issued January 6, 1874.</p>	

1873 U.S. Patent Office Index from 1790-1873 lists inventions of "Ventilators," a total of seventy-six.

1873 Prof. C. P. G. Linde, Munich, Germany. Introduced ammonia refrigerating machine in 1873-1875. (9) U.S. Patent #228,364. Issued June 1, 1880.

1873 In U.S. Patent Office Index from 1790-1873 no invention was listed as air moisteners or air washers.

1875 International Congress fixed various standards of moisture in a number of textiles. Established uniform system of numbering yarns. (24)

1874 York Corporation (Originally York Ice Machine Company) York, Pennsylvania. Founded in 1874. Began building refrigerating machines in 1885.

1874 Azel S. Lyman, New York. Invented a machine for purifying, drying, and cooling or warming air. Passed air through beds of wetted charcoal. (16)

Also invented "Method of Cooling and Ventilating Rooms." Air blown over ice in racks at ceiling of room. Original patent issued 1856 (see above). U.S. Patent Reissue #5,786. Issued March 10, 1874.

1876 Thomas L. Rankin. Invented absorption type refrigerating machine used in breweries, packing houses, refrigerated cars, skating rinks. Between 1868 and 1884 twenty-four patents were issued to him. First on ice machine, U.S. Patent #175,498. Issued March 28, 1876. (9)

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
1878 Upward vs. down- ward air flow in ventilating assembly halls—arguments sum- marized in Report No. 119 of Documents of the House of Repre- sentatives (U.S.) in 1879. (3)	1878 Buffalo Forge Company, Buf- falo, New York. Estab- lished in 1878. 1878 L. J. Wing, founder of L. J. Wing Mfg. Co., Lin- den, N.J. was awarded several medals for "Promotion of Me- chanics" with his de- ign of the Wing Disc Fan. U.S. Patent #215,783. Issued May 27, 1879.	1877 Franz Wind- hausen, Berlin, Germany. Invented water-vacuum refriger- ating machine. Pat- ented in Germany, December 14, 1877. U.S. Patent #236,471. Issued January 11, 1881.	1879 The atomizing nozzles invented by J. G. Garland in- stalled in cotton mill owned by J. F. Slater. Added moisture re- duced electricity in cloth which formerly was sufficient to cause "your beard and hair" to stand out straight. (Atomizing nozzle in- vented by J. G. Gar- land in 1880, see below.) (2)		

1880 American Society
of Mechanical
Engineers organized
1880.

1880 De La Vergne
Refrigerating Ma-
chine Company, New
York. Established 1880.
In 1909 became De La
Vergne Machine Co.
Later The Baldwin
Southwark Corp.,
Philadelphia, a subsidi-
ary of The Baldwin
Locomotive Works,
Philadelphia.

1880 Henry Vogt Ma-
chine Company,
Louisville, Kentucky.
Established in 1880.
Began building refrig-
erating machines for
ice plants in 1885.

1880 Emil H. C. Oehl-
mann, Berlin,
Germany. Invented air
moistening head. Later
manufactured by Amer-
ican Moistening Com-
pany, Providence, Rhode
Island, now a division
of Grinnell Company.
German Patent #12,-
520. Issued March 26,
1880. U.S. Patent
#267,102. Issued No-
vember 7, 1882.

1880 K. Moeller,
Brachwede Ger-
many. Applied Rafi-
nesque's (1819) theory
of electrical precipita-
tions of atmospheric
dust but not success-
fully. (7)

1880 James G. Gar-
land, Biddeford,
Me. Invented "Appa-
ratus for Moistening
Air," a combination of
air and water jet hu-
midifying head. Filed
Oct. 18, 1880. U.S.
Patent #236,319, is-
sued Jan. 4, 1881.

1881 August Kind, Ber-
lin, Germany.
Invented hydraulic
ventilator to moisten
air. U.S. Patent #264,-
149. Issued August 23,
1881.

1880 Robert Portner
and B. Edward J.
Eils, Alexandria, Vir-
ginia. Invented "Proc-
ess of and Apparatus
for Cooling Air." Blew
air over refrigerated
pipes, specified opera-
tion to prevent accu-
mulation of "snow"
on coils. System com-
mended in paper pub-
lished by U.S. Brewers'
Association, New York,
May 19, 1885. (26)

1880 A man in Staten
Island, New York.
Cooled restaurant by
blowing air through
pipes imbedded in ice
and salt. (16)

1880 Madison Square
Theatre, New
York. Put ice in air
stream (4 tons per
evening) of B. F.
Sturtevant Company
fan-heating system to
cool theater. (3)

1881 Fan and Ice
Cooling System.
U.S. White House,
Washington, D.C.
Room occupied by
President Garfield dur-
ing his illness July and

1881 American Blower
Corporation
(originally Huyett &
Smith Manufacturing
Company), Detroit,
Michigan. Established
in 1881.

