Air Conditioning American Movie Theatres
1917-1932

Technical Papers 2

Overhead Air Conditioning Installed in
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Overhead Air Conditioning Installed in New Universal Theatre

Exhibitors Herald
1927

Two interior views of Universal's new theatre in Brooklyn. This is the first atmosphere house in the East.

At the left is the upper lounge. In the center of the page is pictured a Venetian fountain.

Overhead Air Conditioning Installed in New Universal Theatre

Million and a half dollar house is designed by John Eberson

ONE of the features of the new Universal theatre in Brooklyn, an atmospheric house designed by John Eberson, is the air conditioning system.

This system is said to be considerably different than the installations usually made in modern theatres in that it is an entirely overhead system. To explain, the air supply for the theatre enters the auditorium at nearly the ceiling line of blue sky level. This fresh tempered washed air in turn is exhausted through mushrooms or air diffusers in the auditorium floor and through registers in the risers of the balcony steppings. This idea is carried out for both the winter heating season and the summer cooling season. This system, it is said, so evenly distributes air throughout the entire auditorium that one's extreme comfort is assured in any of the 3,000 seats.

Ninety-five thousand cubic feet of air per minute enters the fresh air shaft leading to the main supply fan. Before the air reaches the fan it must pass through a huge air washer which takes out all of the dust particles and thoroughly cleanses it. The supply fan or blower then forces the air through the heater chamber in which are located six Reynolds Unit Heat-Generators. A bypass arrangement allows a portion of the air to go over the Generators and mix with the tempered air assuring correct temperatured air for distribution through the theatre. From the standpoint of economy of operation it is said that only one or more of the Generators need to be fired, depending upon the outside weather conditions. This eliminates keeping of a steam boiler going at all times. Where the air comes in direct contact with the heating surface, as it does in this blast system, the efficiency is said to be increased as there is none of the usual loss through steam pipes, coils, etc.

A large air supply shaft carries the air from the heater chamber to the attic space over the ceiling where in a cork insulated duct it is distributed to the large ventilating beam across the rear of the balcony ceiling, as well as to the front of the auditorium, being discharged

through hidden openings behind the decorative organ lofts on either side of the proscenium arch. The low velocities at which this air enters prohibits objectionable drafts. A large exhaust fan capable of handling practically 60,000 cubic feet of air per minute draws the air out through the floor openings in the balcony and auditorium floors discharging it to the atmosphere.

For the sake of economy proper dampers are installed throughout the

(Continued on page 33)

UNIVERSAL added a magnificent theatre to its growing chain recently, when it opened a 3,000 seat deluxe house in Brooklyn. The theatre, which cost $1,500,000, is called the Universal. Of the atmospheric type, adapted in design from the Italian garden, it is architecturally, another notable achievement of John Eberson.

Carl Laemmle, head of Universal, personally represented his company at the gala premiere, which was also attended by many other notables, including James J. Byrne, president of the borough, and Ralph Jonas, president of the Brooklyn Chamber of Commerce. Dimples Lido, whom Carl Laemmle, Jr., recently brought to this country from Europe to appear in Universal pictures, also was present.

Up-to-the-minute in every theatrical detail, the Universal is also an edifice of impressive beauty. The exterior is arresting, not only in size, but also in design, without, however, being garish. It is located in the growing residential section of Boro Park and aesthetically is thoroughly compatible with its environs.

The lobby is spacious and is done in polychrome, with odd colorings that have a curiously fascinating effect upon the observer, particularly as they change and blend under the soft, yellow glow of the golden lamps in the massive, wrought-iron chandeliers.

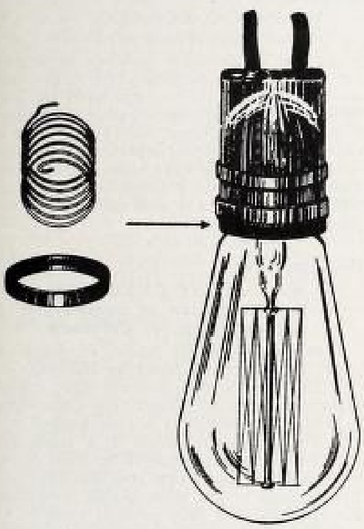
The great auditorium gives the impression of being a huge Italian garden beneath a warm Mediterranean night. Stars shimmer in the vast domed blue, while misty clouds hide them for a moment as they glide on their way. The walls represent garden walls, with trees and shrubbery just beyond. While sitting between them, the effect is one of freedom and quietude.

The Universal has opened with a policy of pictures and stageshows, with a permanent orchestra offering musical novelties. Vaudeville and presentation artists will be presented, many of them in acts designed especially to appeal to the theatre's clientele. Bills are to change twice weekly.

Besides a style of architecture entirely unlike that of most theatres in the East, the Universal is further distinguished by two electric signs, one on the marquee, the other upright, which are among the largest in the country.

Weather Proofed Hubbell Sockets Take Ren Locks

The Ren Manufacturing Company of Winchester, Mass., announces that Ren Locks have been installed in moulded, composition weather proof sockets. These



locks may now be obtained, the company states, in the new Hubbell No. 43310 and No. 60666 composition sockets.

The Ren Lock is made in one style only. It consists of a coiled spring and a grooved ring. Likewise, there is only one style of punch for applying the lock.

These locks may be used interchangeably on brass and porcelain sockets and receptacles and on Hubbell weather proof sockets.

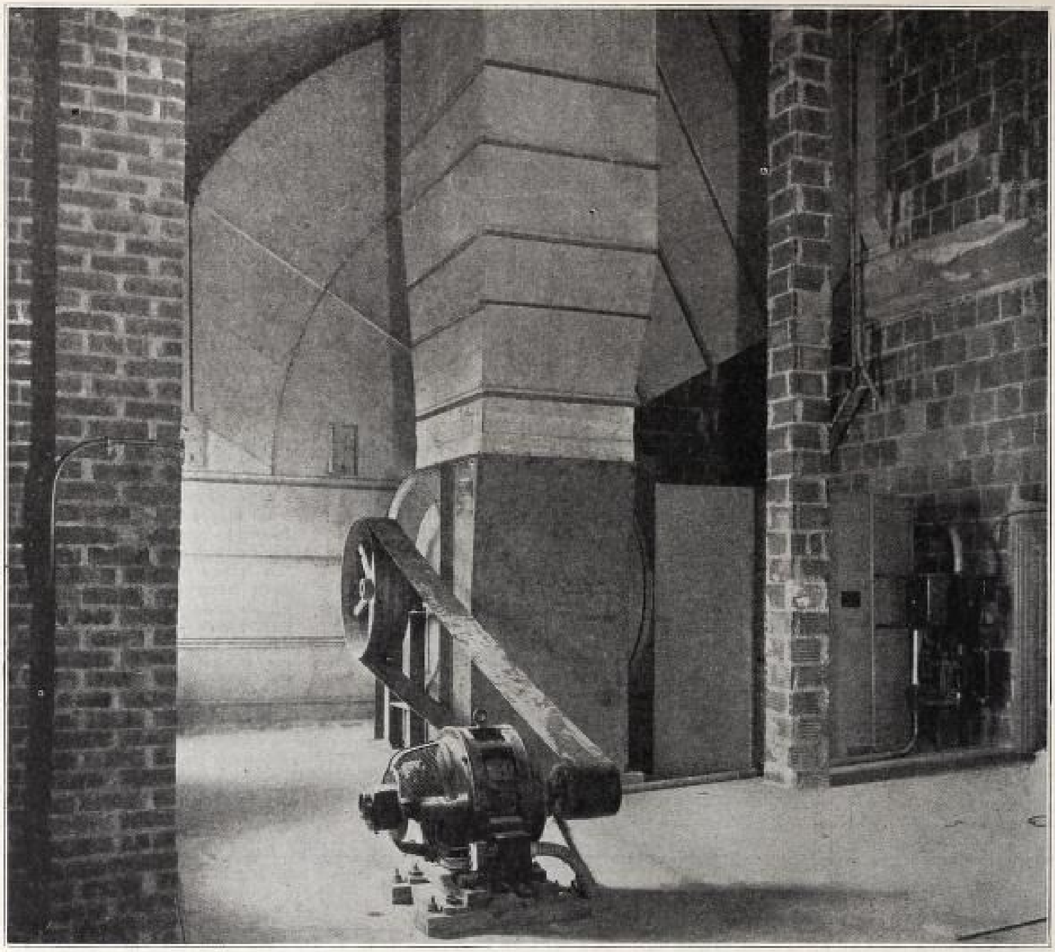
Overhead Air Conditioning System Installed

