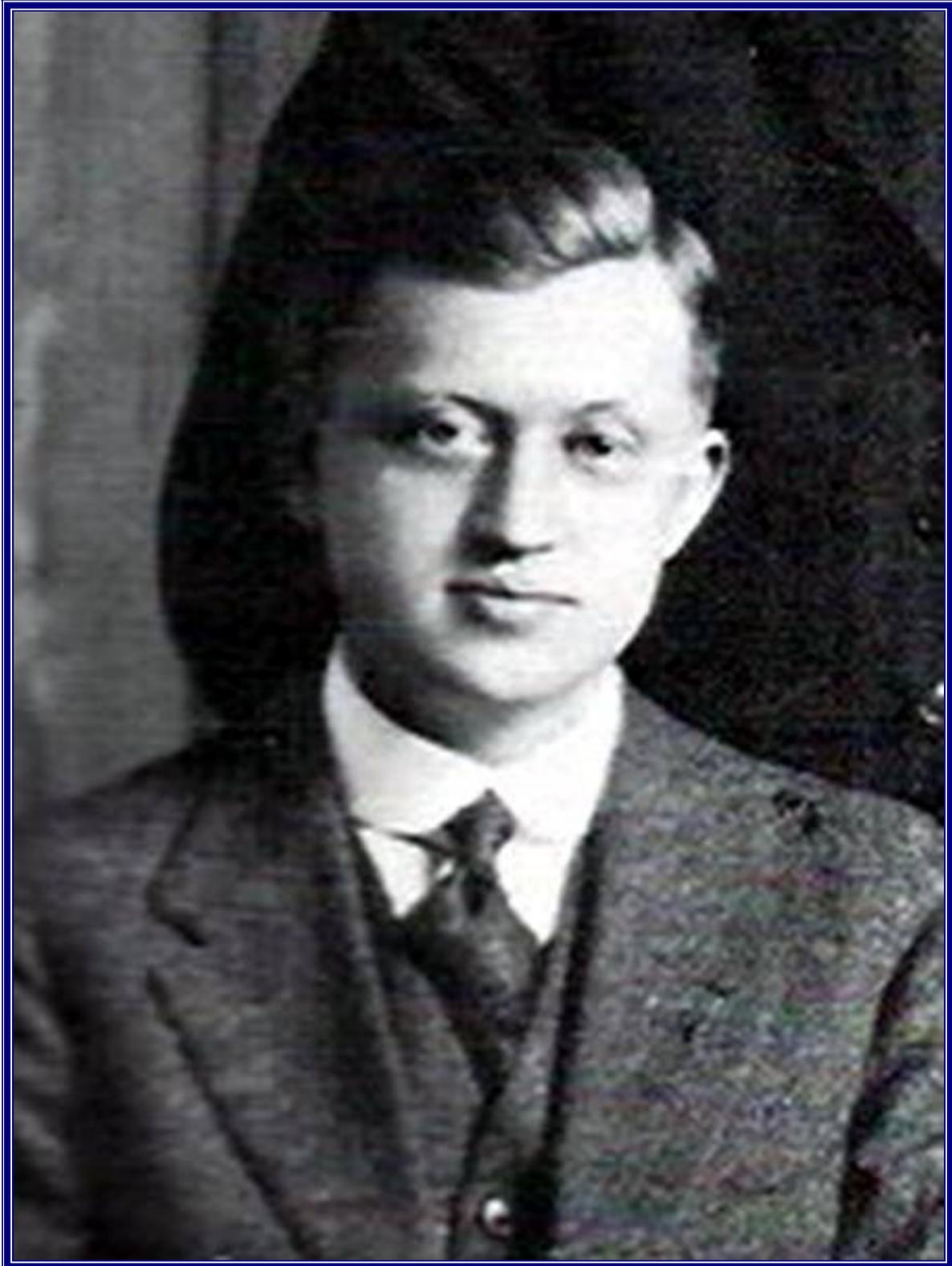


# L LOGAN LEWIS

*By EurIng Brian Roberts, CIBSE Heritage Group*



Leo Logan Lewis, 1887-1965: President ASRE 1941

L Logan Lewis was born in 1887, but details of his education and early career have not been found. He joined Carrier Air Conditioning Company of America (then a subsidiary of Buffalo Forge Company), in 1909 as Chief Engineer, an organisation founded in 1907, which had Willis H Carrier as Vice-President and J Irving Lyle as Sales Manager. The Wendt brothers, William and Henry, who owned Buffalo Forge, were President and Treasurer respectively. As World War I started in Europe in 1914, Buffalo Forge uncertain about the future of air conditioning, decided to close down Carrier Air Conditioning Company of America.

Although Carrier and Lyle would still have jobs, they were both unhappy that all their long, hard work in building the air conditioning industry would be wasted. The idea of forming a new company was discussed and “the result was that seven young engineers banded together, staked their fortunes and futures, grasped opportunity and started the Carrier Engineering Corporation, incorporated in New York State on June 26, 1915.” Willis H Carrier was elected President & Chief Engineer with J Irvine Lyle serving as Treasurer & General Manager. The other founders included L Logan Lewis as Chief Applications Engineer.



**The Founders of Carrier Engineering Corporation**

The early silent cinema experienced problems due to lack of ventilation, while in the warmer states of the USA the summer heat and the smell of the audience, to say nothing of the humidity, became unbearable. The only answer at the time was to close in summer months. One attempted solution, widely adopted, was the installation of powerful roof fans, relying on open doors for make-up air. (By 1923, the Typhoon Fan Company of New York had equipped some 1500 cinemas in this way). An alternative solution was the introduction of the “air-dome” cinema, built outdoors and without a roof, showing films in the late evening.

It became apparent that using mechanical refrigeration was the only real solution. Ammonia systems were in common use at this time, but the toxicity of ammonia was judged an unacceptable risk to large audiences. The way forward was promoted by a Chicago engineer, Fred Wittenmeier, who from around 1917, successfully used carbon dioxide refrigeration machines with direct-expansion cooling coils in a spray washer {See Appendix}. However, the method of supplying cold air through mushroom ventilators beneath seats led to complaints of draughts.