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
1882 Professor Ernest Mueller, Hano- ver, Germany. Re- ported on relation be- tween regain, atmos- pheric moisture, and air temperature, and textile fibers. (24)			1881 William V. Wal- lace, Dorset, Ver- mont. Invented "Air Fountain and Air Cool- ing Apparatus"—a port- able room humidifier. Filed April 8, 1881. U.S. Patent #242,083. Issued May 24, 1881.	August, 1881 cooled by melting about 436 lbs. of ice an hour. Report of Officers of the Navy on Ventilating and Cooling Executive Mansion. Vol. 8, Gov- ernment Printing Of- fice. (3)	
1883 A. M. Butz. Invented a ther- mostatic control instru- ment. Draft regulator operated electrically, consisted of strip of metal fastened to strip of rubber. (27)			1883 George D. Ban- croft, Springfield, Massachusetts. In- vented moistening or humidifying head. U.S. Patent #287,898. Is- sued November 6, 1883.	1883 Restaurant at the Hygiene Exhibition, Berlin, cooled by blow- ing air over ice. (16)	
			1883 Frederic Tudor, Boston, Massa- chusetts. Devised hu- midifying system for Metropolitan Opera House, New York. Put pans of water contain- ing heating coil under seat with up-discharge outlets. (3) Obtained two U.S. Patents:		

1884 George M. Capell and G. S. Ma-Beam. Invented "The Capell" centrifugal fan. Two rotors, one within the other, all blades backward curved. (18) U.S. Patent #291,493. Issued January 8, 1884.

1884 The Carbondale Machine Company, Carbondale, Pennsylvania (now Worthington Pump and Machinery Company, Harrison, New Jersey). Imported "Pontifex" absorption refrigerating machine from England, improved design and began manufacturing it in 1884. First machines were "live steam" absorption type. (28)

(1) "Steam and Hot Water Apparatus" #278,636. Issued May 29, 1883.

(2) "Apparatus for Heating by Exhaust Steam" #283,537. Issued August 21, 1883.

1883 Franz Windhausen, Berlin, Germany. Invented "Apparatus for Purifying Air and Gases." Filed Sept. 14, 1883. U.S. Patent #306,040. Issued September 30, 1884.

1884 Sir Oliver Lodge (1851-1940) British Physicist. Carried on extensive research on electric precipitation. He and associates applied process to lead smelters. (7)

1884 Franz Windhausen, Berlin, Germany. Invented "Refrigerating Rooms and Liquids and Apparatus Used Therefor." Machine chilled brine for cooling coils in air circulating system. Filed November 10, 1884. U.S. Patent #323,767. Issued August 4, 1885.

1884 William V. Wallace, Boston, Massachusetts. Invented "Air Cooling Device" —air passed over wetted disc for evaporative cooling. Filed March 4, 1884, U.S. Patent #297,476. Issued April 22, 1884. Also circulated air through chamber with jet of water discharged into air stream. Filed March 4, 1884, U.S. Patent #297,039. Issued April 15, 1884.

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YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
<p>1885 Professor Warren S. Johnson. Credited with inventing first automatic temperature control. (See 1883 above.) Led to formation of Johnson Service Company, Milwaukee, Wisconsin, in 1885. First control was an electric thermostat. In 1893 produced pneumatic thermostat. (29)</p>			<p>1885 Mortimer Sherman, Lowell, Massachusetts. Invented "Apparatus for Moistening Air in Cotton Mills, etc." U.S. Patent #324,043. Issued August 11, 1885.</p>		
<p>1886 Professor William Ferrel (1817-1891) American Meteorologist, U.S. Weather Bureau. Deduced empirical psychrometric formulae used as bases for U.S. Weather Bureau psychrometric tables. (31)</p>		<p>1887 The Creamery Package Mfg. Company, Chicago, Illinois. Established in 1887.</p>	<p>1887 B. F. Sturtevant Company, Boston, Massachusetts. Installed heating, ventilating, and moistening system in Pacific Mills. Moistening means was a "simple rose nozzle" located in main duct at "mouth of fan." In 1889 similar system installed in Globe Yarn Mill at Fall River, Mass. (30)</p>		

1888 Gotham
Patented extended surface for heat transfer—helically wound finned tubing. Automotive industry employed surface for car radiators.