(Continued from page 31)

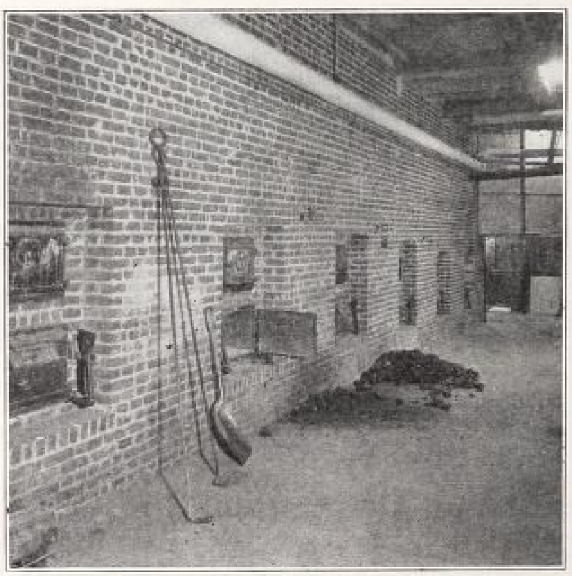
system enabling the air to be either completely or partially recirculated when desired. Auxiliary duct work carries the air to the lounge on the tunnel floor, the main foyer and lobby, as well as the women's and men's lounges, smoking and toilet rooms. Separate smaller exhaust fan systems are installed to carry off the impure air in the smoking and toilet rooms, as well as the sub-stage rooms, such as the musicians' library, rest room, toilets, dressing rooms, etc.

Another important part of the system is the installation of refrigerating machine equipment of the carbon dioxide safety type capable of developing 225 tons of refrigeration every 24 hours. A huge synchronous 300 horsepower motor is directly connected to vertical three-cylinder compressure of the modern type. This again assures the patrons that even in the hottest summer weather they will still enjoy the comfort of a truly atmospheric type theatre.

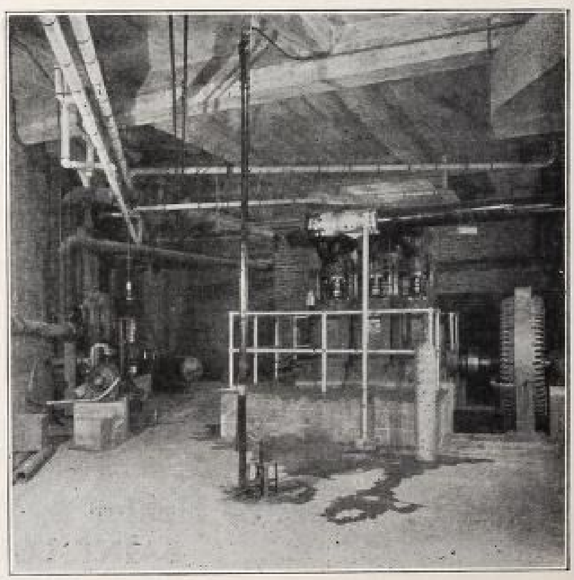
Large ornamental plaster grilles placed in the front and rear of the balcony soffit evenly distribute air in that portion of the rear of the auditorium floor which many times is uncomfortable due to the low ceiling height. Furthermore, this distribution has been so carefully designed by engineers specializing in theatres that no drafts are noticeable anywhere.



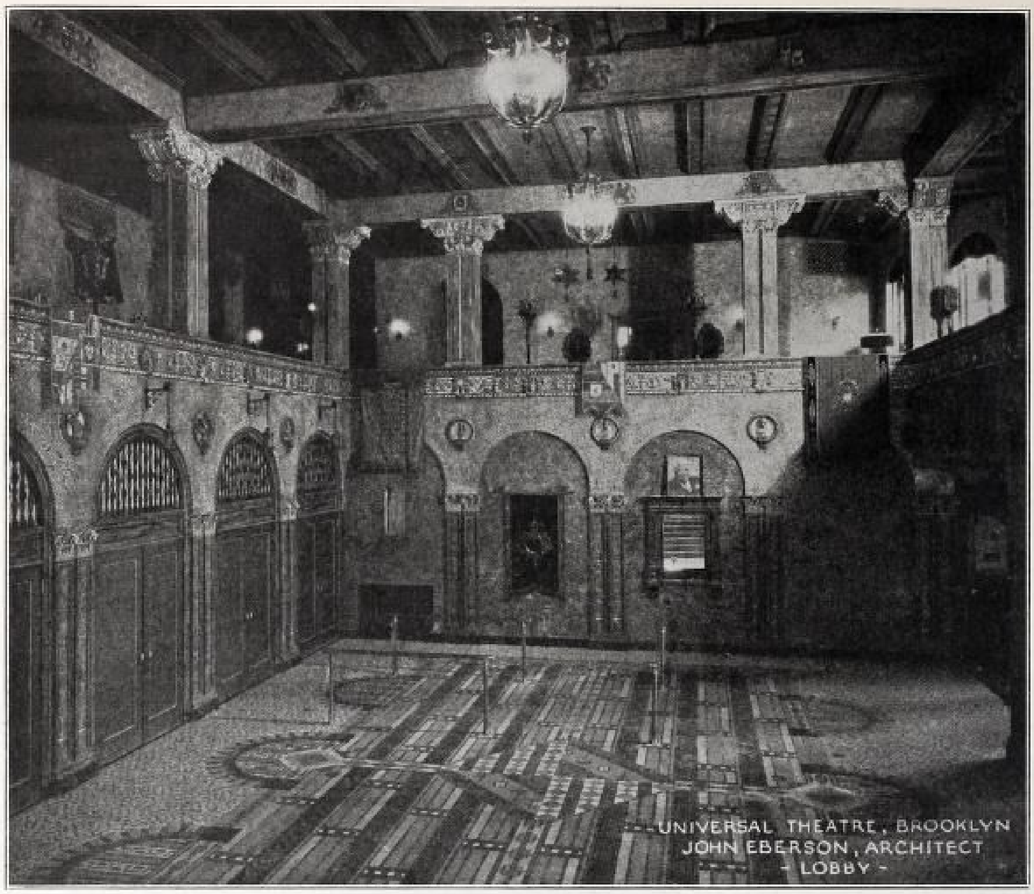
Photograph shows exhaust fan room in air-conditioning system installed in new Brooklyn theatre. The large blower exhausts the air to the outside; the large sheet metal duct in the rear carries the main supply of air into the attic duct work where it is distributed through the auditorium.



The firing room with the bricked in heat generators in the B. F. Reynolds system installed in Universal house, recently opened in Brooklyn.



Above is a view of the refrigerating equipment which is a part of the air-conditioning system of the theatre. This is an over-head system.



