## Willis Haviland Carrier Father of Air Conditioning

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### MODERN

# Air-Conditioning, Heating and Ventilating

Бу

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SECOND EDITION

2.5 Listing of Books and Articles by Willis Carrier

### BOOKS AND PUBLISHED ARTICLES

### BOOKS

Fan Engineering: 1st Edition, 1914, Willis H. Carrier, Editor; 2nd Edition, 1925, R. D. Madison, Editor, Assisted by Willis H. Carrier; 3rd Edition, 1933, R. D. Madison, Editor, Assisted by Willis H. Carrier; Published by Buffalo Forge Company, Buffalo, N.Y.

Modern Air Conditioning, Heating and Ventilating: 1st Edition, 1940, Willis H. Carrier, R. E. Cherne, and W. A. Grant; 2nd Edition, 1950, Willis H. Carrier, R. E. Cherne, and W. A. Grant; Published by Pitman Publishing Corporation, New York, N.Y.

### PUBLISHED ARTICLES

- 1903 "Heating and Ventilating of Foundries and Machine Shops" by Willis H. Carrier. American Foundrymen's Association Journal, June 1903; Foundry (Abstracted), Vol. 22, 1903; American Machinist, August 1903; Iron Age, June 1903.
- 1904 "Cupola Fan Practice" by Willis H. Carrier; American Foundrymen's Association, Trans., Vol. 13, 1904; Foundry, October 1904.
- 1905 "Air Blast for the Foundry Cupola" by Willis H. Carrier; Iron Age, May 1905.
- 1906 "Fan System for Humidifying, Ventilating and Heating Mills" by Willis H. Carrier; Textile World Record, April 1906.
- 1907 "New Departure in Cooling and Humidifying Textile Mills" by Willis H. Carrier; Textile World Record, May 1907; Heating and Ventilating Magazine, June, July 1907; Engineering Review (Abstracted), July 1907; American Cotton Manufacturers Association, Trans., 1907.
- 1908 "Positive and Accurate Humidity Control" by J. I. Lyle and Willis H. Carrier; National Association of Cotton Manufacturers, Trans., 1908.

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Carrier Articles 1
[Willis Haviland Carrier: Father of Air Conditioning" Margaret Ingels,
Country Life Press, 1952]

1910 "Air-Conditioning Apparatus, Its Construction and Application" by Willis H. Carrier; Engineers' Society of Western Pennsylvania, July 1910; Heating and Ventilating Magazine (Abstracted), September 1910.

1910 "Notes on the Theory and Present Practice of Humidifying" by Willis H. Carrier; Heating and Ventilating Magazine, September

1910.

1911 "Rational Psychrometric Formulae" by Willis H. Carrier; American Society of Mechanical Engineers, Trans., 1911; A.S.M.E. Journal, November 1911; Heating and Ventilating Magazine (Abstracted), Dec. 1911; Engineering News, Vol. 66, 1911; Industrial Engineering, Vol. 11, 1911; Institution of Civil Engineers, Vol. 188, 1912.

1911 "Air-Conditioning Apparatus" by Willis H. Carrier and F. L. Busey; American Society of Mechanical Engineers, Trans., Vol. 33, 1911; A.S.M.E. Journal, December 1911; Heating and Ventilating Magazine (Abstracted), March 1912; Engineering News, Vol. 66, 1911; Engineering Review, Jan., April, May, Sept. 1912; Institution of Civil Engineers, Vol. 188, 1912; Industrial Engineering, Vol. 11, 1912.

1912 "Rate of Heat Transmission in Indirect Surface Air Heaters" by Willis H. Carrier and F. L. Busey; Heating and Ventilating Maga-

zine, January 1912.

1912 "Elements of Design of Humidifiers and of Air-Conditioning Apparatus" by Willis H. Carrier and F. L. Busey; Heating and Ven-

tilating Magazine, March 1912.

1913 "Design of Indirect Heating Systems with respect to Maximum Economy of Operation" by F. L. Busey and Willis H. Carrier; American Society of Heating and Ventilating Engineers, Trans., 1913; Heating and Ventilating Magazine (Abstracted), March 1913.

1913 "Heating and Ventilating of the Foundry" by Willis H. Carrier; American Foundrymen's Association, Trans., 1913; Heating and

Ventilating Magazine (Abstracted), January 1913.

1917 Discussions by Willis H. Carrier of Engineering Papers on "Elimination of Corrosion in Hot Water Supply Pipe," "Comparison of Pipe Coils and Cast Iron Sections for Warming Air," "Artificial Drying with the Use of Gas," and "Papers on Drying"; A.S.H.V.E., Trans., 1917.