1888 Representative of four refrigerating machine manufacturers met to consider standardization of products: Frick Company, De La Vergne, Consolidated, and National. Fifteen years lapsed before further cooperative efforts were attempted. (32)

1888 American Moistening Company, Providence, Rhode Island (Founded 1888) Sold humidifying heads, invented by Emil H. C. Oehlman in 1880 (see above) for rayon winding room. (First U.S. Patent for processing nitrocellulose rayon granted in 1884.) (33)

1888 Dr. Kilvington, Pres. Board of Health, Minneapolis, recommended fire to destroy odors. (22)

1888-1889 Walter B. Snow, B. F. Sturtevant Co., Boston, Massachusetts. Cited comparative costs of moistening air in textile mills as a function of the heating and ventilating system and as separate operation with direct heating system. (35)

1888 The Carbondale Machine Company, Carbondale, Pennsylvania. (See column 3, 1844.) Installed its first of many systems to cool air for industrial processes. First installation, coils on walls of plant of Hawley & Hoops Company, New York, 10-ton capacity.

1889 The New York Blower Company (formerly New York), Chicago. Founded in 1889. Named its first centrifugal fan "Seri-Vane" in honor of Prof. Ser who in 1862 developed laws for fan design. (34)

RELATED DEVELOPMENTS AND THEORIES	HEATING AND VENTILATING FANS, HEATERS, HEAT PUMPS	REFRIGERATION (NOT INCLUDING COMMERCIAL EQUIPMENT AS DOMESTIC REFRIGERATORS, ETC.)	AIR CLEANING, HUMIDIFYING, PURIFYING. WASHERS, HUMIDIFYING UNITS OR HEADS, ODOR ABSORBERS, ETC.	AIR COOLING. FAN-ICE, COOLING-COIL AND FAN-COOLING-COIL UNITS AND SYSTEMS	AIR CONDITIONING. SPRAY TYPE CENTRAL STATION APPARATUS AND CHEMICAL DEHUMIDIFIERS
YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
1890 Charles Dudley Warner (1829-1900) American Editor. Wrote in <i>Courant</i> , Hartford, Connecticut, "Everyone is talking about the weather but no one is doing anything about it." Comment often erroneously attributed to Mark Twain.		1890 St. Louis Automatic Refrigerating Company. Installed a central plant refrigerating system to cool restaurants, beer halls, etc. Cooling coils placed on walls midway between floor and ceiling. (37) System still in operation in 1916. (38)		1890 (Circa) C. W. Vollmann, Co-worker of Dr. Carl Linde (see column 3, 1873), and first president of Linde Canadian Refrigeration, Montreal, Canada. Installed air cooling system for Indian Rajah's palace. Coils sprayed with brine for continuous defrosting. (36) 1890 Alfred R. Wolff (1859-1909) Consulting Engineer, New York. Included space for ice in outdoor air intake of heating and ventilating system for Carnegie Hall, New York. (3) (16) 1890 Lennox Lyceum Theater, New York. Used artesian water through heating coils to cool air. Fan-heating system by B. F. Sturtevant. Johnson Electric Heat Regulator on temperature control. (3)	

1891 (Circa) B. F. Sturtevant Company, Boston, Mass. Published its first edition of *Ventilation and Heating* (from 4th edition, copyrighted 1904).

1891 *Ice and Refrigeration*, Chicago, Illinois. Published first issue of the magazine July 1, 1891. (9)

1891 Eastman Kodak Company, Rochester, New York. Installed cooling coils on walls of film and plate coating rooms. De La Vergne's 50 ton ammonia machine supplied refrigeration. (System not installed for removing moisture from air but dehumidification occurred.) (38)

1892 Alfred R. Wolff (see column 5, 1890) Consulting Engineer, New York. Wrote "Artificial Cooling of Air for Ventilation" published in *Engineers News*, July 7, 1892. (19)

1892 Camille Edmond Auguste Rateau, St. Etienne, France. Invented multi-blade, high efficiency centrifugal fan. Filed September 2, 1892. U.S. Patent #500,080. Issued June 30, 1893.

1892 De La Vergne Refrigerating Machine Company, New York. Built the then largest refrigerating machine—ammonia reciprocating machine, 500 tons capacity. Installed in the Anheuser-Busch Brewing Association plant, St. Louis, Missouri, for wort cooling. (39)

1892 Broadway Theater New York. Cooled by ice placed in a fan-ventilating system. (42)

1892 Private home, Frankfurt, Germany. Refrigerated coils in attic cooled air, delivered by gravity through ducts to rooms below. (16) (41)

1893 Blocks of ice placed in "Airways" of ventilating system to cool House of Lords and House of Commons, London. (3)

1893 Professor R. Ogden Doremus, College of City of New York. Wrote in *North American Review*, May, 1893. "If they can cool dead hogs in Chicago why not live bulls and bears in the New York Stock Exchange."