UNIVERSAL THEATRE, BROOKLYN
JOHN EBERSON, ARCHITECT
- LOBBY -

UNIVERSAL THEATRE, BROOKLYN
JOHN EBERSON, ARCHITECT
MEZZANINE PROMENADE - LADIES PARLOR

HEATRE, BROOKLYN
SON, ARCHITECT
ENIUM ARCH

East's First Atmospheric Theatre

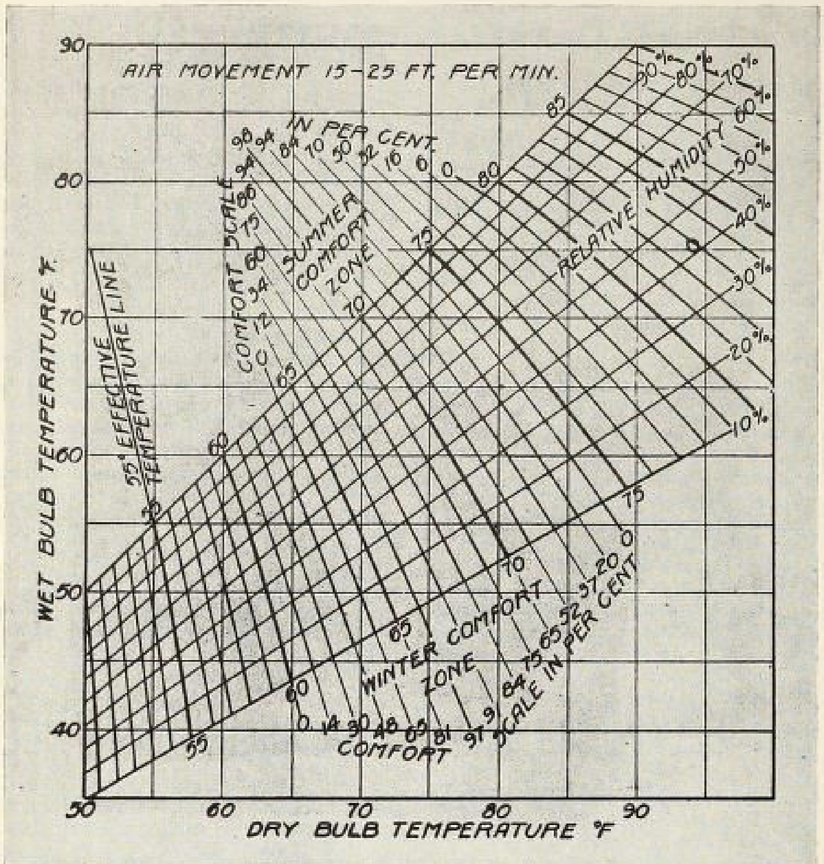
New Universal house in Brooklyn was designed by John Eberson, noted Chicago architect whose atmospheric theatres have become popular throughout world

Air Conditioning American Movie Theatres
1917-1932

Air Conditioning Guide Sheets Nos. 1-4

J T Knight Jr
1933

AIR CONDITIONING: GUIDE SHEET NO. 1



EFFECTIVE TEMPERATURE CHART

SHOWING SUMMER AND WINTER COMFORT ZONES

[The first of four charts applied to theatre air conditioning]

To the management of theatres which have complete air conditioning equipment, this chart is a guide in checking the performance of equipment, in determining the skill of the engineer (or other employe in charge), and in keeping advised of the comfort of patrons. The house manager should have both wet and dry bulb thermometers located at advantageous spots throughout the theatre so that he can check conditions personally from time to time. Understanding this chart, and keeping it handy, he will find it easy to keep a constant check on the operation of the plant.

The engineer should have a copy of the chart and be instructed in its use, for this chart is a measure by which the manager and the engineer may judge the results obtained from the equipment.

Ventilation and air conditioning are elements of patron comfort, and patron comfort is a progressive sales argument and should mean money at the box office.

The chart can be thoroughly understood with a little study of the simplified explanations and examples here accompanying it.

DEFINITIONS

EFFECTIVE TEMPERATURE: The resultant degree of comfort from any combination of readings of the wet and dry bulb thermometers, as evidenced by a person through his sense of feeling.

EFFECTIVE TEMPERATURE LINES: Lines on a chart indicating points resulting from various combinations of wet and dry bulb readings which produce equivalent effects of physical comfort.

DRY-BULB TEMPERATURE: The reading indicated by the ordinary thermometer.

WET-BULB THERMOMETER: An ordinary thermometer which has its bulb covered by a piece of soft cloth which has been dipped in water before taking readings.

WET-BULB TEMPERATURE: The reading indicated by a wet bulb thermometer.

RELATIVE HUMIDITY: The percentage of water, or moisture in a unit of air at any given dry bulb temperature. This percentage is based upon the maximum quantity of water that would completely saturate that unit of air at the given temperature.

EXPLANATION OF CHART

DRY-BULB TEMPERATURES: Represented by vertical lines, with the value in degrees Fahrenheit (indicated on every alternate line along the lower edge of the chart). Multipls of 10° are indicated; the unmarked lines are 55°, 65°, 75°, 85°, and 95°, and between the lines you must interpolate values.

WET-BULB TEMPERATURES: Represented by horizontal lines, with values in degrees Fahrenheit (indicated on every alternate line along the left-hand edge of the chart). Multiples of 10° are indicated, the unmarked lines are 45°, 55°, 65°, 75°, and 85°, between the lines you must interpolate values.

Note: The extreme lower left-hand corner of the chart represents a reading of dry bulb 50° (this is indicated) and wet bulb of 35° (this figure 35 is not shown on the chart).

RELATIVE HUMIDITY: Indicated in percentage on diagonal lines extending from lower left-hand side toward the upper right-hand side.

EFFECTIVE TEMPERATURE: Indicated by diagonal lines extending from lower right-hand to upper left-hand, cutting across the relative humidity lines. Effective temperature values are indicated in degrees along the upper extreme relative humidity line.

SUMMER COMFORT ZONE: In the upper left-hand corner of this chart you will see the Effective Temperature lines from 64° line up to the 79° line, extended. Within this range of effective temperature lines you will see printed the words "Summer Comfort Zone." At the ends of these extended effective temperature lines, and enclosing the words "Summer Comfort Zone," you will note figures from zero—12, 34 and so on up to 98—then down to zero again. These figures represent the percentage of summer comfort resulting when the combination of wet and dry bulb readings in your theatre fall on a point on any of these effective temperature lines. See following examples:

Example No. 1—Dry bulb reading 75°, with wet bulb reading of 62½°, results in an effective temperature of 70°, which is 94% comfortable.

Example No. 2.—Dry bulb reading 80°, with wet bulb reading of 69½°, results in an effective temperature of 75°, which is only 50% comfortable.

In both examples the conditions assumed result in effective temperatures within the comfort zone, yet the conditions of the first example are far more desirable than the conditions indicated in the second example.

WINTER COMFORT ZONE: This zone is indicated in the lower right-hand corner of the chart. An explanation similar to the one above for the summer comfort zone would explain the winter comfort zone. You will note that the "Winter Comfort Zone" has its range of Effective Temperatures from 60° to 74°.

OBSERVATIONS FROM CHART

The summer and winter comfort zones overlap so far as Effective Temperatures are concerned. The Effective Temperatures from 64° to 74° are common to both zones

Effective Temperatures from 74° up to 78° indicate conditions which would be very uncomfortable in summer.

Effective Temperatures from 61° to 64° indicate conditions which would be very uncomfortable in winter.

These facts show conclusively that audiences can be comfortable in colder theatres in winter than they could possibly stand in summer. Also, that an audience can be comfortable in a warmer theatre in summer time than they could possibly stand in winter. The explanation for this is that people wear less clothing in summer and generally eat food with less heat value, and in addition the human body goes through certain physiological changes in conformity with the general seasons of the year.

Note: Though not indicated on this chart, Relative Humidity greater than 70%, or less than 30%, regardless of dry-bulb readings, are not to be desired in theatres.

BEST SUMMER CONDITIONS

Effective Temperatures between 68° and 74°.

Relative Humidity between 45% and 65%.

BEST WINTER CONDITIONS

Effective Temperatures between 64° and 69°.

Relative Humidity between 50% and 70%.

THEATRE WITHOUT CONDITIONING

What does this all mean to the theatre manager who has no air conditioning equipment, and is struggling along with, perhaps, two ancient fans? So far as improving conditions immediately it is not of any assistance. But by understanding this chart and by taking constant, regular readings in the theatre throughout a summer season, it is possible to judge just how badly that theatre needs additional equipment. It might be definitely learned that air conditions within the theatre are much worse than the owner had ever before believed.

OPERATING WITH FANS ONLY: The results of the regular readings should be plotted on cross-section paper. In this form it is possible to see the variations from day to day, and what is more important, just how many days during the summer when air conditioning equipment was actually needed. Whether the manager is also the owner or not, such a picture of the actual conditions should be most convincing.

IMPROVING FANS: To improve the fans already in the theatre the following suggestions are made:

1. Have the bearings of the fans checked. If they are worn or loose, replace them.

2. If the fan is driven by a belt, consider one of the more silent and efficient V-type drives.

3. Be sure that the fans are operated at maximum speed. Generally the higher the speed, the more air delivered into the theatre.

4. If these steps give a disturbing noise, consider (a) placing fans and motors on sound absorbing bases, (b) insulating and bracing connected duct work for sound absorption material, (c) placing staggered baffles in the ducts, these baffles should be of sound absorbing material

CREATING COOL EFFECT: Without air washers or air conditioning equipment, the only means of creating an apparent cool effect in a theatre is to put into it all the air possible with the equipment available. Fifteen or 20 cubic feet of air per minute per seat is not enough; get 40 or 50 if possible, even if it is necessary to alter your equipment to obtain this quantity.