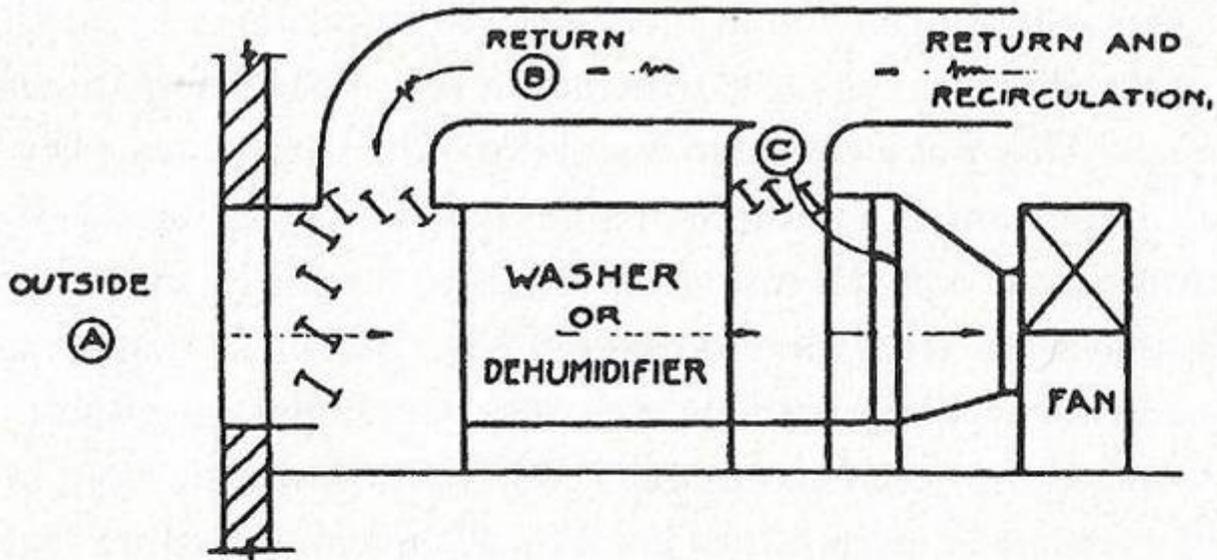
Early US cinema air conditioning systems discharged cold air near the feet of the audience

Meanwhile, Carrier Corporation and Logan Lewis developed their own solution to air distribution in cinemas and for their 1922 air conditioning installation in Grauman's Metropolitan Theatre in Los Angeles they introduced the supply air at ceiling level. (This became known as the "upside-down" system). The original high-level supply air system was not a complete or immediate success. As Lewis explained: "The problem appears to have been a reluctance by the architect to use distributors, trumpet-shaped outlets that diffused the air gently over a wide area.....architects found their appearance objectionable in these elaborate movie palaces." However, engineers found a way to satisfy both aesthetic and technical requirements by using the pan outlet, a panel hung below the discharge over which the cold air diffused.



**The Metropolitan Theatre in Los Angeles**

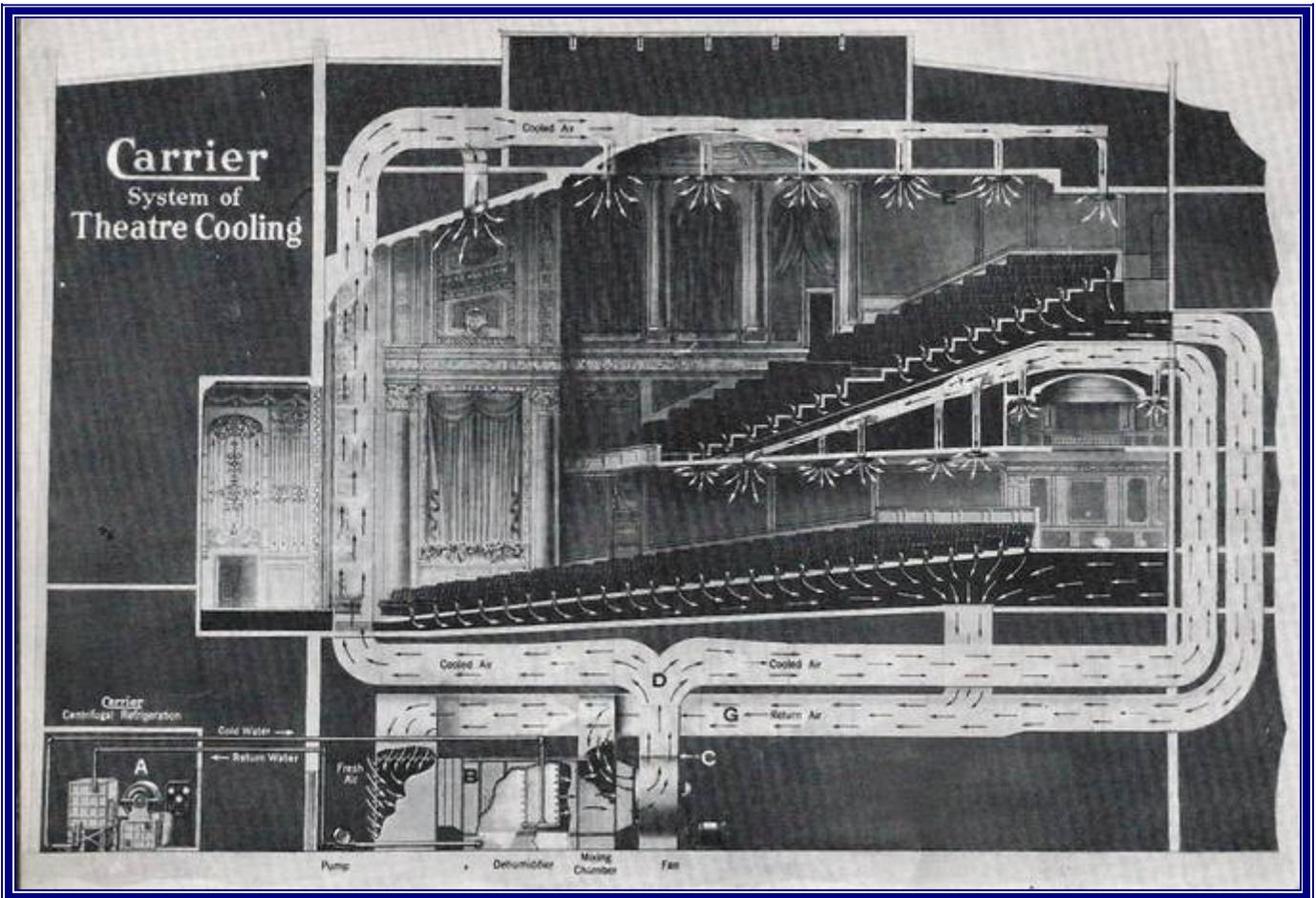
**The Metropolitan, owned by Sid Grauman, opened in 1922 and was designed by architect William Lee Woollett with a seating capacity of 3485.**



