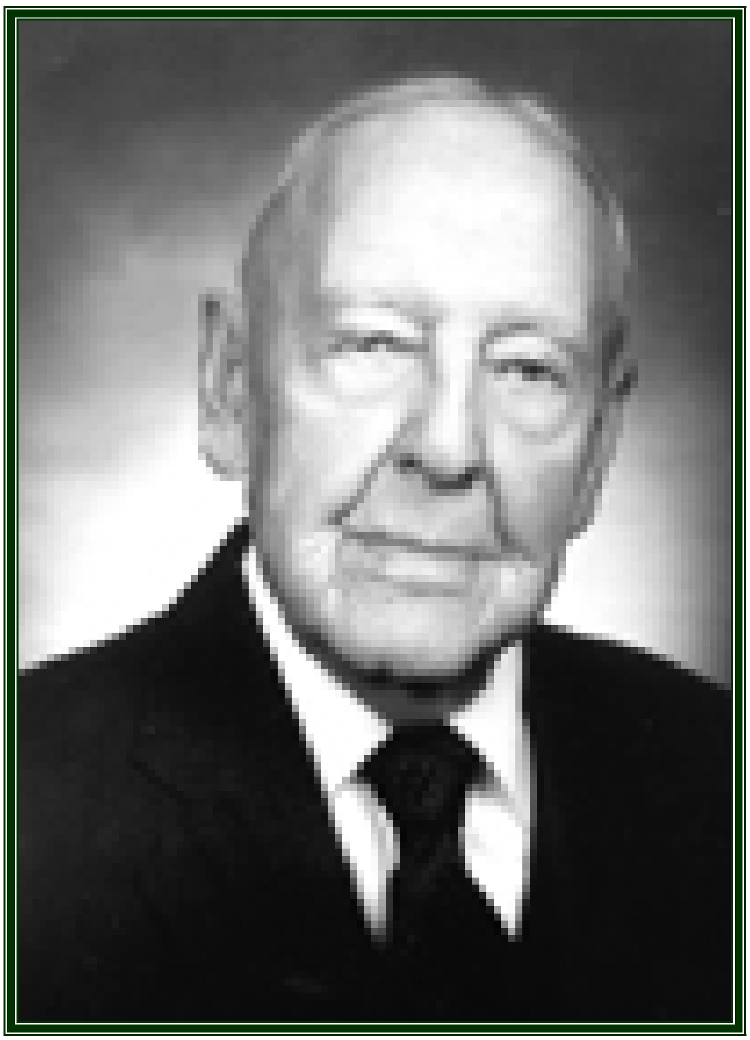
MILTON W GARLAND
1895-2000



"Mr Refrigeration"

MILTON W GARLAND **1895 – 2000**

In 1998, Garland was honoured as the nation's oldest worker, having begun his career in 1920 at the Frick Company, now part of York International. He was known as "Mr. Refrigeration" for his work in systems for gold mines in South Africa and in the ice cream factories of Philadelphia. Garland held some 40 patents of refrigeration-related items, ranging from icemakers to screw compressor volume controls. His work in refrigeration aided in the construction of Hoover Dam for which he designed systems to cool the water, sand and rock used to make the concrete to build it. At ASHRAE's Centennial Meeting in 1995, Garland was recognized as a pioneer in technology. In 1989, ASHRAE endowed an award in his honour - the Milton W. Garland Commemorative Refrigeration Award for Project Excellence. He was a recipient of the ASHRAE F Paul Anderson Award, the Distinguished 50-Year Member Award and the Louise and Bill Holladay Distinguished Fellow Award. In 1996, he received the first Andy Ammonia Award from the International Institute of Ammonia Refrigeration. Milton Garland died in July 2000 at age 104. He was inducted into the ASHRAE Hall of Fame in 2003.

(Edited extract from ASHRAE "Hall of Fame" Citation)