1918 "Temperature of Evaporation" by Willis H. Carrier; American Society of Heating and Ventilating Engineers, Trans., 1918.

1918 Discussions by Willis H. Carrier of Engineering Papers on: "Economy in Heating," "Fuel Economy in House Heating," "Reasons for Failure of Heating Systems," "High Temperature Drying," and "What We Do and Don't Know About Heating"; A.S.H.V.E., Trans., 1918.

1919 Discussions by Willis H. Carrier of Engineering Papers on: "Arrangement of Heating Pipes, an Important Factor in Decay of Factory Roofs," and "Mine Ventilation"; A.S.H.V.E., Trans., 1919.

1920 Discussion of Papers on "Drying" by Willis H. Carrier; A.S.H.V.E.,

Trans., 1920.

1921 "Compartment Dryer" by Willis H. Carrier and A. E. Stacey, Jr.; Journal of Industrial and Engineering Chemistry, May 1921.

1921 "Theory of Atmospheric Evaporation—with Special Reference to Compartment Dryers" by Willis H. Carrier; Journal of Industrial and Engineering Chemistry, May 1921.

1921 Discussion of "Theory of Dust Action" by Willis H. Carrier;

A.S.H.V.E., Trans., 1921.

1922 "Manufactured Weather and Personal Efficiency" by Willis H. Carrier; Chemical and Metallurgical Engineering, August 1922.

1922 Discussions by Willis H. Carrier of Engineering Papers on: "Heat Transfer by Conduction and Convection," and "The Intermediate or Junior High School in Detroit"; A.S.H.V.E., Trans., 1922.

1923 Discussions by Willis H. Carrier of Engineering Papers on: "Modern Tendencies of Ventilation Practice," "Lines of Equal Comfort," "Heat Transmission Through Building Structures," "Heating the New Navy Gun Shop," and "Capacities of Steam Heating Risers as Affected by Critical Velocity of Steam and Condensate Mixtures"; A.S.H.V.E., Trans., 1923.

1924 "Thermodynamic Characteristics of Various Refrigerating Fluids" by Willis H. Carrier and R. W. Waterfill; Refrigerating Engineering,

June 1924.

1924 "Temperature of Evaporation of Water into Air" by Willis H. Carrier and D. C. Lindsay; American Society of Mechanical Engineers, Trans., 1924; Mechanical Engineering (Abstracted), May 1925; Refrigerating Engineering, Jan. 1925.

1924 Discussions by Willis H. Carrier of Engineering Papers on: "The Efficiency of Air Cleaners," "Measuring Heat Transmission in Building Structures," "Cooling Effect at Various Air Velocities," and "Ventilation of Department Store"; A.S.H.V.E., Trans., 1924.

1925 Discussions by Willis H. Carrier of Engineering Papers on: "Modern Steam Power Station," and "A Proposed Method for Comparison of Effectiveness of Indirect Heating Surfaces"; A.S.H.V.E., Trans., 1925.

1926 "Centrifugal Compression as Applied to Refrigeration" by Willis H.

Carrier; Refrigerating Engineering, Feb. 1926.

1926 Discussions by Willis H. Carrier of Engineering Papers on: "Heating Effect of Radiators," "Proposed Code for Rating—Testing Radiators," and "New Psychrometric Humidity Chart"; A.S.H.V.E., Trans., 1926.