*Bypass. As depicted here, in bypass circulation, air is returned from the air-conditioned room and bypassed around the air washer at C. This warmer, recirculated air raises the temperature of the treated air to bring it up to a proper level of humidity and comfort before it is reintroduced into the room. Bypass circulation proved to be the most economical way to achieve humidity control in comfort air conditioning, and consequently the patent holders captured an estimated 90 percent of the comfort air-conditioning market.*  
*(Refrigeration Engineering 15 [May 1928]: 122)*

Another innovation by Logan Lewis was the provision of a return air bypass control arrangement which made a considerable reduction to the cooling load, for which he applied for a patent in 1924 and which was granted in 1926. However, after some 300 installations it was discovered that Carrier had infringed upon an earlier patent by Walter Fleisher. So in 1927, Carrier and Fleisher pooled their patents to form the Auditorium Conditioning Corporation. These patents were challenged by the York Ice Machinery Corporation who lost in court. It is said that by 1946 the Auditorium Conditioning Corp had licensed an estimated 90% of the comfort installations in the USA.

With the introduction of their centrifugal water chiller in 1922, Carrier Corporation became actively engaged in the development of air conditioning for "movie-theatres." In 1924, they air conditioned the Palace in Dallas, and then both the Iris and the Texan in Houston (the Iris had a chilled water storage tank fed from the centrifugal chiller in the Texan across the street). Then in 1925, Carrier Corporation installed air conditioning in the Rivoli, New York, where Willis Carrier had to overcome great difficulty in obtaining safety approval for their dielene refrigerant, not listed as approved. In 1926, Carrier Corporation recorded their sixteenth theatre contract when they provided the air conditioning to the Paramount in New York.



Lewis's "upside-down" system of air distribution as used in the 1922 air conditioning system for the Metropolitan in Los Angeles. In this diagram, the refrigeration (bottom left corner) is shown provided by a Carrier centrifugal chiller, but in the Metropolitan installation it was by a Carbondale machine as the centrifugal was not yet available, a decision Lewis later said that he regretted.

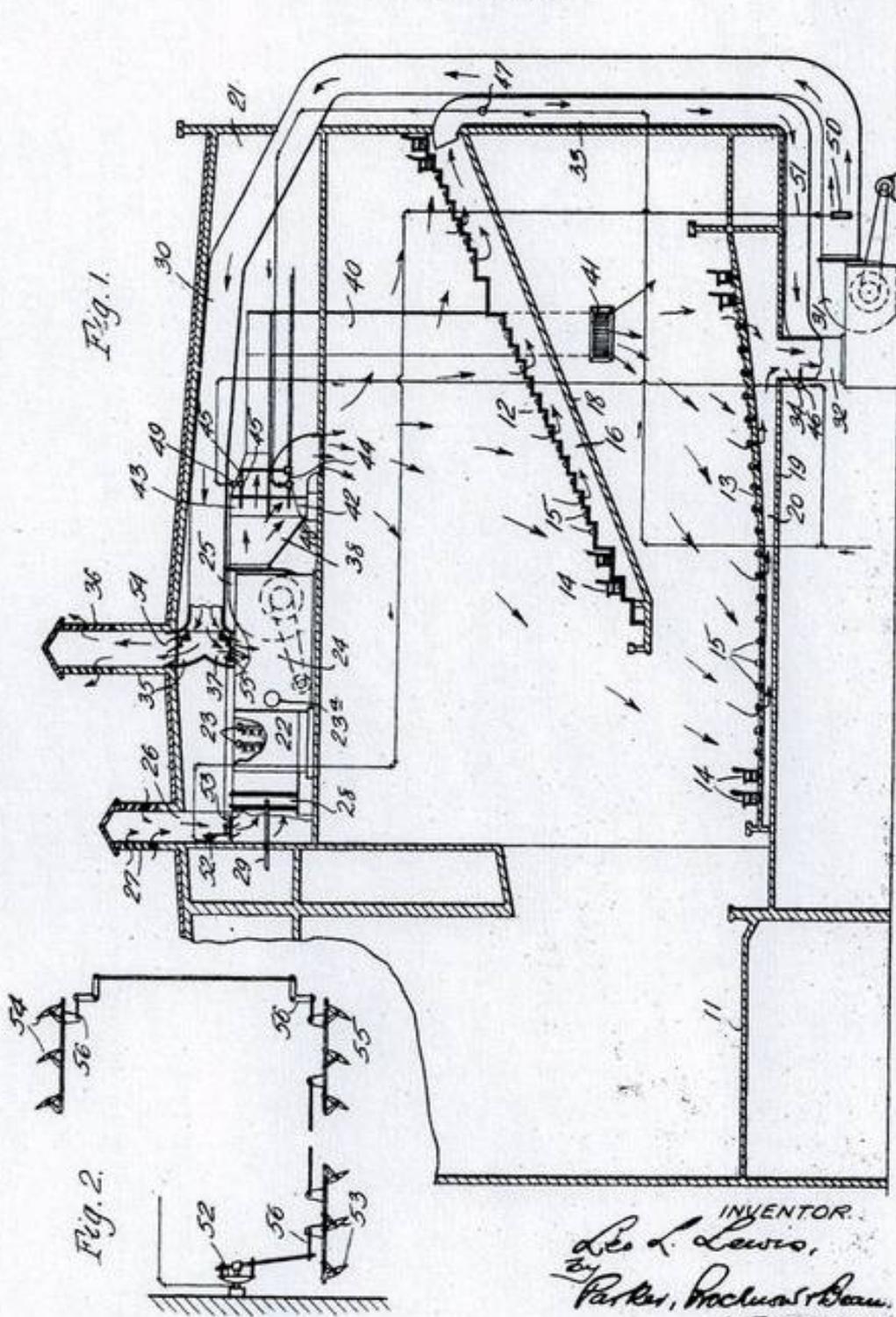
May 4, 1926.