OPERATING WITH FANS AND AIR WASHER: The theatre manager who has no air conditioning equipment other than fans and an air washer should note carefully what has been said previously about fans, fan speeds, noises and quantities of air in the foregoing case of the manager with fans only. These same thoughts apply in this case of fans and air washer.

For example, look at the chart and check the conditions represented by a dry bulb reading of 80°, and a wet-bulb reading of 65°. Looking along the bottom of the chart for 80°, follow up that vertical line until the horizontal line indicating the wet-bulb reading of 65° is reached. The point where these two lines cross represents this condition This point indicates a relative humidity of about 45%, an Effective Temperature of slightly over 73°, and summer comfort of about 80%, really very good conditions.

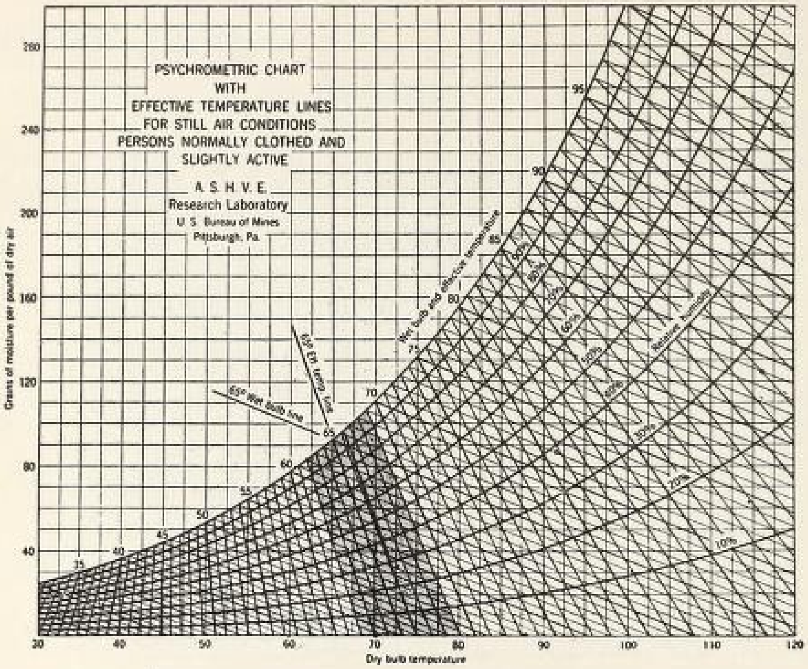
Assume that the water in your air washer system is approximately the temperature of the air (dry-bulb temperature, or 80°), which will be the case in a very few minutes after you start your air washer (unless the water in the washer tank is continually replenished from the city main and the surplus permitted to escape into the sewer through the overflow pipe). Under these conditions, with the air washer water at 80°, the use of the washer will only add moisture to the air, which increases its relative humidity. In effect, the point where the horizontal line 65° crosses the vertical line 80° would tend to rise along the vertical line and approach a wet-bulb reading of 80°, which would represent complete saturation at an 80° dry-bulb temperature. Therefore as the point approached while the washer is being used, would be the intersection of the vertical line 80° with the horizontal line 80°, and as this point falls completely without the comfort zone, it follows that by using the air washer it produces a condition far worse than if it had not been used.

Actually in practice this maximum condition would not be reached. Several elements prevents this from existing.

CHART CARDS

Instead of mutilating the magazine in order to place these guide sheets on air conditioning in a handy place for references, it is suggested that theatre managers and engineers write to Better Theatres indicating they would desire reprints of this material. If enough orders are received, each of the four charts will be issued, with condensed explanations, on durable cards of convenient size.

AIR CONDITIONING GUIDE SHEET NO. 2



PSYCHROMETRIC CHART: INCLUDING TEMPERATURE LINES FOR STILL AIR CONDITIONS

[The second of four charts applied to theatre air conditioning.]

This chart covers the same field as the Effective Temperature Chart presented in the July 1st issue of Better Theatres, plus some additional information. Though set up in slightly different form from the Effective Temperature Chart, this brief explanation, with some study on your part, should make it understandable.

METHOD OF CHART

DRY-BULB TEMPERATURES: Represented by vertical lines, with the value in degrees Fahrenheit indicated on every even multiple of ten lines; i. e., 30°, 40°, 50°, etc. The distance between each vertical line represents 2½ degrees—therefor, for odd degrees it is necessary to establish a point between two vertical lines.

WET-BULB TEMPERATURES: Represented by lines sloping from lower right-hand to upper left-hand at about an angle of 30°.

Note: On the uppermost sweeping curved line at the point where the figure 65 appears, at this point there is an extended line labeled "65° Wet-Bulb Line." All lines parallel to that line represent Wet-Bulb lines. The value of the lines in degrees Fahrenheit are represented by the numbers noted on the uppermost of the sweeping curved lines. Every fifth line is numbered, hence each line represents a degree of Wet-Bulb temperature.

EFFECTIVE TEMPERATURE: Indicated by sloping lines from lower right to upper left at an angle of about 60°. Look again at the point 65 mentioned in the above paragraph: At that point you will observe another line extended and labeled "65° EFFective TEMPerature LINE." All lines parallel to that line represent Effective Temperature. The value of these lines in degrees Fahrenheit are represented by the numbers noted on the uppermost of the sweeping curved lines (the same numbers that represent Wet-Bulb temperatures, but in this case applying to a different set of lines). Every fifth line is numbered, hence each line represents a degree of Effective Temperature

RELATIVE HUMIDITY: Indicated by sweeping curved lines from lower left-hand to upper right-hand. Each line shown represents the Relative Humidity in percentage (of moisture) in multiples of ten. The lowest curved line is labeled 10%, the next 20%, and so on up to 90%. The uppermost sweeping curved line represents the 100% Relative Humidity line.

At this point it is indicated that when you have a Relative Humidity of 100%, the Effective Temperature is the same value in degrees as the Wet-Bulb reading. At any point on the 100% Relative Humidity line, the Wet-Bulb temperature line and the Effective Temperature line corresponding to that point intersect.

HORIZONTAL LINES IN THIS CHART: Represent grains of moisture in each pound of dry air, for points falling on any particular line.

BODY MOISTURE

The following facts are not directly tied in with this chart, but it is of value to know them.

An adult human at rest in 72° F. Dry-Bulb air throws off about 700 grains of water per hour.

1 pound of water=7,000 grains
8⅓ pounds of water=1 gallon
58,310 grains of water=1 gallon

An audience of 1,000 persons will throw off 700,000 grains of moisture per hour, or 12 gallons of water.

The average performance is 2¼ hours long, so multiplying this result by 2.25, it follows that at each performance there would be 30 gallons of water added to the moisture of the air. From this it is easily understood why people say that the air becomes heavy when a number of persons are gathered in a room with no positive means of ventilation.

The shaded portion of this chart represents the mean winter comfort zone It does not specifically distinguish between the summer and winter comfort zones. For daily records of conditions within your theatre you should use the Effective Temperature Chart (See Better Theatres of July 1).

Example No. 1: Dry-Bulb 72°, Wet-Bulb 64°.

Along the base of the chart line to the right is 72°. Follow up this line until you strike the point of intersection with the 64° Wet-Bulb line. (Remember the Wet-Bulb lines slant at an angle of about 30° from the lower right to upper left.) This point falls just outside the edge of the shaded portion of the chart. Resulting Effective Temperature, 69¼°—Relative Humidity, 65% — Grains of moisture per pound of air, 75.

Example No. 2: Dry-Bulb 77½°, Wet-Bulb 69°.