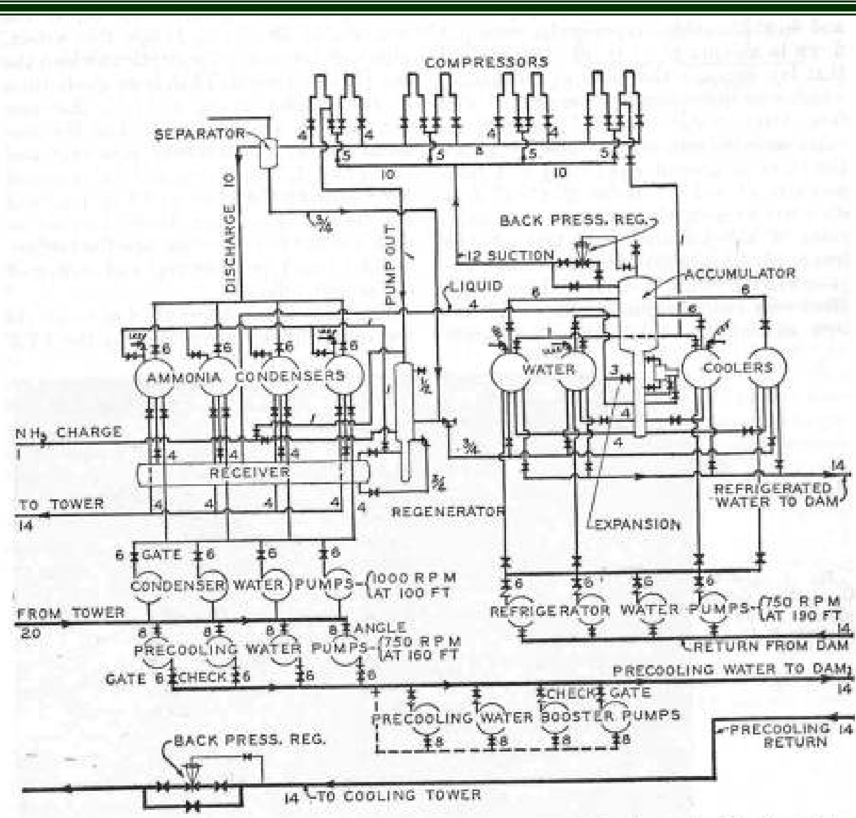
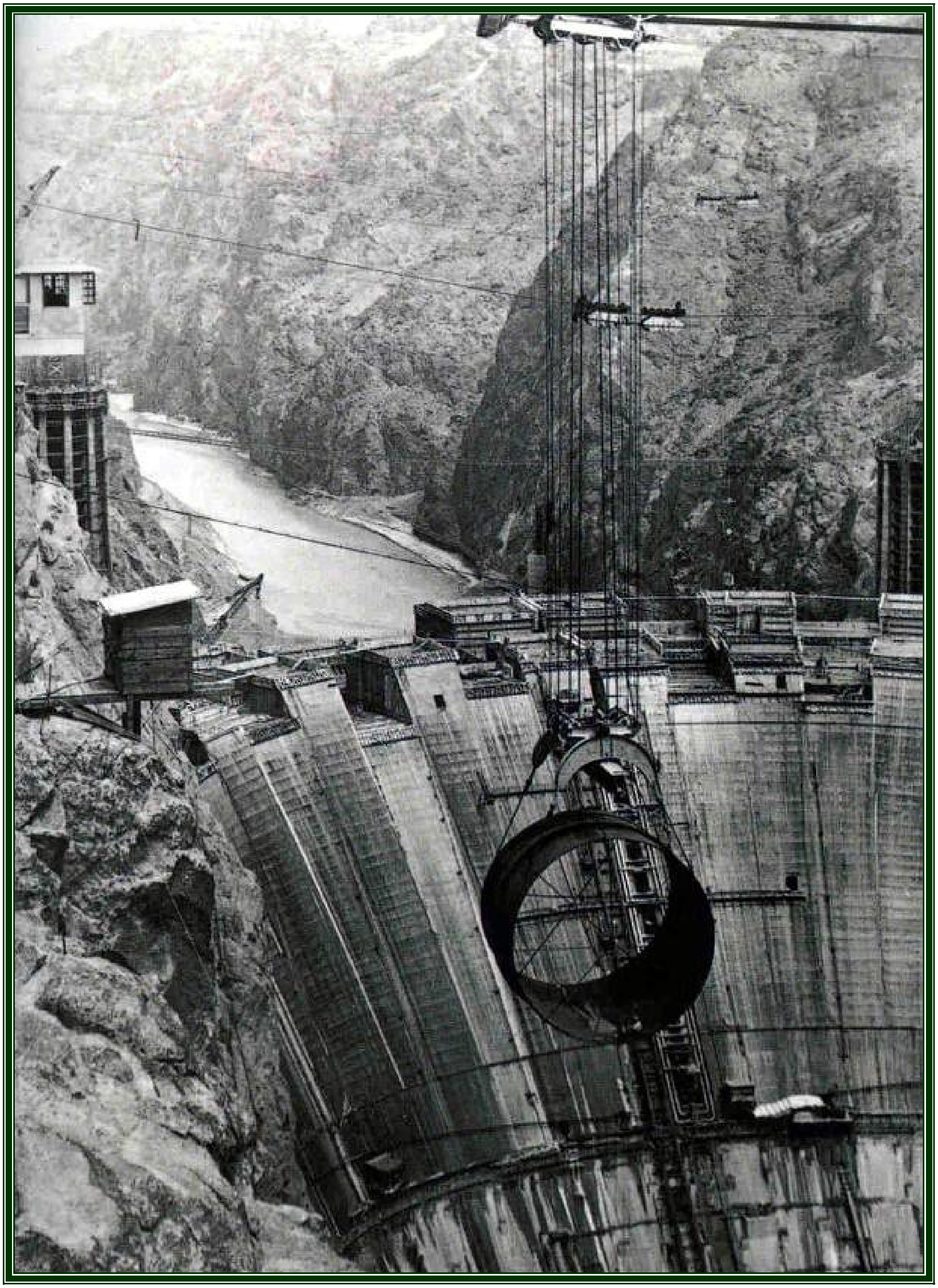


Fig. 6. Layout of Refrigerating Apparatus for Cooling Coils Embedded in Concrete of Boulder Dam.

(From ASRE Data Book, "Applications," 1954-55)
After completion, the Boulder Dam was renamed the Hoover Dam



Hoover Dam under Construction, c.1934 ("The Builders: Marvels of Engineering," 1992)

CH-99-21-2

Milton Ward Garland, Refrigeration Engineer, and a Case History of Manufactured Ice

Harry M. Will
Member ASHRAE

ABSTRACT

This paper recognizes the accomplishments of Milton W. Garland, engineer and inventor and leader in the refrigeration industry, honored in 1998 by the President as the Oldest Working American. It touches on the history of the Frick Company, where Garland has worked for 78 years, focusing on his renovation of the Waynesboro Ice and Cold Storage plant, originally built in 1901.

INTRODUCTION

Milton W. Garland, Engineer—Innovator—Leader

Milton Garland was honored in June 1998 by the President of the United States as being the Oldest Working American. What a well deserved honor! Garland not only goes to work every day but continues to give his support to engineering societies such as ASHRAE and IIAR and by generous donations and leadership promotes the art and science of refrigeration engineering.

The purpose of this article is to recognize this engineer and inventor, who has been a leader in the refrigeration industry. Many stories could be written heralding his accomplishments, and this article includes just one of them. It centers around his work relative to the Waynesboro Ice and Cold Storage facility in Waynesboro, Pennsylvania. Because of his interest and involvement, this article also amplifies our rich heritage associated with this region and its early settlers. The author has drawn much of the material for this article from the bountiful knowledge and experience of Milton Garland and his long association with the Frick Company. This is a biography and an interesting slice of Americana; to a lesser extent, it is a recordation of technical accomplishments.

Milton Garland, born in 1895 in Harrisburg, Pennsylvania, was mechanically inclined from his earliest years and worked in a bike repair shop at age 10. In 1917, right after graduation from Worchester Tech, he went into the Navy as the Second Engineering Officer on a passenger ship converted to a collier, even though he was only licensed as a Third Class Steam Engineer in the state of Massachusetts.

In 1920 he went to work for the Frick Company in Waynesboro, Pennsylvania (near the Mason/Dixon Line in central Pennsylvania). By 1928 he had risen to superintendent of field operations for the Frick Company, and in that position one of his projects was to supervise the reconstruction and retrofit of the Waynesboro Ice and Cold Storage plant. You may see how Garland appeared in those days along with his associates in Figure 1, a picture taken at the Frick Company in 1924 (Garland is third from the right in the front row). Later, he became a director of Waynesboro Ice and Cold Storage and served in that capacity from 1944 to 1984. Garland is still actively employed with the Frick Company as its senior consultant for technical services.