1,583,060

L. L. LEWIS

METHOD OF AND APPARATUS FOR COOLING AND VENTILATING.

Filed Dec. 22, 1924



# UNITED STATES PATENT OFFICE.

LEO L. LEWIS, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO CARRIER ENGINEERING CORPORATION, OF NEWARK, NEW JERSEY.

## METHOD OF AND APPARATUS FOR COOLING AND VENTILATING.

Application filed December 22, 1924. Serial No. 757,389.

# REISSUED

*To all whom it may concern:*

Be it known that I, LEO L. LEWIS, a citizen of the United States, residing at Plainfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Methods of and Apparatus for Cooling and Ventilating, of which the following is a specification.

This invention relates to the cooling and ventilating of rooms or buildings and has reference more particularly to a method of and apparatus for cooling and ventilating which is especially adapted to be used in rooms or buildings where people congregate, such as theaters, auditoriums, assembly rooms, schools, and other enclosures occupied by people in considerable numbers.

For the greatest comfort of people assembled in such places, it is desirable to maintain a comparatively low relative humidity of the air, preferably not greater than about 50 percent, since a high relative humidity causes greater discomfort than a lower relative humidity with a higher temperature. It is also desirable, especially in the summer months to maintain the room temperature and humidity as low as practicable and to keep the air circulating so as to quickly absorb the heat and moisture from the bodies and exhalations of the people in the room. It is also important that the air admitted through the supply ducts or the like near persons in the room should not have a temperature more than about 8 degrees lower than the average room temperature or said air current will cause discomfort to the individuals.

In ventilating and cooling systems for similar purposes as heretofore designed, the greater part of the air which is recirculated is passed through a dehumidifier where its temperature is reduced as much as 25 degrees to 30 degrees below the dry bulb temperature in the room in order to reduce the relative humidity of the air which has been unduly raised as a result of the moisture respired and evaporated from the bodies of the people in the room. As the air at this low temperature was too cold to reintroduce into the room containing the people without discomfort to the latter, said air had to be reheated at additional expense so that the system is expensive to operate as to cost of

refrigeration and heating. This method moreover, requires the operation of a boiler during the summer season, which is objectionable.

An object of this invention is to produce a practical and efficient cooling and ventilating system for theaters and other enclosures in which people congregate in considerable numbers, in which a desirable temperature and relative humidity are maintained in the enclosure regardless of the number of people therein, and in which the air for ventilating and cooling is supplied to the enclosure with the greatest comfort to the people therein.

Other objects of the invention are to produce an efficient cooling and ventilating system which is economical in operation, and can be installed with a minimum initial investment; also to provide a cooling and ventilating system in which the bulk of the air is recirculated without being conditioned, and only a small part of the air supplied to the enclosure is taken from the outside and conditioned or dehumidified and then mixed with the recirculated air, thus saving in refrigeration, and eliminating the necessity of means for reheating the air during the summer months; also to provide a system of the class described, in which the conditioned or dehumidified air is perfectly blended or mixed with the recirculated air to produce a mixture having a sufficiently high temperature so as not to produce discomfort to the occupants when the mixed air is introduced into the enclosure; also to cause the requisite amount of vitiated air containing moisture evaporated and respired from the persons to be discharged out of the enclosure instead of being passed through the dehumidifier, thus saving in refrigeration; also to provide a system of the class described in which the admission of fresh air from the outside and the relief of vitiated air from the enclosure are automatically regulated so as to maintain the desired conditions of temperature and relative humidity in the enclosure, and also to improve cooling and ventilating methods and apparatus in other respects hereinafter specified and claimed.

In the accompanying drawings:

Fig. 1 is a diagrammatic sectional eleva-

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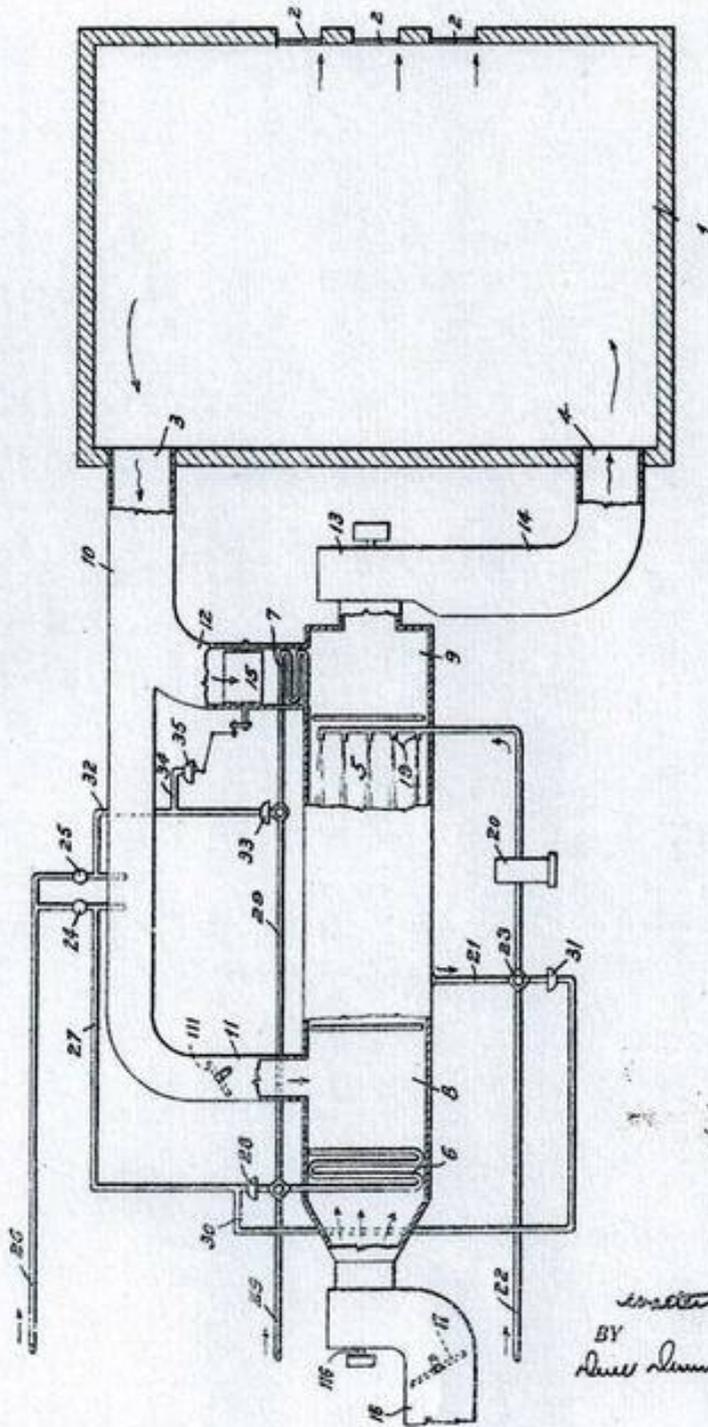
May 22, 1928.