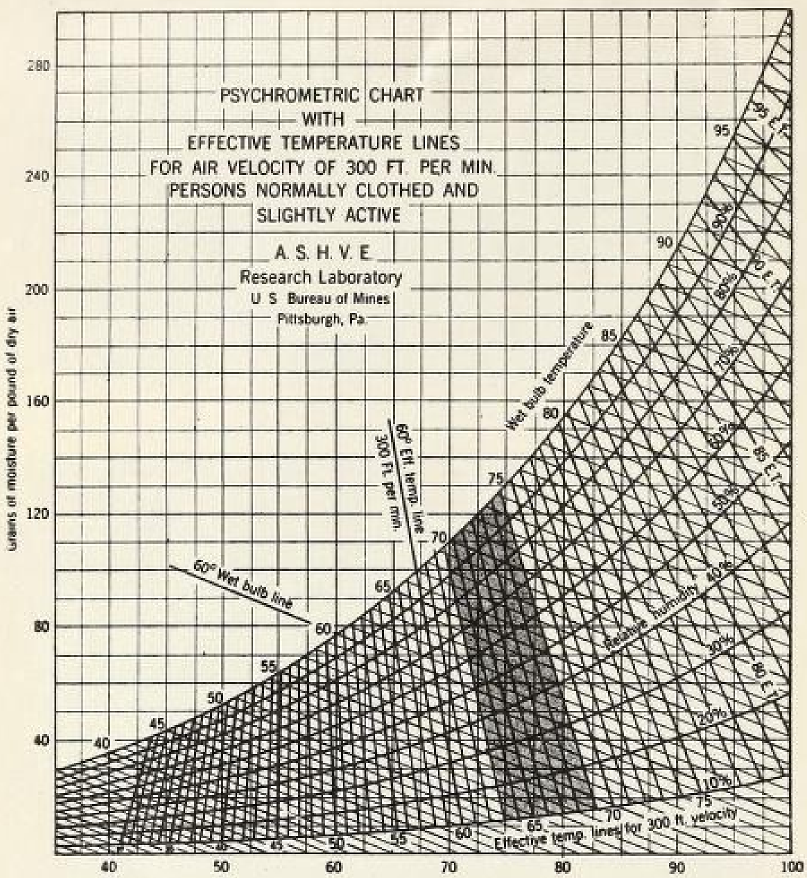
Locate the point of intersection of the 77½° Dry-Bulb line and the 69° Wet-Bulb line as explained in Example No. 1. This point will represent resulting conditions consisting in Effective Temperature, 73½° —Relative Humidity, 65% — Grains of moisture per pound of air, 93.

Comparing the two examples, we find the Effective Temperature of Example No. 1 about 4° lower than that of Example No. 2—Relative Humidity in Example No. 1 the same as in Example No. 2—Grains of moisture in Example No. 1 are 18 less than in Example No. 2.

Now check these same conditions on the Effective Temperature Chart published in Better Theatres of July 1.

[This material has been prepared with the aid of J. T. Knight, Jr., head of maintenance for Publix Theatres; the publication, Heating and Ventilating; and the American Society of Heating and Ventilating Engineers.]

AIR CONDITIONING GUIDE SHEET NO. 3



PSYCHROMETRIC CHART: EFFECTIVE TEMPERATURE, AIR VELOCITY 300 F. P. M.

[The third of four charts applied to theatre air conditioning.]

The greatest benefit may be derived in following this discussion and interpretation of this chart from comparison with the chart described in the last issue (July 29) of Better Theatres. With last month's chart, representing still air conditions at hand, compare the chart reproduced on this page.

It will be noted that the definition and designation of the various groups of lines representing the same element on each chart are approximately in the same location and extend in the same directions on both charts.

Note carefully these differences. The small figures on the uppermost sweeping curved line from lower left to upper right indicate WET BULB TEMPERATURES, in degrees Fahrenheit. These same numbers do not indicate effective temperatures. Effective temperatures are indicated on the lowest of the sweeping curved lines. The figures indicating effective temperatures are noted along this line from 30 on up to 75 in multiples of 5; after 75 the remaining lines are indicated by every fifth line being marked 80 E.T., 85 E.T., 90 E.T. and 95 E.T. These markings come just inside the righthand edge of the chart, from bottom to top.

Air motion produces a cooling effect upon the human body, therefore, it becomes an important and determining factor in establishing the comfort of patrons in a theatre. How can this cooling effect be determined? By using the chart published in the last issue and by using the chart reproduced here.

For example: the condition within the theatre is represented by a dry bulb reading of 85°, and wet bulb of 75°. How much cooler would it feel if you could adjust the fans to give an air motion of 300 feet velocity? On the chart published last month for "still air conditions," 85° dry bulb, and 75° wet bulb produce an effective temperature of 79½°. The same conditions, by referring to the chart reproduced here, represent an effective temperature of 76 1/3°. The cooling effect is consequently 79½°—76 1/3°, or 3 1/6°.

Now refer to the comfort chart described in the July 1st issue of Better Theatres. An effective temperature of 79½° falls outside of the summer comfort zone, while an effective temperature of 76 1/3° falls within the summer comfort zone and represents a condition that is 30 per cent comfortable. Briefly, by fan adjustment only the temperature within the theatre has been greatly improved.

A velocity of 300 feet per minute is not the maximum velocity obtainable. A velocity of 600 feet per minute would give you a more pronounced cooling effect.

This chart definitely illustrates the great importance of air motion in the creating of comfortable air conditions within the theatre. The three charts so far reproduced in Better Theatres positively point out the three basic factors in comfortable ventilation. Temperature (dry-bulb), humidity (wet-bulb), and air motion combine to create effective sensations of heat or cold, which within certain ranges as shown by these charts represent comfortable or uncomfortable conditions in the theatre.

DETERMINING AIR VELOCITY

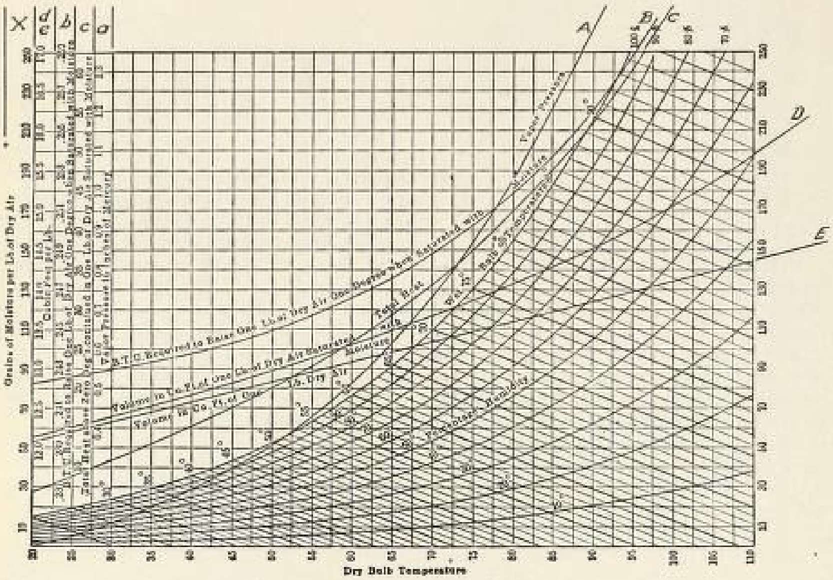
Air motion within a theatre auditorium is generally expressed in minutes for each complete air change. This is arrived at by taking the cubic volume of the auditorium and dividing it by the cubic feet of air delivered into the auditorium each minute.

For example: an auditorium 65 feet wide, 100 feet long with the average or mean ceiling height 45 feet has 292,500 cubic feet of air space in it. Assume that the fans deliver 40,000 cubic feet per minute:— $\frac{292,500}{40,000}$ = 7.31 minutes, or it requires 7 1/3 minutes to completely change the air in the auditorium. This is commonly expressed as a 7 1/3-minute air change.

To determine quantity of air delivered into the auditorium, borrow an instrument known as an anamometer. This instrument, held in front of each point of entry of air, and moved slowly over the area of the grille will determine the velocity of the air being delivered through that opening. This velocity, multiplied by the square foot area of that opening, will give the quantity in cubic feet per minute of the air delivered at that point. Repeat this procedure at every point of delivery of air. Then total the results obtained at the various delivery points and that summation will represent the cubic feet of air per minute delivered into the auditorium.

[This material has been prepared with the aid of J. T. Knight, Jr., head of maintenance for Publix Theatres; the publication, Heating and Ventilating; and the American Society of Heating and Ventilating Engineers.]

AIR CONDITIONING GUIDE SHEET NO. 4



PSYCHROMETRIC CHART: WITH VAPOR PRESSURE, B. T. U., VOLUME CURVES AND SCALES

[The last of four charts applied to theatre air conditions.]