Milt Garland, a member of the Baltimore Chapter, is frequently referred to as the "R" in ASHRAE, Mr. Refrigeration. He became a member of ASRE in 1925 and holds many distinguished awards from ASHRAE including the Distinguished Service Award (June 30, 1970), Life Membership (July 1, 1967), Fellow, Region III Regionaire Award (September 17, 1988) for promoting refrigeration technology among twelve chapters, and the Society's highest engineering achievement award, the F. Paul Anderson Medal (January 30, 1988), the citation for which reads:

> Milton W. Garland, P. E.
>
> Who as an inventor and author has continuously pioneered for more than six decades the development of

Harry M. Will is president of Harry M. Will, Inc., Lutherville, Md.

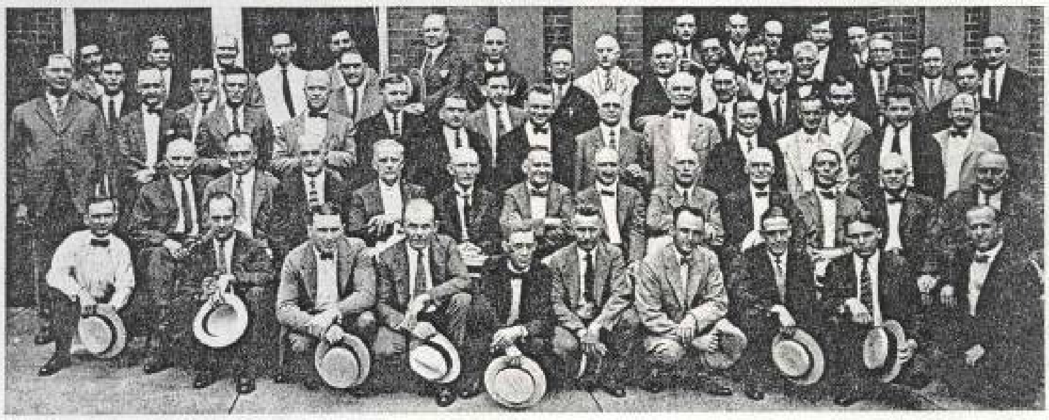


Figure 1 Group picture at Frick Company showing Milt Garland. Office executives, branch managers, and distributors are handling Frick refrigerating equipment; photograph taken at Waynesboro in July 1924. Photo courtesy of the Frick Company 1952 Centennial Publication.

refrigeration compressors for industrial and commercial use, holding thirty-seven patents that have shaped the development of the science of refrigeration, rendering invaluable improvements in the efficiency and operations of refrigeration systems and service to humanity, is presented with the

1988 F. Paul Anderson Medal

upon recommendation of the Honors & Awards Committee and by a vote of the Board of Directors of the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Garland has been a long-time member of IIAR and in March 1993 was awarded Honorary Life Membership for dedicated service and contributions. He has published numerous articles related to refrigeration and, in particular, regarding ammonia systems. This is only an encapsulation of his accolades.

His wife, Alice, is a frequent companion and constant source of encouragement, attending almost all of the ASHRAE meetings with him. They have lived at 208 West Second Street in Waynesboro since 1926. The rear of the Garland home fronts on Hagerstown Pike, which itself is interesting in that this was originally called the Buchanan Trail (named for the 15th President of the United States who immediately preceded Abraham Lincoln and whose birth place was in Mercersburg, Pennsylvania). This trail was the southern route option of westward travelers when they reached Gettysburg, as opposed to the Lincoln Highway route that went west through Chambersburg, Pennsylvania. Garland notes that these trails deliberately followed the high ground, both for drainage and for observation against possible Indian attacks. This entire area is steeped in history and is known as the Cumberland Valley (once called the Great Valley). This very fertile basin, connecting the Shenandoah Valley in Virginia and the Lebanon Valley of eastern Pennsylvania, is the geographic location where much of America's industrialization originated.

Frick Company—Manufacturing Pioneer

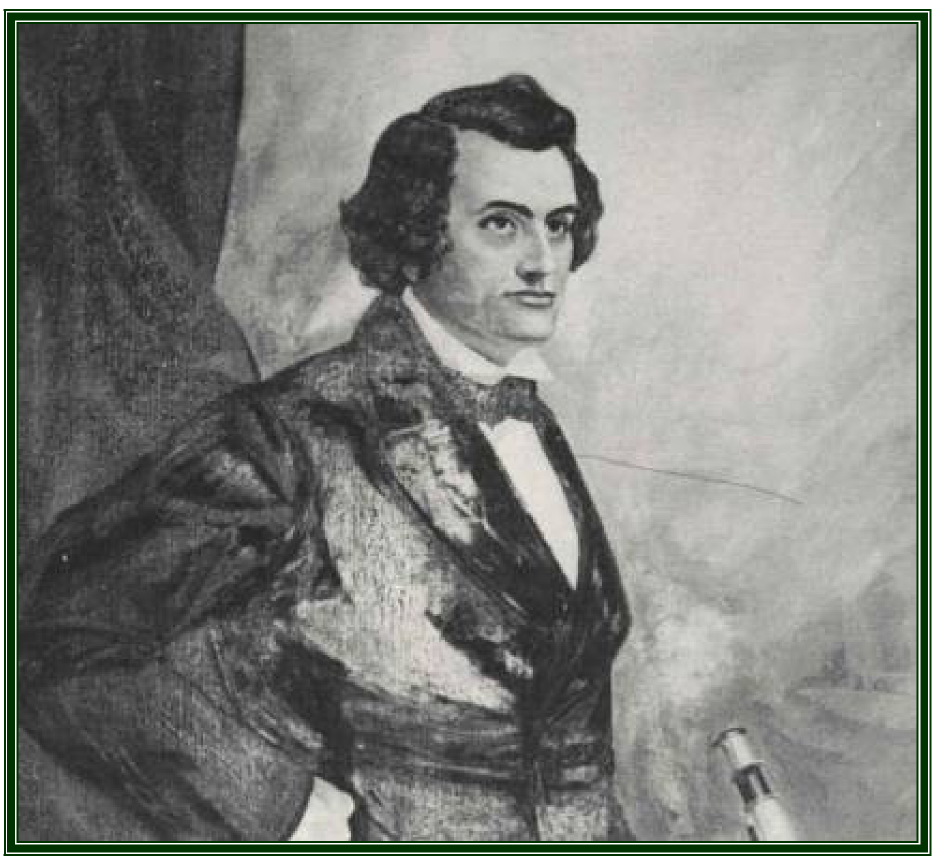
The expanding population of the United States migrated to the west, principally to valleys such as these, since in those days we were primarily an agrarian society. It was natural for manufacturing to sprout up in and around the active population, and this area offered convenient support of minerals, iron, and steel production. Landis Machine Company, Waynesboro Knitting Company (first knitting machines to make underwear), Frick Clockworks (original time clocks to ring school bells), and the Frick Company are a few notable examples.