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- 1927 Discussion on "How Design and Operation of Heating Plant Compare in an Insulated Office Building" by Willis H. Carrier; A.S.H.V.E., Trans., 1927.
- 1927 "Thermal Engineer" by Willis H. Carrier; Refrigerating Engineering, January 1928.
- 1928 "Air Conditioning" by Willis H. Carrier; Encyclopedia Britannica, Fourteenth Edition, Vol. 1, 1929.
- 1928 "Air Conditioning for Homes in 1950" by Willis H. Carrier; Domestic Engineering, May 1928.
- of Dust Determinators," "Heat Transmission Research," "Method of Calculating Cost of Gas Heating," "Refrigeration as Applied to Air Conditioning," "Standard Test Code for Heat Transmission through Walls," and "Test Methods for Radiators and Boilers"; A.S.H.V.E., Trans., 1928.
- 1929 "Air Conditioning—Its Phenomenal Development" by Willis H. Carrier; Heating and Ventilating, June 1929.
- "Air Conditioning in the Printing and Lithographing Industry" by Willis H. Carrier and R. T. Williams; American Society of Mechanical Engineers, Trans., Vol. 51, 1929. Zeitschrift für die Gesamte Kälte—Industrie (Abstracted in German), Sept. 1930.
- 1929 "New Prospects for an Established Industry" by Willis H. Carrier; Heating, Piping and Air Conditioning, May 1929.
- "Control of Humidity and Temperature as Applied to Manufacturing Processes and Human Comfort" by Willis H. Carrier and others; World Engineering Congress, Tokyo, 1929. Proceedings 1931; Heating and Ventilating (Abstracted), Nov., Dec. 1929; (Revised 1939) Heating, Piping and Air Conditioning; (Revised 1950) Heating, Piping and Air Conditioning, April, June, August 1950, Feb. 1951.
- 1929 Discussions by Willis H. Carrier of Engineering Papers on: "Architectural Aspects of Concealed Heaters," "Capacity of Radiator Supply Branches for One- and Two-Pipe Systems," "Frost and Condensation on Windows," "Heating with Steam Below Atmospheric Pressure," "Instruments for the Measurement of Air Velocity," "Report of Committee on Rating Low-Pressure Heating Boilers," "The Summer Comfort Zone; Climate and Clothing," and "Thermal Resistance of Air Spaces"; A.S.H.V.E., Trans., 1929.
- 1930 "Control of Humidity and Temperature" by Willis H. Carrier; Heating and Ventilating, March 1930; Domestic Engineering, June, July 1930.
- 1930 "Air Conditioning for Summer and Winter Comfort" by Willis H. Carrier; Heating, Piping and Air Conditioning, Sept. 1930; Plumbers Trade Journal, Oct. 1930; Domestic Engineering, Oct. 1930.

1930 Discussion by Willis H. Carrier of Engineering Papers on: "Constancy of Wet-Bulb Temperature and Total Heat Content during Adiabatic Saturation of Dry Air with Water Vapor"; Refrigerating

Engineering, Vol. 19, 1930.

1930 Discussions by Willis H. Carrier of Engineering Papers on: "Air Conditioning the Halls of Congress," "How Comfort is Affected by Surface Temperatures and Insulation," "Panel Warming," "Rating of Heating Boilers by Their Physical Characteristics," "Report of Continuing Committee on Codes for Testing and Rating Steam Heating Solid Fuel Boilers," and "Wall Surface Temperatures"; A.S.H.V.E., Trans., 1930.

1931 "Cost of Air Conditioning in Department Stores" by Willis H. Car-

rier; Electrical World, Feb. 1931.

1931 "Field of Refrigeration in Air Conditioning and Methods of its Application" by Willis H. Carrier; Ice and Refrigeration, March 1931; Refrigerating Engineering (Abstracted), March 1931; Power, March 1931.

1931 "Making Weather to Order in the Home" by Willis H. Carrier and

Margaret Ingels; Good Housekeeping, March 1931.

1931 "Recent Progress in Air Conditioning" by Willis H. Carrier; Refrig-

erating Engineering, March 1931.

- 1931 "Relation of Standardization to Air Conditioning Printing Industry" by Willis H. Carrier; Printing Institute Conference, Washington, D.C., March 1931; Heating, Piping and Air Conditioning, April 1931.
- 1931 "Making Weather for Human Comfort" by Willis H. Carrier; Domestic Engineering, July 1931.

1931 "Standards of Heating and Ventilation" by Willis H. Carrier;

School Executives Magazine, Oct. 1931.

1931 Discussions by Willis H. Carrier of Engineering Papers on: "Heat Emission from the Surfaces of Cast Iron and Copper Cylinders Heated with Low Pressure Steam," "Heating Effects of Radiators," "Air Conditioning in the Bakery," "Air Conditioning for Railway Passenger Cars," "Air Pollution from the Engineer's Standpoint," "Friction Heads in One-Inch Standard Cast-Iron Tees," and "Essential Elements for Determining Heating Plant Requirements"; A.S.H.V.E., Trans., 1931.

1932 "Accomplishments in the Art of Heating and Ventilating, and Contributions Thereto during My Presidential Year" by Willis H. Carrier, Jan. 1932; A.S.H.V.E., Trans., 1932.

1932 "How to Use the Effective Temperature Index and Comfort Charts" by C. P. Yaglon, Willis H. Carrier, E. V. Hill, F. C. Houghten, and J. H. Walker; Heating, Piping and Air Conditioning, June 1932.