The chart presented herewith is universally used by air conditioning, ventilating and fan engineers. Some understanding of the uses to which this chart can be put will, of course, be of advantage to every theatre manager and every theatre engineer regardless of the type or condition of the equipment at present in any particular theatre.

In general this chart represents still air conditions. In this respect it is somewhat similar to the second chart of this series, presented in the July 29 issue of Better Theatres, with some additional curves and scales.

The additional curves and scales will be indicated, described and explained. One example will be worked out for the purpose of illustrating the use to be made of this chart

The five additional curves have been extended beyond the edges of the chart and on these extended portions of the curves a capital letter of the alphabet has been placed. These curves during the discussion will be referred to by these letters.

The additional scales shown along the lefthand edge of the chart, and related to the additional curves, will be indicated with the same letter of the alphabet at the curve to which they refer (except that the letter will not be printed as a capital):

Curve A—Vapor pressure.
Curve B—B.T.U. required to raise one pound of dry air one degree when saturated with moisture.
Curve C—Total heat.
Curve D—Volume in cubic feet of one pound of dry air saturated with moisture.
Curve E—Volume in cubic feet of one pound of dry air.

It is to be noted here that as the scales on the left-hand of the chart are compared with the curves, first that one scale represents readings from two of the curves, second that there is no curve shown on the chart to correspond with the first scale (labeled X) on the left-hand side of the chart. A curve representing the grains of moisture per cubic foot of saturated air always appears on a complete Psychrometric Chart

A fall-of-the-year problem: Given an outside air condition represented by a dew point of 50 degrees, and a dry bulb of 60 degrees; the fans, an air washer spray, and steam are available in the theatre. Steam has got to be used. But should the air washer be used?

Follow with a pencil up the vertical lines labeled 60 (dry bulb temperature) at the bottom of the chart until the point is reached which will be the intersection of this line with a horizontal line through the point marked 50 degrees on the curve labeled "wet bulb temperature." The horizontal line passing through this point marked 50 degrees may be drawn very lightly in pencil. Follow along this horizontal line to the right until the pencil intersects the line of a dry bulb temperature of 70 degrees (the temperature desirable in the theatre, steam being used to gain this heat). This point located indicates a relative humidity of slightly less than 50 per cent.

Now by using steam only to heat the incoming air, these conditions exist inside the theatre—that is, dry bulb temperature 70 degrees, relative humidity 50 per cent.

Referring to the Comfort chart (the first one in this series, and published in Better Theatres of June 3) it may be seen that this condition represents an effective temperature of 66 degrees, an ideal mid-winter condition (when everybody is wearing winter-weight clothing). But such a condition would undoubtedly be very chilly for early fall.

By using the air washers the moisture content (relative humidity) could be increased and a more comfortable condition would exist inside the theatre.

Assume now that the washers have been turned on, and the resulting condition within the theatre is represented by 70 degrees dry bulb, relative humidity 80 per cent. Then outside conditions are still the same, dew point 50 degrees, dry bulb 60 degrees. Completing the data on these two conditions by reading from the chart:

Outside conditions, dry bulb 60 degrees, wet bulb 54 degrees, dew point 50 degrees, relative humidity 70 per cent

Inside conditions, dry bulb 70 degrees, wet bulb 65½ degrees, dew point 63½ degrees, relative humidity 80 per cent.

With these conditions find the difference in total heat between a mixture of one pound of dry air and the quantity of moisture present at the wet bulb temperature of 65½ degrees (inside conditions) and a similar mixture at the wet bulb temperature of 54 degrees (outside conditions).

As total heat is a function of the wet bulb temperature, independent of the dry bulb reading, and quantity of moisture present for any specific wet bulb temperature varies with the dry bulb temperature, it follows that the quantity of moisture present does not affect the total heat, provided the wet bulb temperature remains unchanged.

Locate the point on the wet bulb curve corresponding to 65½ degrees (the inside condition). Follow vertically to the intersection of Curve C, then horizontally to the left to Scale C, this indicates 29 B.T.U. Follow this same procedure from the point on the wet bulb curve corresponding to 54 degrees (the outside condition), scale C indicates 22½ B.T.U.

Subtracting—29 B.T.U minus 22.5 B.T.U. equals 6.5 B.T.U., the difference in total heat per pound of air.

This computation deals with a mixture of one pound of dry air with the amount of moisture present under the given conditions added to it.

This procedure represents the method used in determining the total heat to be added to, or removed from, air to heat or cool to certain given conditions. Whether to heat or to cool depends upon whether summer or winter conditions are prevailing. In this specific case it would be heat added.

To find the difference in vapor pressure: Using the same conditions, outside dew point, 50 degrees, inside dew point, 63½ degrees. Follow from the outside indicated dew point 50 degrees vertically to the intersection with Curve A, then horizontally to Scale A, indicating .352 inches of mercury.

Follow the same procedure for the inside condition 63½ degrees dew point, Scale A indicates .54 inches of mercury.

Subtracting — .54 inches of mercury minus .352 inches of mercury equals .188 inches of mercury.

This is interesting and indicates that the air in the theatre is actually heavier than it is outside. Not an appreciable amount, it is true, but very sensative barometers would be able to indicate this difference.

It follows that vapor pressure is dependent upon the dew point and is always indicated in inches of mercury.

Absolute Humidity—This refers to the weight of water vapor expressed either in grains per pound, or in grains per cubic foot of air. Absolute Humidity is a function of the dew point.

Find the absolute humidity of the outside and inside conditions as set forth in this problem: Outside conditions, dew point 50 degrees; inside condition, dew point 63½ degrees

From the point representing 50 degrees dew point, follow horizontally to the left to Scale X. This indicates 53 grains of moisture per pound of dry air.

To interpret this in grains of moisture per cubic foot of air, find the point of intersection of the vertical dry bulb temperature line 60 degrees (outside conditions) with the Curve E, follow horizontally from this point to Scale E (labeled cubic feet per pound). This indicates 13.03 cubic feet per pound of dry air.

Now from the point of intersection of the vertical dry bulb line 60 degrees with the Curve D follow horizontally from this point to Scale D (the same scale as E), this indicates 13.53 cubic feet per pound of saturated air.

Subtract—13.53 minus 13.03 equals .5 cubic feet increase in volume due to 100 per cent saturation.

The relative humidity of the outside conditions was found to be 70 per cent; therefore, .5 cubic feet times .70 relative humidity equals .35 cubic feet, or one pound of air at outside conditions is equivalent to 13.03 plus .35 equals 13.38 cubic feet.

Now to express the Absolute Humidity in grains of moisture per cubic foot, divide:

$$\frac{\text{53 grains of moisture per pound of air}}{\text{13.38 cubic feet per pound of air}} = \text{3.96 grains}$$

of moisture per cubic foot of air, or an Absolute Humidity of 3.96.

By following the same procedure it may be determined that inside the theatre the Absolute Humidity is 6.14.

General observations from this chart and this problem: When air is heated without the addition of water vapor, the relative humidity decreases. . . When air is cooled without the extraction of water vapor the relative humidity increases. . . . The higher the temperature of air the greater is its capacity to hold water.

There is a distinct difference between Relative Humidity and Absolute Humidity. Referring to the problem, the Relative Humidity of the inside conditions over the outside conditions is an increase of 14.29 per cent, while the increase in Absolute Humidity is 55.3 per cent.

In winter try to raise the temperature, raise the Absolute Humidity and cut down on air motion (for in the August 26th article it was shown that air motion has a cooling effect).

In summer try to lower the temperature, lower the Absolute Humidity and produce as much air motion as possible conducive to comfort.

[This material has been prepared with the aid of J. T. Knight, Jr., head of maintenance for Publix Theatres; the publication, Heating and Ventilating; and the American Society of Heating and Ventilating Engineers.]

REFERENCE CHARTS

The adjoining chart, as applied to theatre air conditioning, is the final one of the series of four. Accompanying the first chart in the June 3d issue, was an announcement that if enough requests were received, these charts, with proper explanations, would be made available in a form suitable for ready reference. Those wanting this service who have not sent in their requests should please do so at once.

A Famous Theatre Passes

(*Continued from page* 8)

capacity, which was used in the earlier days for fire protection. Of course, there also is an asbestos curtain on the stage. And the engineers of that day were not to be outdone, either. An iron ventilating system installed under the stage changed 175,000 cubic feet of air every five minutes.

This gigantic undertaking of its day cost the Tootle Estate $150,000, with an additional $100,000 for the remodeling in 1893.