The inventiveness of the American pioneer is exemplified by George Frick, (eighth-generation descendant of Henry Frick of the Frick Valley in Switzerland). George Frick was born in 1826, 100 years after his ancestors came to America. His company was started in 1853 and specialized in the innovation, engineering, manufacture, and installation of four essential types of equipment: steam engines, grain threshers, saw mills, and refrigerating systems. All of these were designed to ease human labor while increasing production and harnessing other power such as either animal or fossil fuel.

In this particular case history, the Frick Company was instrumental in the design and construction in 1901 of the ice manufacturing and cold storage plant in Waynesboro, Pennsylvania. They had ventured into refrigeration in the 1880s after decades of success in innovating and manufacturing steam traction engines (tractors and power takeoffs that perform tasks from sawing lumber to crushing rock). The 140-year history of the Frick Company is an insight into America's engineering inventiveness and manufacturing prowess.

Extract from Preprint for ASHRAE Transactions 1999

Dr JOHN GORRIE
1802-1853



Constructed an air-cycle refrigerating machine and carried out experiments to provide comfort cooling

Historical Note

Dr. John Gorrie Pioneers Artificial Icemaking

(The Northwest Florida Chapter received a regional Gold Ribbon for this article by Region VII Historian Ron Shelton and Northwest Florida Chapter Historian Bert Stotz.)

In 1833, Apalachicola, Florida was already flourishing as the third largest port on the Gulf of Mexico for ships carrying cotton to New England and Europe. It was in 1833 that a young physician/inventor by the name of John Gorrie arrived to assume duties for the U.S. Marine Hospital Service. He was soon the leading physician at the hospital and became prominent in civic affairs, serving as a postmaster, councilman, treasurer and mayor. In 1839, he gave up public office to devote full attention to his profession.

Gorrie's concern for patients inflicted with tropical fevers led him to identify and develop a method for manufacturing ice and cooling hospital rooms to both cure and prevent fever. By 1844, he had built a compressed air-cycle refrigeration machine and began experiments to cool two rooms in his house set aside for critical fever patients. In the same year, he published a series of 11 articles in the Apalachicola *Commercial Advertiser* entitled "On the Prevention of Malarial Diseases."

Gorrie wrote these articles as predictions even though he had already proven the principle with his machine. He used the pen name "Jenner," anticipating ridicule from nonbelievers for making ice and chilling air by mechanical means.

Such criticism was expressed by a *New York Globe* editor, who wrote, "There is a crank down in Apalachicola, Florida that thinks he can make ice by his machine as good as God Almighty!"

However, the editor of the Apalachicola paper wrote:

> *"We know of no want of mankind more urgent than the cheap means of producing an abundance of artificial cold. The discovery and invention which our correspondent proposes to apply to this object are calculated to alter and extend the face of civilization."*

Having artificially cooled air, Gorrie concentrated on the production of ice, and in 1850 succeeded in designing machinery. International recognition began when one of the Gorrie machines was purchased and successfully tested by British engineers under the direction of William Siemens. Gorrie's invention was also described in *Scientific American* in 1849.

Gorrie received a U.S. patent on May 6, 1851 and a British patent on August 22, 1850. His model machine, U.S. Patent 8080, is displayed in the Smithsonia Institute in Washington, D.C.

Gorrie travelled the country, but was unable to secure the financial backing to commercially develop his machine. He continued to write about and improve the operation of his apparatus until he died in 1855 at the age of 53, unable to realize the far-reaching effects of his pioneering efforts.

In recognition of Gorrie's invention, a statue was unveiled in Statuary hall at the U.S. Capitol in Washington, D.C., on April 30, 1914. The John Gorrie State Museum in Apalachicola contains a replica of his ice machine and patent and is open to the public.

St. Petersburg Independent Monday, July 16, 1973

The earliest success in mechanical refrigeration, where an individual pursued development and built actual systems over an extended period of time, can be found in the work of the American John Gorrie, a physician of Apalachicola, Florida[11] (Figure 8-10). Gorrie became interested in the possibilities of using mechanical refrigeration for humanitarian reasons. As early as 1842, he proposed cooling entire cities so as to relieve the inhabitants from the unhealthful effects of excessive heat and humidity. In an anonymous article, Gorrie described the problems of summer heat and humidity in the southern United States, including "malarious" diseases. The author proposed that cities should be cooled by artificial means "to counteract the evils of high temperature, and improve the condition of our cities . . . [by] the rarefaction and distribution of atmospheric air, previously deprived of large portions of latent caloric by mechanical condensation."