1893 Theophile Schoensing, Fils. Reported research on Hygroscopic properties of cotton, wool, and silk. (24)

1893 Alfred R. Wolff, Consulting Engineer, New York. Introduced heat-unit practice in heating calculations. Introduced thermostatic control for heating systems in high class residences. (40)

RELATED DEVELOPMENTS AND THEORIES	HEATING AND VENTILATING FANS, HEATERS, HEAT PUMPS	REFRIGERATION (NOT INCLUDING COMMERCIAL EQUIPMENT AS DOMESTIC REFRIGERATORS, ETC.)	AIR CLEANING, HUMIDIFYING, PURIFYING. WASHERS, HUMIDIFYING UNITS OR HEADS, ODOR ABSORBERS, ETC.	AIR COOLING. FAN-ICE, COOLING-COIL AND FAN-COOLING-COIL UNITS AND SYSTEMS	AIR CONDITIONING. SPRAY TYPE CENTRAL STATION APPARATUS AND CHEMICAL DEHUMIDIFIERS
YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
<p>1895 American Society of Heating and Ventilating Engineers founded in 1895.</p> <p>1895 William D. Hartshorne, Lawrence, Mass. Began tests on moisture regain of textiles. (24)</p> <p>1895 Prof. De Volson Wood, Stevens Institute of Technology. Employed "BTU" for British thermal units in <i>Thermodynamics</i> written by him and published by John Wiley & Sons, New York, 1895. Unit employed as early as 1851 although not named in Appleton's Dictionary of Mechanics in 1851.</p> <p>William John Macquorn Rankine in "Steam Engines" published in 1885 used "unit of heat" and "thermal unit." By 1897 term was accepted by engineers. (45)</p>	<p>1895 Professor Rolla C. Carpenter, Cornell University, Ithaca, New York. Wrote <i>Heating and Ventilating Buildings, an Elementary Treatise</i>. Published by John Wiley & Sons, New York and Chapman & Hall, Ltd., London, 1895.</p> <p>1895 M. C. Huyett, Chicago, Illinois. Wrote <i>Mechanical Heating and Ventilation</i>. Published by The Henry O. Shepard Company, Chicago.</p>	<p>1895 De La Vergne Refrigerating Machine Company, New York. Installed ice-making plant for skating rink at New York Hippodrome, later refrigeration system was used for air cooling. (See Walter L. Fleisher, column 4, 1905.)</p>	<p>1895 Stuart W. Cramer (1868-1950) Textile Mill Engineer. Became Southern Agent for Whitin Machine Works, (43) and started outstanding work which later had large part in air conditioning industry.</p>	<p>1894 The Creamery Package Mfg. Co., Chicago, Illinois. Installed cooling system for butter making. (Candy making in 1896.)</p> <p>1895 Linde Canadian Refrigeration Co. Ltd., Montreal. Installed Fan-coil (with brine spray defrosting) for air cooling: Gould Cold Storage Co., Montreal (System still in operation in 1950). In 1896, Lovell & Christmas, Ltd., Montreal, cold storage. System in part still in operation in 1950.</p>	

1896 Fournier and Cornu Fans. Patented in France in 1896. Never filed in United States. Fans were forerunners of modern narrow blade multivane centrifugal fans. (18)

1896 Buffalo Forge Co., Buffalo, New York. Installed fan-ice air-cooling and ventilating system in Auditorium Hotel, Chicago. (44)

1897 Prof. R. C. Carpenter and W. G. Walker wrote informative article on theory and practice in design of fans and blowers, published in *Heating and Ventilating*, December 1897. (19)

1897 Elbert A. Corbin, Philadelphia, and Charles E. Foster, Washington, D.C. Invented a "Heating and Ventilating Device." Disc fan in outside wall opening located back of floor type radiator. U.S. Patent #593,737, issued Mar. 16, 1897.

1897 Kroeschell Bros. Ice Machine Company, Chicago. Established 1897. Built carbon dioxide reciprocating machines. (46) In 1922 joined Brunswick Refrigerating Company, New Brunswick, N.J. In 1930 became part of Carrier Corporation, Syracuse, N.Y.

1897 Joseph McCreery, Toledo, Ohio. Invented apparatus in which air was drawn over tank of water for cleaping and compartment filled with ice for cooling. Filed February 17, 1897, U.S. Patent #586,365. Issued July 13, 1897. Invented "Air Cleaning and Cooling Device." Tiers of pans from which water spilled into path of air stream. Filed November 5, 1897, U.S. Patent #626,388. Issued June 6, 1899.

1897 Joseph McCreery, Toledo, Ohio. Added ice compartment to Air Cooling, Cleansing and Ventilating Device. (See column 4, 1897.)
1897 Kroeschell Bros. Ice Machine Company, Chicago. Installed refrigerated coils on chocolate dipping room walls in candy factory of Jos. B. Funke Co., La Crosse, Wisconsin. (47)
1897 Edwin F. Portor, Boston (Bay State Electric Heat and Light Co., Jersey City, N.J.). Invented "Apparatus for Cooling and Agitating Air," a disc-type-fan cold diffuser. Filed December 20, 1897, U.S. Patent #702,994. Issued June 24, 1902.