"Ben Hur" still held the Tootle house record to the last. Special matinees were offered to accommodate the crowds which came from cities and towns within 300 miles from St. Joseph. And it was at the Tootle theatre that a stagehand forgot his cue and pulled the wrong treadmill for the famous chariot race. He lost the race for Ben Hur!

The Tootle Estate operated the house until 1904, with C. U. Philley named manager in 1898. In August 1904, Martin Beck leased the house for the then small Orpheum circuit. In September 1905, the well-known Woodward Stock Company leased it. The Shuberts took it for the season of 1911, bringing all of their glamorous offerings to St. Joseph. Dubinsky Brothers, operating a string of theatres in Missouri and Kansas, took the place for stock presentations from September 1916 until August 1925. The Hostettler Amusement Company of Omaha, which operated for Universal, leased it then until August 1928. After that the building was rented periodically until last year, when it was taken by the St. Joseph Little theatre.

The passing of the Tootle Opera House in St. Joseph, Mo., truly symbolizes the end of an era doomed soon to end that day in 1895 when motion pictures were brought to Broadway.

Constructing Theatre Advertising

(*Continued from page* 12)

art work, reduced to the size of the advertisement. The negatives of both the illustrations and the type are then *stripped* together, according to the layout, for etching on the same plate.

One other method of rendering an advertisement entirely in plate form ready for the newspaper's use is that referred to earlier in the article—that of the combination halftone and line etching. When the art work requires the halftone process, this method must be used. The type dimensions are scaled as in the procedure last described, is similarly set and proved-up. From this proof the engraver makes a finished line etching. At the same time, the art work is made into a halftone in a reduction dictated by the size of the advertisement. Both of these elements, each in separate pieces of metal, are mounted (tacked on wood blocks, as all engravings are) together according to the layout. This single block is all that need be sent to the newspaper.

Each of these processes make the cost somewhat larger than it would be were

(*Continued on page* 34)

Air Conditioning American Movie Theatres
1917-1932

The Intelligent Selection of Air Conditioning Equipment

J T Knight Jr
1936

The Intelligent Selection Of Air-Conditioning Equipment

● Examining the present type of proposals, and offering a questionnaire designed to obtain for the theatre operator the information that he needs

WE HAVE repeatedly pointed out to exhibitors the weakness and the superficialities of the great majority of proposals, even by the larger and more experienced companies, for air-conditioning. I have been called upon during the past six months to pass on or make recommendations on literally dozens of air-conditioning jobs, and I still want to emphasize that four out of every five proposals are useless to an engineer for checking purposes. We are going to continue to get a large percentage of unsatisfactory installations just as long as we accept incomplete and general specifications for machinery instead of a complete air-conditioning plant. Some of the larger companies are adamant in their attitude towards changing their form of proposal, and the motion picture exhibitors of the country, who represent a very real market for air-conditioning equipment running beyond the million dollar mark for the next few years, should be determined in demands for specific and exact proposals from all seeking the contract.

So far this has been almost a single-handed fight, but it is slowly bringing results, in better and more satisfactory installations, to the mutual benefit of the theatre operator and the air-conditioning contractors. Because of the delays and red tape resulting from trying to get air-conditioning companies to alter their form of proposal, I have given up insisting upon it, and in place I have compiled a questionnaire which goes with the invitation for them to bid on a job. This questionnaire cannot be correctly filled out unless the job has actually been calculated and engineered. Furthermore, the air-conditioning companies have absolutely no excuse for not submitting this questionnaire with their proposal, a buyer certainly has the right to ask questions, either verbally or in writing.

PURPOSE AND FORM OF QUESTIONNAIRE

THIS QUESTIONNAIRE when completely filled out serves two very important purposes. First, it will be found invaluable, even for one not versed in the technical aspects of air-conditioning to compare a number of proposals and determine wherein those proposals differ. Second, the proposal and the questionnaire, together, will contain enough data to permit an engineer (even without having ever visited the proposed location of the installation) to check the calculations and the engineering and to advise or constructively criticize the job.

It would be to the advantage of the theatre operator if he used such a questionnaire in calling for bids on air-conditioning installations. The text of the questionnaire follows:

Every contractor or vendor bidding or presenting proposals on air-conditioning the .... theatre in .... must comply with this questionnaire, presenting the answers to questions in the order in which they are asked. This is mandatory regardless of whether or not the information requested may appear elsewhere in your proposal. All of the attachments requested are necessary and must accompany this questionnaire, completely filled out at the time the bid is submitted.

1. State definitely the outside design conditions, dry bulb, wet bulb and relative humidity.
2. State definitely the inside design conditions, dry bulb, wet bulb and relative humidity.
3. How many cubic feet of fresh air per minute per person will be taken into the theatre by this contemplated system.
4. How many cubic feet of air per minute per person will be recirculated by this contemplated system.
5. State exactly the computed heat gain under the following headings:
   a. Total sensible heat transmission for surfaces not exposed to the sun.
   b. Total sensible heat transmitted through roof, attic space and ceiling including the sun effect. State the over all transmission coefficient used for roof, attic space, and ceiling.
   c. How many tons of refrigeration could be deducted if the roof or ceiling were insulated with 4 inches rock wool.
   d. Total sensible heat gain from fresh air introduced by the system.
   e. Total latent heat gain from fresh air introduced by the system.
   f. Total sensible heat gain from the occupants of the auditorium.
   g. Total latent heat gain from the occupants of the auditorium.
6. What is your guarantee covering any disturbing noise from this proposed installation.
7. What is your guarantee covering any disturbing vibration from this installation.
8. Give a detailed breakdown of the complete operating cost of this system.
9. State definitely who manufactures the following items of equipment if included as part of this installation:
   a. Compressors
   b. Compressor motors
   c. Expansion coils
   d. Condensers
   e. Expansion valves
   f. Controls
   g. Blower
   h. Blower motors
10. Are we to expect fulfillment of mechanical guarantees on this equipment by you or must we press any claims that might develop with the manufacturer?
11. Are you prepared to render an inspection of this installation without further cost to us at each change of season during the life of the mechanical guarantee?
12. If this contract should be awarded to you what items or classifications of work involved do you contemplate subletting.
13. Of the various items of equipment included under this contract state definitely those for which you are a direct factory representative, or licensed dealer and those items purchased on the open market.
14. Submit attached to this questionnaire an engineering data sheet on each of the major items of equipment specified in this contract.
15. Submit a drawing or drawings showing the location of equipment, the duct lay-out, the duct sizes, the velocities and quantities of air at each outlet.
16. Outline a practical test which may be carried out after the completion of this contemplated installation which would be accepted by an unbiased engineering authority as substantiating your performance guarantee.

Streamlined Space Saving Features 1940 Conditioning Systems

Box Office
1940

Streamlined SPACE-SAVING *features*

1940 CONDITIONING SYSTEMS

SO-CALLED air conditioning for theatres no longer is accomplished so largely through the two extremes of equipment provision which in the early days was a common practice when strenuous efforts were made to change and improve the temperature in theatres and with it the temper of theatre patrons.