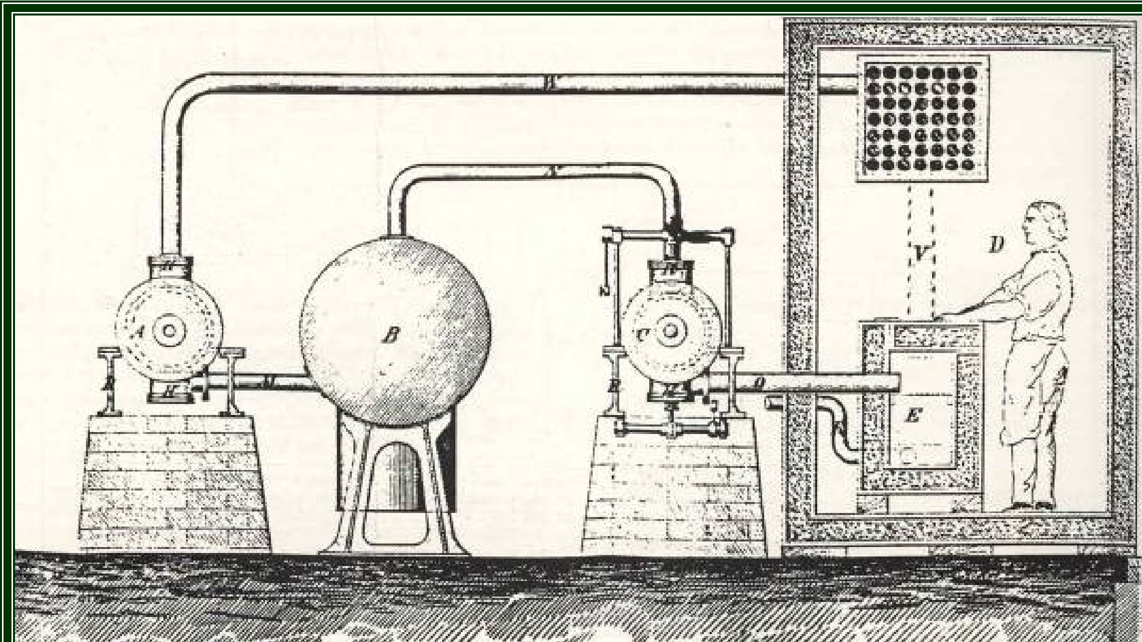
> Wherever the escape of air . . . takes place, it will expand, and in the process, precisely the quantity of heat which was previously obtained from it will be absorbed from all surrounding substances, and rendered latent. Acting on this powerful source of heat, by means of water, wind or steam power, into suitable reservoirs in the suburbs of cities, and thence to transmit it through conduits, like water or gas, so that it may be distributed to, and set free in the houses, and even in the streets and squares of the city.[12]

A discussion of the "condensation" (compression) and "rarefaction" (expansion) of air followed. The advantages of cool, dry air were emphasized, with evaluation of costs in the application of a conditioning system for an entire city.

During the next two years, Gorrie constructed a working air-cycle refrigerating system, which he described in a series of articles for the *Commercial Advertiser*, a local Apalachicola newspaper, using the nom-de-plume "Jenner."[13] Gorrie repeated a large part of the thought from the 1842 article, but he left out his plans to cool and ventilate entire cities. Instead, he concentrated on the interaction of climate with humans and diseases, particularly malaria.

> Let the houses of warm countries be built with an equal regard to insulation, and a like labor and expense be incurred in moderating the temperature, and lessening the moisture of the internal atmosphere, and the occupants would incur little or no risk from malaria . . . high atmospheric temperature . . . prevents a large portion of the human family from sharing the natural advantages they possess. It is a source of evil that has a double operational; first in causing the mental and physical deterioration of the native inhabitants; second in inducing, or rather, creating malarial diseases. Atmospherical temperature determines, or at least greatly modifies the character of our race.[14]

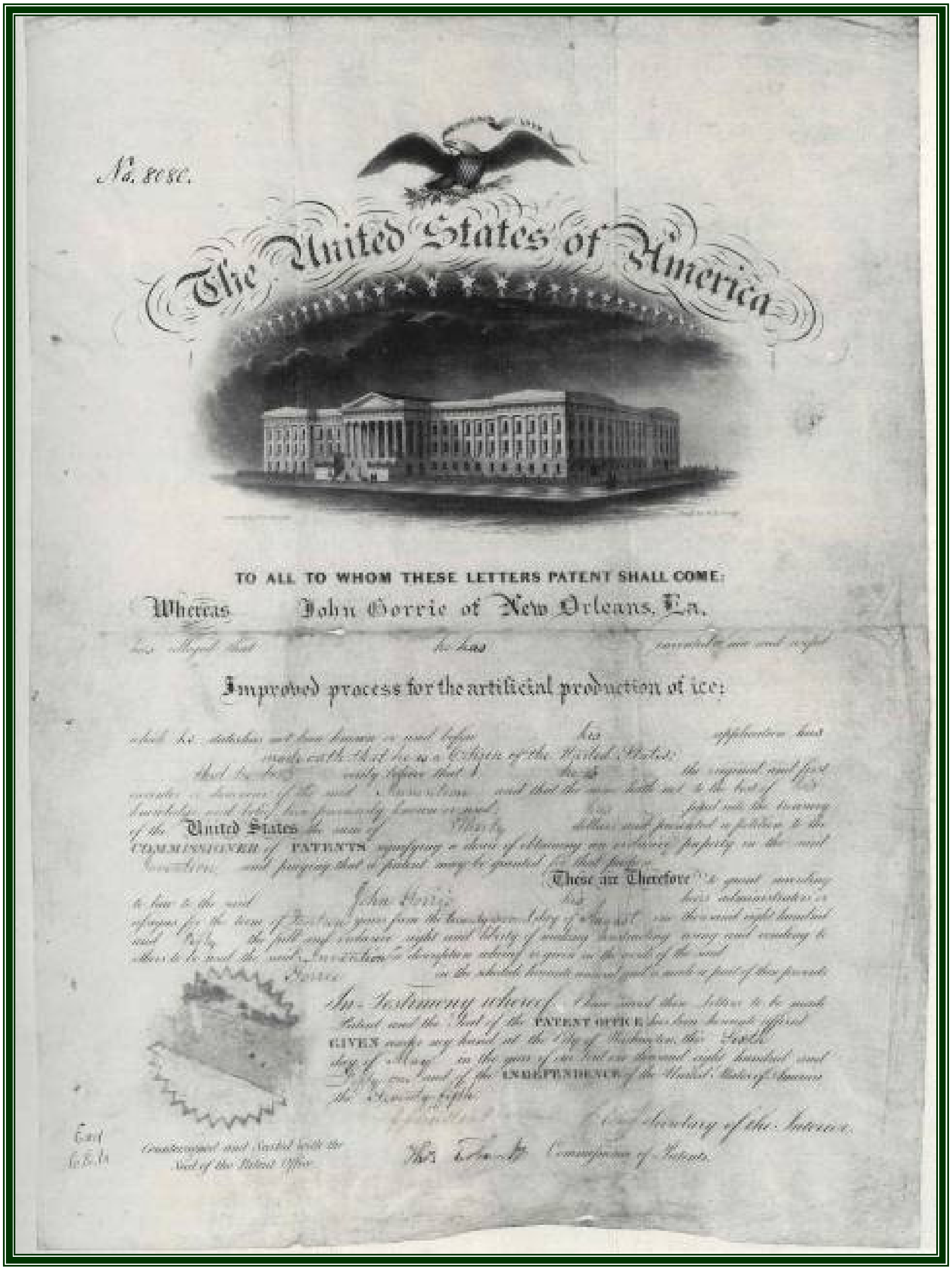
Gorrie then describes "an engine for ventilation, and cooling air in tropical climates by mechanical power. . . ." The machine compressed air with a double-acting piston pump, forcing it into a storage tank, through a "weighted