- 1932 "Weather Yields to Man's Control" by Willis H. Carrier; National Safety News, June 1932.
- 1932 "Gas and Air Conditioning" by Willis H. Carrier; American Gas Journal, October 1932.
- 1932 "Air Conditioning" by Willis H. Carrier; Manufacturers Record, Dec. 1932.
- 1932 "Air Conditioning Is Saving Industry \$15,000,000 Yearly" by Willis H. Carrier; Heating, Piping and Air Conditioning, Dec. 1932; Refrigeration (Abstracted), Feb. 1933.
- 1933 "History and Development of Air Conditioning Industry" by Willis H. Carrier; Refrigeration, Jan. 1933.
- 1933 "Trends in Heating and Air Conditioning" by Willis H. Carrier; Heating, Piping and Air Conditioning, Jan. 1933.
- 1933 "Future of Heating and Air Conditioning" by Willis H. Carrier; Domestic Engineering, Feb. 1933.
- 1933 "Present Trends in Air Conditioning Summarized" by Willis H. Carrier; School Management, March 1933.
- 1933 "Economics of Man-Made Weather" by Willis H. Carrier; Scientific American, April 1933.
- of Fuel Burning Rates and Power Requirements of Oil Burners in Relation to Excess Air," and "Design and Valuation of Cast Iron Domestic Heating Boilers"; A.S.H.V.E., Trans., 1934.
- 1935 Discussion by Willis H. Carrier on "A Rational Heat Gain Method for the Determination of Air Conditioning Cooling Loads"; A.S.H.V.E., Trans., 1935.
- 1936 "Progress in Air Conditioning in the Last Quarter Century" by Willis H. Carrier; Heating, Piping and Air Conditioning, August 1936; A.S.H.V.E., Trans., 1936.
- 1936 Discussions by Willis H. Carrier of Engineering Paper on: "Refrigerants—Their Use and Regulation" by H. D. Edwards; Refrigerating Engineering, Aug. 1936.
- 1936 "Air Conditioning—Advances and Trends of the Art" by Willis H. Carrier and R. W. Waterfill; American Institute of Refrigeration, Holland, 1936; Proceedings—International Congress of Refrigeration, 1936.
- 1936 "Appraising Air Conditioning and Cooling Equipment" by Willis H. Carrier; Review (Society of Residential Appraisers), Nov. 1936.
- 1936 "Air Conditioning" by Willis H. Carrier; The Encyclopedia Americana, 1936.
- 1937 "Review of Existing Psychrometric Data in Relation to Practical Engineering Problems" by Willis H. Carrier and C. O. Mackey; A.S.M.E., Trans., 1937.

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- 1937 "Contact-Mixture Analogy Applied to Heat Transfer with Mixtures of Air and Water Vapor" by Willis H. Carrier; A.S.M.E., Trans., 1937.
- 1937 "A Pioneer Looks into the Future of Air Conditioning" by Willis H. Carrier; Automatic Heat and Air Conditioning, April 1937.
- 1937 "Applying Science and Engineering to Education" by Willis H. Carrier; Mechanical Engineering, May 1937.
- 1937 "Principles versus Curriculum in Memorizing Facts and Theories" by Willis H. Carrier; Mechanical Engineering, May 1937.
- 1937 "The Graduate's Dilemma: Small City versus Large City" by Willis H. Carrier; Rotarian, June 1937.
- 1938 Discussion by Willis H. Carrier of Engineering Paper on: "Mining Methods and Health and Safety in Mines"; American Institute of Mining and Metallurgical Engineers, Feb. 1938.
- 1938 "The Development of Air Conditioning" by Willis H. Carrier; Refrigeration and Air Conditioning, Quebec, Canada, Summer 1938.
- 1938 "Air Conditioning in Relation to Industrial Hygiene" by Willis H. Carrier; Industrial Physicians and Surgeons, Chicago, June 1939; Industrial Medicine, September 1938.
- 1938 "Air Cooling in Gold Mine on Rand" by Willis H. Carrier; American Institute of Mining and Metallurgical Engineers, Vol. 141, 1940; Canadian Mining Journal, December 1938.
- 1938 "Weather by Prescription" by Willis H. Carrier; National Safety News, October 1938.
- 1938 Discussions by Willis H. Carrier of Engineering Papers on: "Performance Tests of Asbestos Insulating Air Duct," and "Physiological Reactions and Sensations of Pleasantness under Varying Atmospheric Conditions"; A.S.H.V.E., Trans., 1938.
- 1939 "Development of Air Conditioning" by Willis H. Carrier; Western Society of Engineers Journal, February 1939.
- 1939 "Making Weather around the Globe" by Willis H. Carrier; Popular Mechanics, July 1939.
- 1939 Discussion by Willis H. Carrier of Engineering Paper on: "Air Conditioning in Industry"; A.S.H.V.E., Trans., 1939.
- 1940 "Employer Suggests Needed Improvements in our System of Technical Education" by Willis H. Carrier; Mechanical Engineering, October 1940; Electrical Engineering (Abstracted), September 1940; Engineer (and Editorial Comment), November 1940; Engineering, January 1941.
- 1940 "Air Conditioning—An Industry Opportunity" by Willis H. Carrier; American Gas Association, 1940; New York Times (Abstracted), October 1940.
- 1941 "Conduit System of Central Station Air Conditioning" by Willis H. Carrier and G. W. Meek; Refrigerating Engineering, July 1941.