1,670,656

W. L. FLEISHER

VENTILATING SYSTEM

Filed May 20, 1927



INVENTOR  
*W. L. Fleisher*  
BY  
*Wm. L. Anderson*  
ATTORNEYS

The Fleisher Patent

Patented May 22, 1928.

1,670,656

## UNITED STATES PATENT OFFICE.

WALTER L. FLEISHER, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO AUDITORIUM VENTILATING CORPORATION, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

VENTILATING SYSTEM.

REISSUED

Application filed May 20, 1927. Serial No. 192,898.

This invention relates to air conditioning apparatus and more particularly to systems intended to maintain desirable conditions within a public enclosure. In the ventilation of buildings it has been found that the comfort of the occupants is dependent not only upon the temperature, humidity, and purity of the air, but also upon air movement, this latter playing its part not only in its direct effect upon the occupants, but also in its services in maintaining a proper distribution of suitable air throughout the enclosure.

It is also desirable that there shall not be too great a difference in temperature between incoming air and the air in the room itself.

The problem of ventilating public enclosures, particularly theatres, is primarily a cooling and de-humidifying one, both winter and summer. In the winter time the natural dry outside air assists in this, but in the summer time the effect is opposite; in either instance, the outer air may differ very widely, both in temperature and moisture content from that desired in the room.

On the other hand, the air within the room, with an automatic system of control, is fairly constant, in both respects, and is quite close to the condition desired. Great economies may be thus effected by utilizing, insofar as possible, air coming from the room itself rather than outside air. This withdrawn or recirculated air is preferably used for two purposes. First, because of its close approximation to the standard desired, it may be used in part at least, as the air to be conditioned intensively to restore the room conditions. Second, it may be used to increase the volume of circulating air and to dilute the intensively conditioned air so that it shall not differ too much either in temperature or humidity from the standard to be maintained.

It is an object of the present invention to provide a system which will accurately control and maintain the predetermined conditions within the room and which will employ a minimum of power and which will operate satisfactorily under widely varying conditions of outside air and in spite of wide changes of heat and moisture given off within the room.

For a fuller understanding of the nature and objects of the invention, reference

should be had to the following detailed description taken in connection with the accompanying drawing, which is a diagrammatic representation of a system embodying important features of my invention.

In the drawings the numeral 1 represents a room or building to be ventilated, having diagrammatically represented at 2 the customary windows and doors. Suitable outlets and inlets 3 and 4 are provided, and means are provided for withdrawing air from the outlets and back in through the inlets. In practice there will be, generally, a plurality of both inlets and outlets, properly distributed throughout the building and it is to be understood in the present invention, that a proper and suitable distribution will be employed. Only one inlet and one outlet have been shown in the drawing, as the specific distribution does not form a part of this invention.

Where a conditioning problem is primarily a dehumidifying one, and the dehumidification is to be effected by refrigeration, it is more economical intensively to dehumidify a small body of air than extract the same quantity of moisture from a larger body. Moreover, the effect of refrigeration can be most efficiently produced upon air within the temperature limits involved in ventilation, by bringing such bodies of air into direct contact in the form of a spray. The particular embodiment of the invention herein illustrated, therefore, embraces this principle of dehumidification.

Thus, as shown, conditioning apparatus comprises, generally, a washer 5, connected with heaters 6 and 7, and mixing chambers 8 and 9. The term conditioning apparatus will be used herein to refer to the washing apparatus, as it is well understood that the washer not only purifies the air, but is also used to dry or humidify the air, dependent upon the temperature of the wash water employed and the condition of the air to be washed. The exhaust air from the outlet 3 is carried by a conduit 10 having two branches, one of which, 11, leads to the mixing chamber 8 at one side of the conditioning apparatus, while the other branch 12 leads to the other mixing chamber 9 at the other side of the conditioning apparatus. The mixing chambers 8 and 9 are in direct communication with the conditioning apparatus



Logan Lewis continued in the air conditioning industry having claimed “that by 1918 he had designed or directed the installation of 400 air conditioning plants, worth an estimated \$2.5 million, in more than 70 industries.” He served as President ASRE in 1941. By 1950, Lewis was a Vice-President of Carrier Corporation. He died in 1965.