Gorrie's improved ice-machine of 1854

valve," then into a double-acting "expansion engine." This engine was connected to the compressor so as to "exert the same mechanical force that was required" to compress the air. The compressor could be operated by horse, water, or steam power. Gorrie also proposed wind-driven sails mounted on the house roof that could "by a slight modification of the present modes of constructing roofs, be so easily screened from view, that they would present no unsightly object." The cool, dry air would be distributed though fireplace chimneys "with the addition of valves to close the top, and valves to shut out or admit the entrance of air into rooms. . . ." Gorrie notes that besides having the benefit of cool air, the humidity of the rooms would also be lowered.[15]

Although John Gorrie had high aspirations for refrigeration, he evidently realized that the only way to realize his humanitarian dreams would be to commercialize his refrigerating machine. In the 1840s, the only possible commercial application of refrigeration was ice making. After 1844, Gorrie's work seems to have shifted more toward the goal of commercial ice manufacture. Gorrie had obtained development capital from a New Orleans businessman and conducted experiments with his machine in New Orleans and Cincinnati, Ohio.[16] Gorrie also attempted to obtain financial


No. 8080.

The United States of America

TO ALL TO WHOM THESE LETTERS PATENT SHALL COME:

Whereas John Gorrie of New Orleans, La.

Improved process for the artificial production of ice;

United States

COMMISSIONER of PATENTS

These are Therefore

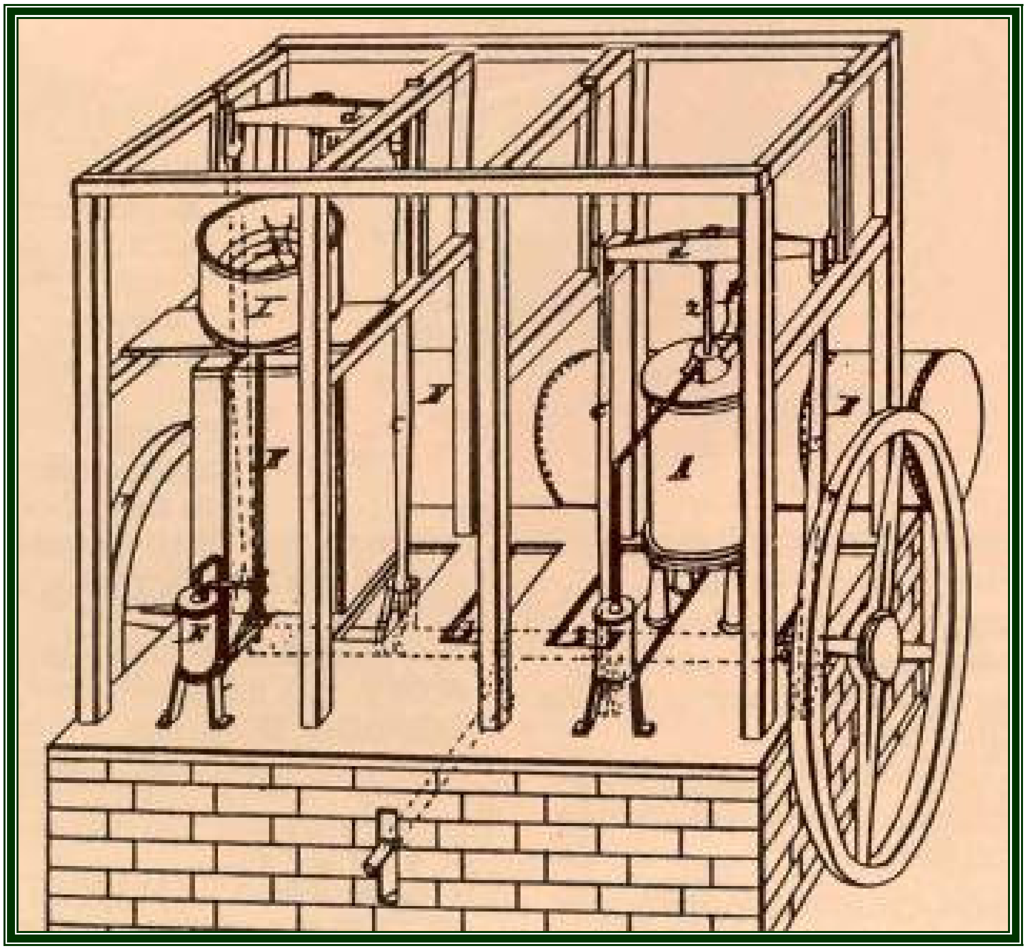
In Testimony whereof

PATENT OFFICE

GIVEN

INDEPENDENCE

Gorrie was granted US Patent 8080 on 6 May 1851
He obtained British Patent BP 13,234 in 1850