1941 Discussion by Willis H. Carrier of Engineering Paper on: "Local Cooling of Workers in Hot Industry"; A.S.H.V.E., Trans., 1941.

1942 "After the War, What?" by Willis H. Carrier; Refrigeration Engi-

neering, September 1942.

1943 "How Air Conditioning Has Advanced Refrigeration" by Willis H. Carrier; Mechanical Engineering, May 1943; Modern Refrigeration, July 1943; Machinery Market (Abstracted), July 1943.

1943 "Trends in Technical Education" by Willis H. Carrier; Ceramic Age,

May 1943.

1943 Discussions by Willis H. Carrier of Engineering Papers on: "Final Values of the Interaction Constant for Moist Air," "Spray Nozzle Performance in a Cooling Tower," and "Study of Actual vs. Predicted Cooling Load on an Air-Conditioning System"; A.S.H.V.E., Trans., 1943.

1944 "Prospects in Air-Conditioning and Refrigeration Fields" by Willis

H. Carrier; Machinery, January 1944.

1944 "The Resistance to Heat Flow through Finned Tubing" by Willis H. Carrier and S. W. Anderson; Heating, Piping and Air Conditioning, May 1944.

1944 "Air Conditioning for Peace-time Production" by Willis H. Carrier;

The Underwear & Hosiery Review, April 1944.

1944 Discussions by Willis H. Carrier of Engineering Papers on: "Aerodynamic Development of Axial Flow Fans," "The Discoloration Methods of Rating Air Filters," "A Method of Heating a Corrugated-Iron Coal Preparation Plant," and "A Study of Intermittent Heating of Churches"; A.S.H.V.E., Trans., 1944.

1945 "Air Conditioning Industry" by Willis H. Carrier; Army and Navy

Journal, September 1945.

1945 "Air Conditioning" by Willis H. Carrier; Encyclopedia Americana, 1945.

1945 Discussion by Willis H. Carrier on Engineering Paper: "Summer Weather Data and Sol-Air Temperature"; A.S.H.V.E., Trans., 1945.

1946 "American Developments in Air Conditioning and Refrigeration during War Period" by Willis H. Carrier; Engineers' Digest (British Edition), January 1946.

1946 "Let's Hit a High Standard of Living for the American People" by Willis H. Carrier; Home Comfort Wholesaler, January 1946.

1946 "Modern Marine Refrigeration and Air Conditioning" by Willis H. Carrier and L. E. Starr; Refrigerating Engineering, Vol. 51, 1946; Marine Engineering and Shipping Review (Abstracted), April 1946; Pacific Marine Review, July 1946.

1946 Discussions by Willis H. Carrier of Engineering Papers on: "Characteristics of Unit Dust Collectors," "Heat Losses through Wetted Walls," "Hold-Fire Controls for Bituminous Coal Stokers," and

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"Influence of an Interior Coating of Aluminum Paper on Internal Thermal Conditions and Heat Economy"; A.S.H.V.E., Trans., 1946.

1947 "American Developments in Air Conditioning and Refrigeration during the Last Decade" by Willis H. Carrier; Institution of Mechanical Engineers, Vol. 157, 1947.

1947 "Air Conditioning" by Willis H. Carrier; Lionel Marks Handbook,

1947.

1951 "Principles of Air Conditioning" by Willis H. Carrier; Heating, Piping and Air Conditioning, April, June, August 1950, February 1951.

1953 "Mixing and Equilibrium in Pipe Flow" by Willis H. Carrier and

W. S. Misener.

(Scheduled for Spring Meeting)—A.S.M.E., 1953.

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[Willis Haviland Carrier: Father of Air Conditioning" Margaret Ingels,
Country Life Press, 1952]