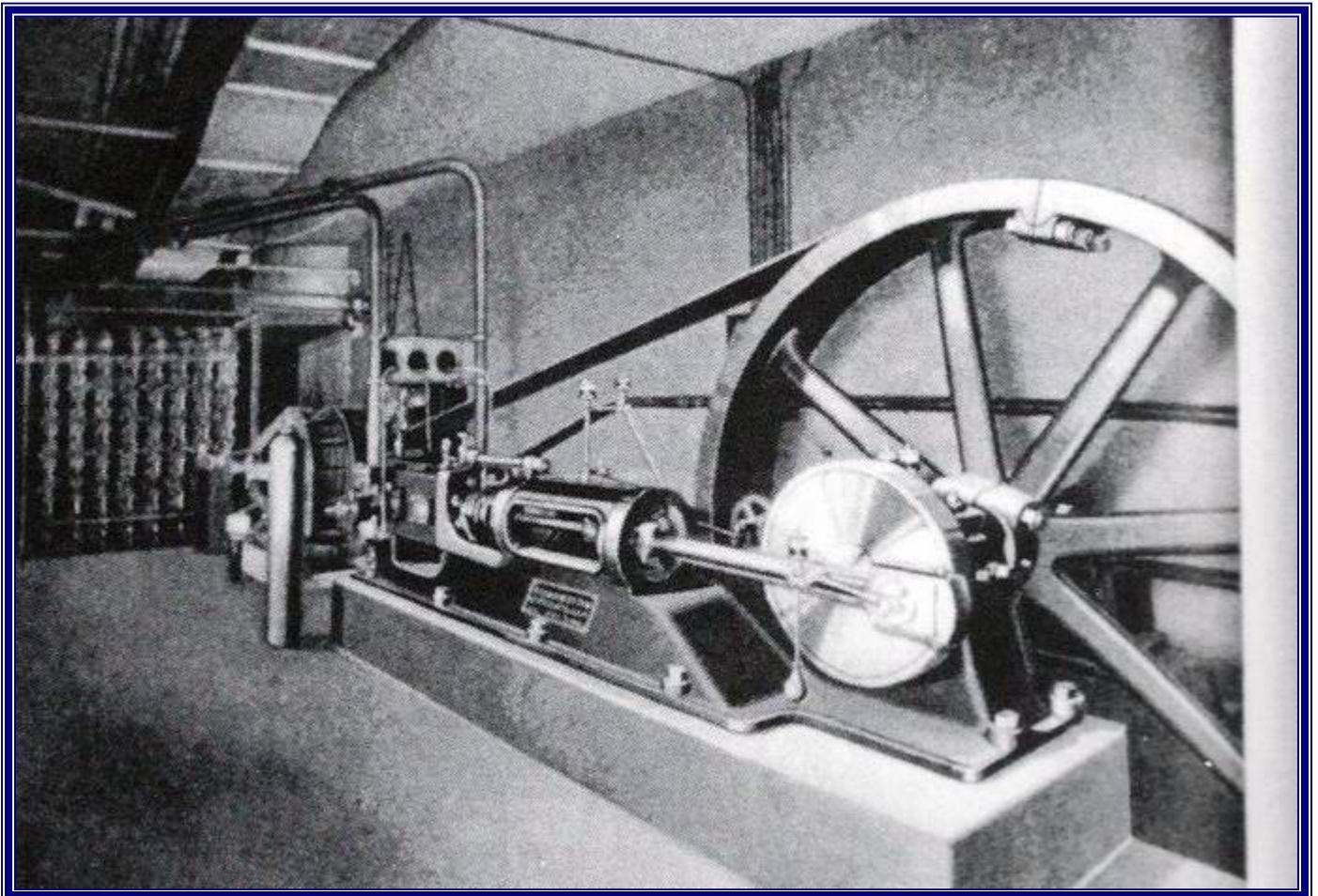
### **Footnote**

Air conditioning was late in coming to UK cinemas and initially was due to the Carrier Engineering Company Ltd (CEC) of London (established in 1921 with a 50% US Carrier shareholding). In 1927, CEC installed a ventilation and air washer system for the Broadway cinema in Stratford, London. The first fully air conditioned cinema in the UK was by CEC for the Carlton Theatre in London’s Haymarket in 1927, employing a Carrier centrifugal chiller. This was followed, in 1928, by the CEC air conditioning of the Empire in London’s Leicester Square, and, in 1930, by an installation for the Paramount Theatre in Manchester.

## APPENDIX

In 1917, the Chicago cinema chain of Balaban & Katz opened their Central Park Theatre with a comfort cooling system designed by Frederick Wittenmeier, Chief Engineer for the Kroeschell Brothers Ice Machine Company. He overcame safety concerns by using carbon dioxide as the refrigerant. (Wittenmeier claimed to have introduced carbon dioxide refrigeration into the USA using the patents of Julius Sedlacek). The air conditioning system in the Central Park incorporated features from Wittenmeier's 1911 patent and was designed to maintain 78 degF dry bulb temperature in the theatre when the outside dry bulb was 96 degF. (However, he believed that the resulting 75% relative humidity was acceptable, a view not shared by Logan Lewis).

In 1917, Wittenmeier established the Wittenmeier Machinery Company which he headed until his death in 1927. The Central Park air conditioning proved so successful that Balaban & Katz made it a standard feature in their expanding chain: The Riviera (1910), the Tivoli (1921) and the Chicago (1921). These pioneer installations led to the widescale adoption of cinema air conditioning across the USA.



The refrigeration system at the Central Park Theatre in Chicago.

F. WITTENMEIER.  
 AIR COOLING APPARATUS.  
 APPLICATION FILED MAY 18, 1911.

1,003,129.

Patented Sept. 12, 1911.