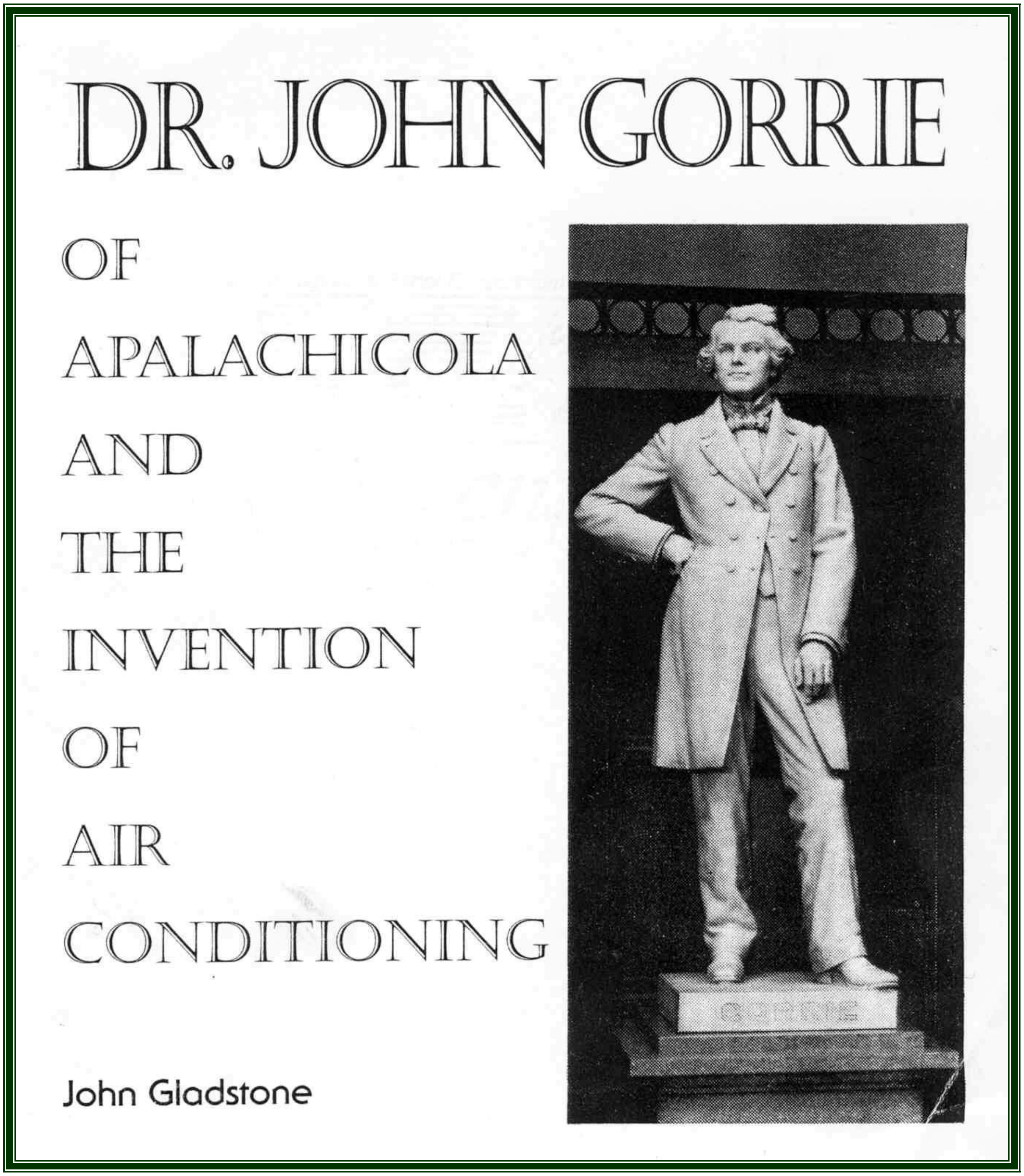


Gorrie's refined ice-making system of 1854 backing from a Boston man. The New Orleans financiers failed to pursue Gorrie's project and his northern patron died, erasing any hope of commercial development for the moment.[17] In the meantime, Gorrie obtained British and U.S. patents on his ice-making machine[18] (Figure 8-11).

Gorrie next attempted to license his machine, utilizing the services of a New York agent, and published a pamphlet in 1854 that described and illustrated a much refined ice-making machine[19] (Figure 8-12). Subsequent literature makes no reference to Gorrie's apparatus being licensed or produced; however, there is contemporary mention of two systems based on Gorrie's machine. One was in Cuba, near Havana,[20] and another was constructed by Wollaston Blake on the outskirts of London. The latter system did not work well and was the subject of a critique by William Siemens, who pointed out that with modification the machine could be greatly improved. Many of Siemens' suggestions were used by later air-cycle refrigeration pioneers.[21]

The failure to realize his dream took a toll on John Gorrie's health, and he passed away in 1855 at age 53.[22]

(Text extract from "Heat & Cold: Mastering the Great Indoors,"
Barry Donaldson & Bernard Nagengast, ASHRAE, 1994)



A biography of Gorrie (CIBSE Heritage Group Collection)

He is commemorated in the
Statuary Hall of the Capitol Building, Washington DC

WALTER A GRANT
1904-1990

Air Conditioning and Refrigeration Engineer for Carrier

[106] Walter A. GRANT **1904-1990**

American air conditioning and refrigeration engineer. Worked at Carrier Corp. Wrote *Modern Air Conditioning, Heating & Ventilating* (1940, with Carrier [101] and Realto Cherne), for many years regarded as the standard textbook on air conditioning. Also wrote *A History of the Centrifugal Refrigeration Machine* (1941), which describes the pioneering work of Leblanc [92] and the construction of a practical machine by Carrier. Grant was President ASHRAE (1960) and recipient of ASHRAE's F. Paul Anderson Award (1967). Later wrote *Milestones in Air Conditioning* (1969).

(Mini-biography from "The Comfort Makers," Brian Roberts, ASHRAE, 2000)

June 1960-Feb. 1961

ASHRAE

WALTER A. GRANT

1904-1990

SYRACUSE, NY

"While experienced leaders in any organization necessarily will be buffeted by the eddies and cross-currents of events and opinions, in the long run they are obliged to determine a wise and consistent course in tune with the membership in order to make constructive progress." (p. 47, *ASHRAE Journal*, July 1960)

(From "Proclaiming The Truth," ASHRAE, 1995)

A History of the Centrifugal Refrigeration Machine*

By Walter A. Grant

Eastern Regional Chief Engineer, Carrier Corporation, Philadelphia, Pa.

THERE is in operation today throughout the world a total installed capacity of approximately 300,000 tons of centrifugal refrigeration. Although originally developed to chill water for air conditioning service, its application has been extended into almost every field requiring the production of cold—for comfort, for industrial and for commercial processes—for temperatures from +60°F. down to —110°F.—in effect almost every conceivable refrigerating duty.

It is difficult to realize that 30 years ago the centrifugal principle was just a dream, that 20 years ago saw the first practical machine built, and that ten years ago textbooks still dismissed it with a casual reference. Although the past two decades have given rise to an unprecedented expansion in refrigerating development and enterprise, there have probably been few inventions that have been as revolutionary in fundamental concept and as important in their impact upon the trend of the industry, as the introduction of centrifugal refrigeration.

The Economic Need

AN invention is an empty thing unless it fulfills an economic need. The need which gave birth to the centrifugal idea arose between 1905 and 1920 when the men who had pioneered in air conditioning were starting to use refrigeration in order to produce cooling and dehumidification of air. This was before the days of comfort cooling, although there had been a few installations even then. The importance of air conditioning in those days lay in the control of atmosphere for industrial processes.

Finned heat exchangers such as present-day air cooling coils were unknown at that time, and bare pipe coils were impractical on account of cost. Cooling and dehumidifying of air was done almost entirely by the use of spray washers, in which a finely atomized cloud of chilled water provided the contact surface for the absorption of heat from the air being cooled.

The spray washer was a very satisfactory cooling and dehumidifying device, as is evidenced by its continued use today. The equipment which chilled the water, however, was eminently unsatisfactory. About the only machines of commercial importance were ammonia and CO_2 compression, and ammonia absorption. Ammonia was a hazardous refrigerant for air conditioning. Carbon dioxide, while safe, was inefficient and quite expensive. No refrigerant that was both safe and thermodynamically satisfactory had been made available for reciprocating machines. Yet safety was a primary requirement for this type of service, since the safety of hundreds of employees could be endangered by an accident to refrigerating machinery employing a hazardous gas.

Another very important limitation to machines of that day was the difficulty of controlling capacity of a machine which was cooling water. An air conditioning load is a variable load, subject to the vagaries of outside weather and the process load it may be serving. A machine chilling water for such a service must be extremely flexible, and automatically so, for if its capacity does not continually match the changing load, the water will either be too warm or will freeze into ice.

At that time expansion valves and compressor capacity control were manual, which required entirely too much attention by the operator. Shell and tube coolers could not be used because of the hazard of freezing up, even with

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

In this interesting account of the development of the centrifugal refrigeration machine, the author reminds us that the first practical machine was built only twenty years ago, and that even ten years ago this invention was not considered seriously. In a final section on applications, he states that although the prevalent idea is that centrifugal refrigeration is used chiefly for comfort cooling, the machine is well suited to the production of very low temperatures.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

* Presented before the Baltimore-Washington Section of the A.S.R.E., October 30, 1941.

(From Refrigerating Engineering, February 1942)
At the time Grant was Eastern Regional Chief Engineer for Carrier Corporation

MODERN

Air-Conditioning, Heating and Ventilating

by

WILLIS H. CARRIER

Chairman of the Board of Directors, Carrier Corporation, Syracuse, N.Y.

REALTO E. CHERNE

Consulting Engineer, Rochester, N.Y.

WALTER A. GRANT

Director of Research, Carrier Corporation, Syracuse, N.Y.

SECOND EDITION

PITMAN PUBLISHING CORPORATION

NEW YORK · TORONTO · LONDON

Written in 1959 when Grant was Director of Research at Carrier Corporation
(CIBSE Heritage Group Collection)
First published 1950, a standard textbook for designers in the 1950's & 60's when the book was commonly referred to as "Carrier, Cherne & Grant."

MILESTONES in AIR CONDITIONING

WALTER A. GRANT
Presidential Member ASHRAE

WHERE does the history of air conditioning begin? With the cave man who thousands of years ago modified his personal climate by nurturing the first fire? With the Romans who so ingeniously engineered ventilating and panel heating into their baths? With the unsung pioneer who first cooled a room with air cascading over a suspended tub of ice?

These questions remind us that the art and industry of air conditioning did not spring suddenly from the brain of a single genius or from the inspirations of a line of distinguished inventors. They evolved falteringly and gradually from their predecessor arts and crafts – heating, ventilating, cooling and cleaning. The development of scientific theory, credible engineering data and practical how-to-do-it technology was just getting underway when the American Society of Heating and Ventilating Engineers (ASH&VE) was born in 1894, even though the underlying principles had started to evolve four centuries earlier.

ROOTS IN THE PAST

The remarkable Leonardo da Vinci had built a ventilating fan at the end of the 15th century.[1] Robert Boyle enacted his famous law in 1659, and John Dalton took his turn in 1800. The Scottish physician Dr. William Cullen in 1775 pumped a vacuum in a vessel of water to make ice. And a few years later our own Benjamin Franklin wrote his treatise on Pennsylvania fireplaces, detailing their construction, installation and operation with elaborate illustrations.[2]

During the 19th century the techniques of warming and ventilating were progressing well. Fans, boilers and radiators had been invented and were in common use. In 1815, Robertson Buchanan, a civil engineer in Glasgow, published his definitive text on heating and ventilating, followed nine years later by the landmark manual of Thomas Tredgold.[3] In 1895, Professor Rolla C. Carpenter of Cornell University (later ASH&VE's third President), climaxed the many textbooks published here and abroad with his authoritative Heating and Ventilating Buildings.

As installations multiplied and were debugged and improved, pioneers of the new steam and hot water heating systems were no longer compelled to design and fabricate their own furnaces, boilers, fans and radiators; a manufacturing industry was growing up to satisfy their needs. Companies familiar to our own generations were established – Babcock & Wilcox, H.B. Smith, Crane, and Walworth, as well as a host of others whose names have long since faded from the scene.[4] The stage was set for the advent of air conditioning.

Refrigerating technology was not very far behind. Dr. John Gorrie, a physician in Charleston, S.C., invented a dense air compression machine in 1849. In France, Ferdinand Carré in 1851 designed the first ammonia absorption unit. In 1853, Professor Alexander Twining of New Haven, employing the unsuccessful invention of Jacob Perkins, produced 1600 lbs of ice a day with a double-acting vacuum and compression pump using sulfuric ether as the refrigerant.[5] The enterprising Daniel L. Holden, who later became a charter member of the American Society of Refrigerating Engineers (ASRE), improved the Carré machine, designed and built reciprocating compressors, and applied them both to icemaking, brewing and meat packing.[6] In 1872, David Boyle invented the ammonia compression machine, producing ice with it the following year.[5]

Manufacturers soon organized to meet the rapidly growing demand for refrigeration equipment. The Frick Co was established in 1853, followed by a long line of famous ice machine concerns,[7] – Vilter, York, De La Vergne, Vogt, Carbondale, Creamery Package, Kroeschell and Brunswick – all prior to 1904, the year ASRE was founded. By then many hundreds of compression and absorption machines were in operation. While most of them made ice or cooled produce,[8] a few had already been applied to the chilling of air which was blown over brine or direct expansion pipe coils.

Toward the latter half of the century, accompanying the growth of the textile industry in New England, invention and art went hand in hand to develop methods for

W.A. Grant is a consulting engineer in Fayetteville, N.Y.

Write for ASHRAE Journal, September 1960 when Grant was a Consulting Engineer