2 SHEETS-SHEET 1.

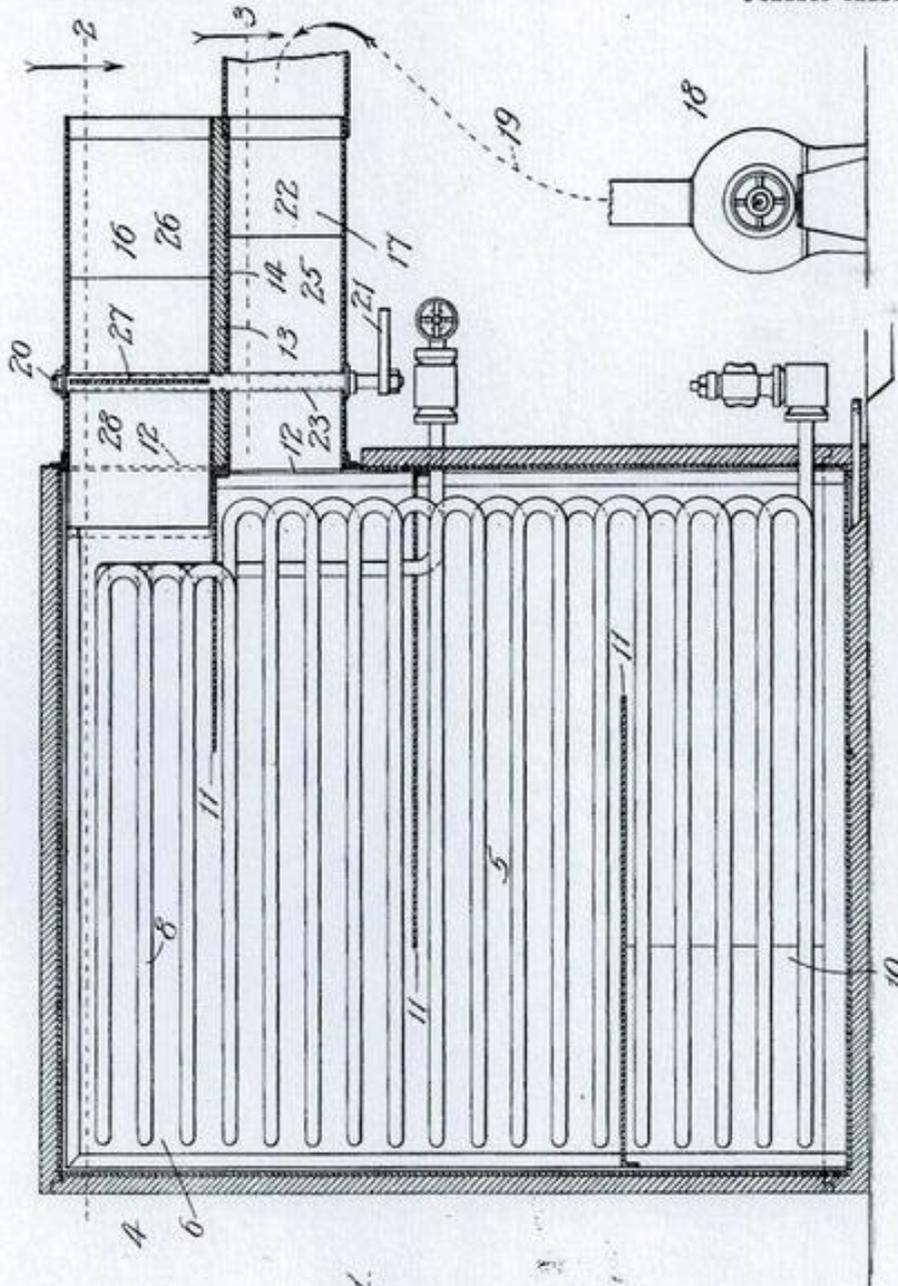


Fig. 1.

Witnesses:  
 Chas. H. Bull,  
 J. J. Chase

Inventor:  
 Frederick Wittenmeier  
 By D. J. Dyerforth, Les. Critton & Co.  
 Attys.

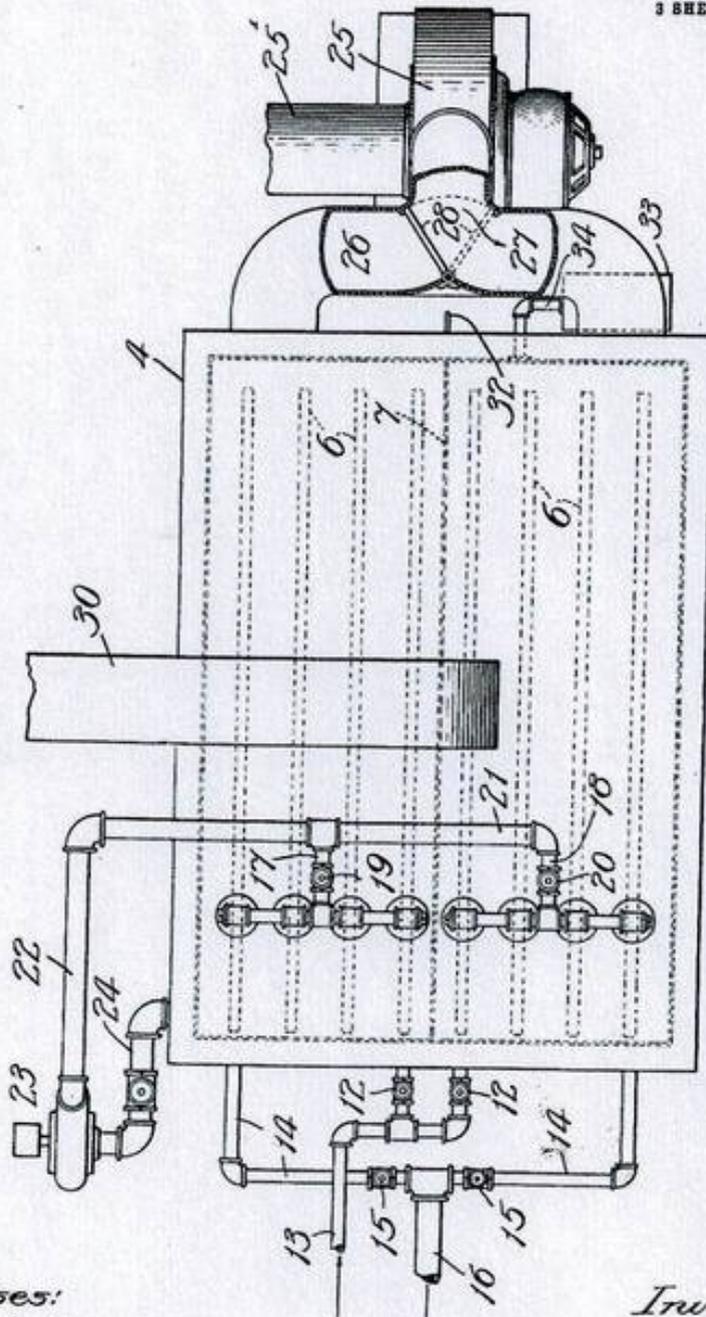
F. WITTENMEIER.  
 AIR COOLING APPARATUS.  
 APPLICATION FILED OCT. 26, 1910.

988,613.

Patented Apr. 4, 1911

3 SHEETS-SHEET 1.

Fig. 1.



Witnesses:  
*Carl J. ...*  
*Chas. H. ...*

Inventor:  
 Frederick Wittenmeier.  
*By ...*  
*Attys.*



# RIVIERA

**BALABAN & KATZ**

Announce the Only Air Refrigerating  
Systems in Theatrical Use

—at the—

**Riviera Theatre**

Broadway and Lawrence

**Central Park Theatre**

W. 12th St. and Central Park

Refreshingly cool air, as invigorating as the balmy mountain breezes, undeniable beauty and exquisite entertainment are the valued possessions of these wonder theaters.

## OUR FREEZING PLANT

(JUST INSTALLED)

**Removes the Temper  
from Temperature**

It provides fresh and exhilarating air, chilled to any degree of coolness necessary to our patrons' comfort.

No Heat Is So Intense But That It  
Succumbs to Its Treatment—No  
Humidity So Great But That It  
Disappears Under Its Influence

If you want to escape the summer's heat and humidity and at the same time enjoy the season's best cinematic offerings artistically exploited, visit the RIVIERA and CENTRAL PARK Theaters.

# CENTRAL PARK

## Early Twentieth Century Cinemas

### Warners' Theatre, New York



**Date Built/Opened:** 1926 (built as Piccadilly Theatre c.1924) The photo is of the premiere of the movie "Don Juan" with a prerecorded music soundtrack by Vitaphone which predated the first talkie "The Jazz Singer"

**Seating Capacity:** 1322

**Architect:** Originally Joseph Orlando & Newton L Schloss

**HVAC Engineer:** Wittenmeier, New York

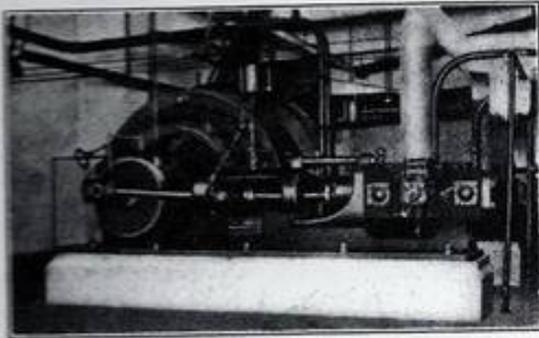
**HVAC System:** Mechanical ventilation "vitolized air" with air washer and probably CO<sub>2</sub> refrigeration. Note under the canopy the icicles and the slogan "Refrigerated Washed Air"

**Status:** Demolished

**References:** *The Movie*, Issue 1, 1979

# Ventilation

## Complete Air Conditioning Installations Cooling—Refrigerating—Washing



*Wittenmeier Horizontal Compressor CO<sub>2</sub>*

### *A Few Representative Installations*

CAPITOL THEATRE, New York, N. Y.  
WARNER BROS. THEATRE, New York, N. Y.  
KEITH'S FORDHAM, New York, N. Y.  
LOEW'S NEW ROCHELLE, New Rochelle, N. Y.  
FOX ACADEMY OF MUSIC, New York, N. Y.  
UNITED ARTISTS THEATRE, Los Angeles, Calif.  
METROPOLITAN THEATRE, Boston, Mass.  
PYTHIAN TEMPLE, New York, N. Y.  
ELKS CLUB, Union Hill, N. J.  
MASONIC TEMPLE, Kansas City, Mo.  
ILLINOIS ATHLETIC CLUB, Chicago, Ill.  
UNION LEAGUE CLUB, Chicago, Ill.  
N. Y. COUNTY COURT HOUSE, New York, N. Y.  
FEDERAL RESERVE BANK, Chicago, Ill.  
U. S. NAVAL HOSPITALS, San Diego, Calif.  
CONCOURSE PLAZA APTS., New York, N. Y.  
RALEIGH APTS., New York, N. Y.  
WEYLIN HOTEL, New York, N. Y.  
MONTAUK POINT HOTEL, Montauk Point, N. Y.  
RITZ-CARLTON HOTEL, Boston, Mass.  
NEW BEDFORD HOTEL, New Bedford, Mass.  
AMBASSADOR HOTEL, Chicago, Ill.  
WINDERMERE HOTEL, Chicago, Ill.  
AUGUSTINIAN FATHERS, Staten Island, N. Y.  
BOARD OF EDUCATION, Chicago, Ill.  
N. Y. TELEPHONE COMPANY, New York, N. Y.  
NATIONAL CITY BANK, New York, N. Y.  
WRIGLEY BUILDING, Chicago, Ill.  
TRIBUNE BUILDING, Chicago, Ill.  
KINGS COUNTY HOSPITAL, Brooklyn, N. Y.  
CITY OF NEW YORK NURSES' HOME, Welfare Island, N. Y.  
NORTH COMMUNITY HOSPITAL, Glen Cove, N. Y.  
MICHIGAN CHILDREN'S HOSPITAL, Detroit, Mich.  
ILLINOIS CENTRAL R. R. HOSPITAL, Paducah, Ky.  
NORTHERN PACIFIC HOSPITAL, St. Paul, Minn.  
LUCKEY PLATT DEPT. STORE, Poughkeepsie, N. Y.  
HORNE DEPT. STORE, Pittsburgh, Pa.  
CURTISS CANDY CO., Chicago, Ill.  
ALBERT PICK & CO., Chicago, Ill.  
TRIANON BALLROOM, Chicago, Ill.

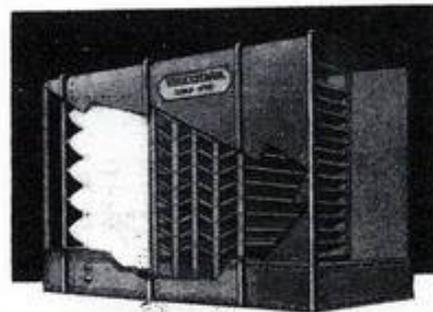
WHEREVER comfort and efficiency require cooled or refrigerated air, Wittenmeier-Vitolyzed-Air equipment delivers it.

In hundreds of theatres, hotels, clubs, restaurants, apartment houses, schools, hospitals, and industrial plants our installations give perfect service.

Simple in design, construction and in operation, once installed they become almost automatic, requiring a minimum of time on the part of mechanic or engineer.

No matter what problem of cooling or refrigeration presents itself to you, we have sometime, somewhere faced and solved a problem similar in its main essentials—and installed the necessary apparatus.

Our experience is at your service. Full information supplied gladly upon request.



*Air washer and eliminator as installed by Wittenmeier-Vitolyzed-Air*

*One Contract---One Responsibility*

# WITTENMEIER-VITOLYZED-AIR

1926 BROADWAY—NEW YORK CITY

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*The Comfort Makers*, Brian Roberts, ASHRAE, 2004

*HVAC in Early Theatres & Cinemas*, Brian Roberts, ebook on the CIBSE Heritage Group website:  
[www.hevac-heritage.org](http://www.hevac-heritage.org)