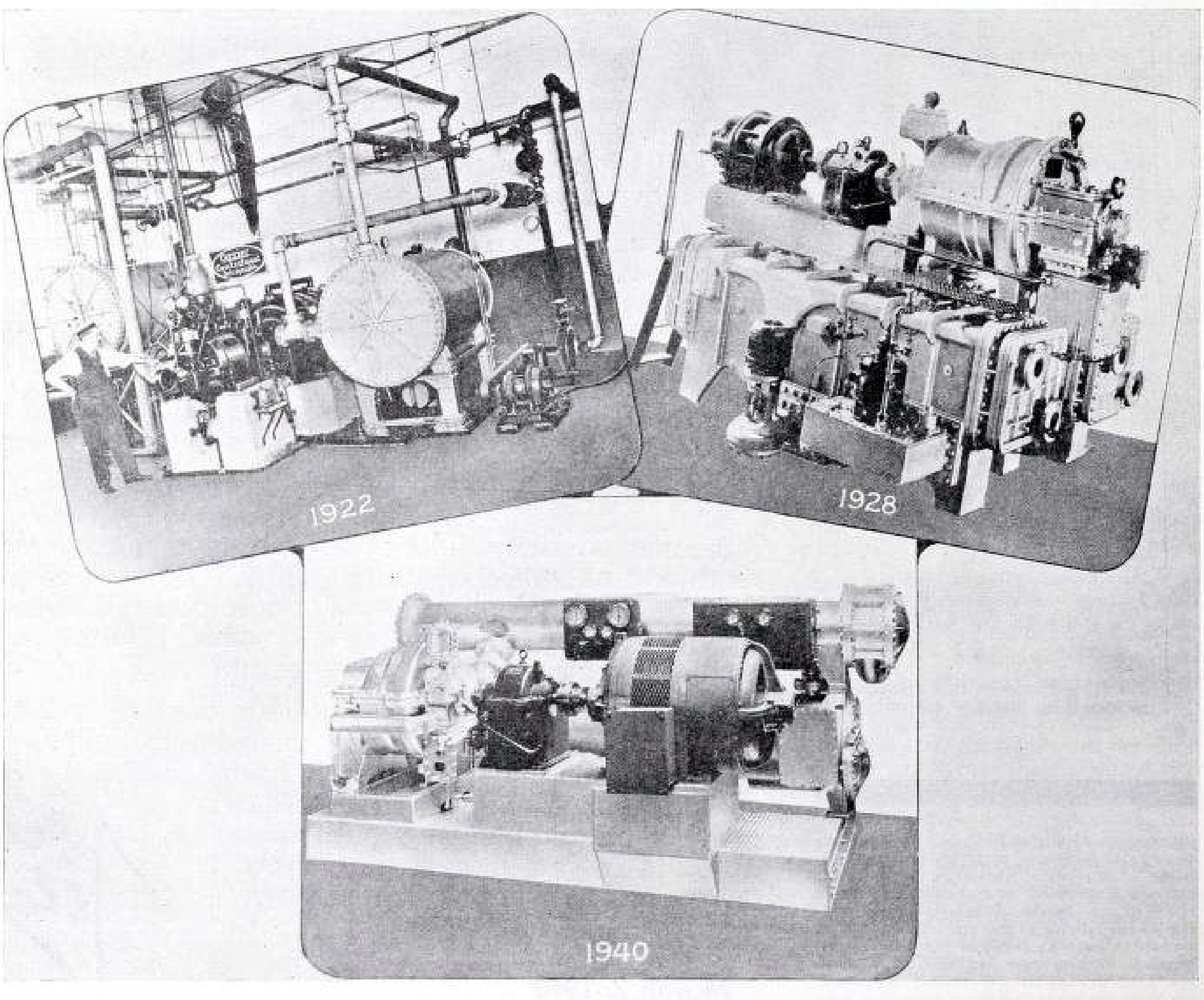
The two extremes were characterized by huge engines consisting of more or less integrated elements and requiring enormous areas of space for installation, available only in the large capacity houses, and ranging to the other extreme of a wide assortment of generally unrelated parts, also requiring more space than was usually available in smaller theatre buildings where efforts were made to add the air conditioning feature to then existing cooling or ventilating plants.

In both these extremes, representing the best engineering practices of their day, the room requirements of air conditioning apparatus was a problem of extraordinary concern to the installer of air conditioning equipment. And the cost of structural alterations and additions to accommodate such equipment was considered prohibitive in many instances.

The Installation Problem

Complete air conditioning for theatres was stalemated in many cases, due, not so much to the high unit cost of the heavy equipment, but to the impracticabilities and often the utter impossibility of installing it in the limited space available. As a result, many theatre owners kept adding small accessories to their old equipment until they ran out of space. Some added outhouses in the rear or at the sides or on top of their buildings, which undoubtedly effected some improvement but the processes were costly and the results many times questionable.

Today the chief component of air conditioning equipment is a "packaged" product—a completely integrated system, streamlined and reduced to minimum weight and requiring only a fraction of valuable theatre space heretofore occupied by the gigantic machines of just a few years ago. And they require much less room than the unrelated systems above referred to, which by continual expansion



finally crowded themselves completely out of smaller theatre buildings.

In the group of three pictures shown at the beginning of this article, depicting the evolution of compressors, which have long been the "heart" of the complete air conditioning system, from 1922 to 1940, there is evidence on the point we endeavor to make, i. e., that air conditioning is keeping pace with streamlined design in cases where greater efficiencies can be obtained and where space limitations are an important consideration. This composite photograph depicting the 18-year history of the centrifugal refrigerating machine is quite interesting.

The machine on the upper left (1922) was the first refrigerating machine of this type to be developed by Willis H. Carrier, founder of his company and present chairman of the board. It was installed in Syracuse, present home city of the air conditioning company. This machine, still in use, is approximately twelve feet long, fifteen feet wide and nine feet high.

On the upper right (1928) is the second development in centrifugal refrigeration, embodying all the features of the larger installation but only occupying 104 square feet of floor space. This type centrifugal is now in use at Radio City and on the ocean liners *Normandie* and *Queen Mary* and many large public buildings in Washington.

THE NINETEEN-FORTY MODEL

Below is the latest centrifugal unit designed by Mr. Carrier and now being installed on large systems. Increased efficiencies have been achieved by improvements in the centrifugal compressor, evaporator and condenser. Horsepower has been reduced by 10 per cent to 15 per cent for equivalent tonnage of refrigeration and the refrigerant pump has been eliminated.

The 1940 "streamlined" machine is only eighteen feet, six inches long, seven feet wide and six feet, four inches high, and has approximately three times the capacities of the older units shown.

The space-saving accomplishments of air conditioning equipment production engineers and designers, who have stepped up capacities and efficiencies while sharply reducing weights, sizes and installation and operating costs, is further illustrated in the accompanying pictures of recent installations in the Rosetta Theatre at Miami, Florida, and in the Mont Clare Theatre in Chicago, respectively.

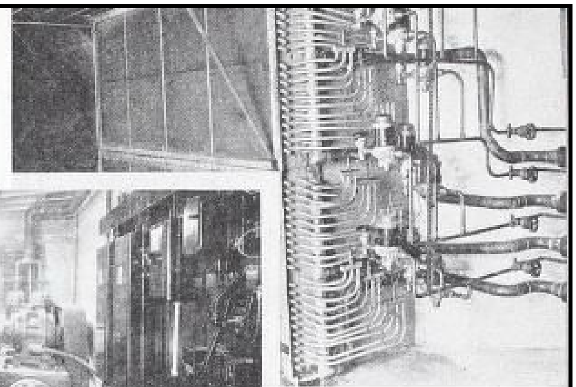
The Rosetta Theatre installation, comprising two compact G-E condensing units of the newest type 20 h. p. rating, emphasizes the degree of compactness and room-saving featured in the new G-E units, which not only conserve space but provide extra air conditioning efficiency at less cost than ever before.

In the Mont Clare Theatre installation, further space conservation is seen in the illustration of the central-plant air conditioner which is connected to four G-E condensing units, each of 20 h. p. capacity, serving this 1,200 seat community theatre with unusual efficiency during all seasons of the year.

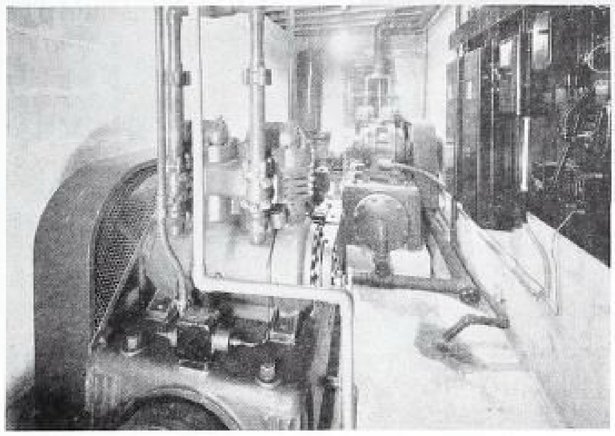
Another example in point is the view of the new air conditioning plant of the State Lake, prominent loop theatre in Chicago, in which the floor space requirement of an older system, an area over 1,000 square feet, was reduced to approximately 200 square feet. But space saving in this instance was not the only feature. Two 125 h. p. refrigerating units weighing over 83 tons and requiring 250 horsepower for operation were replaced by four new Westinghouse freon condensing units, as shown, each 40 h. p., and requiring but 160 h. p. at peak load, the whole system weighing but ten tons.

But recently the Westinghouse company

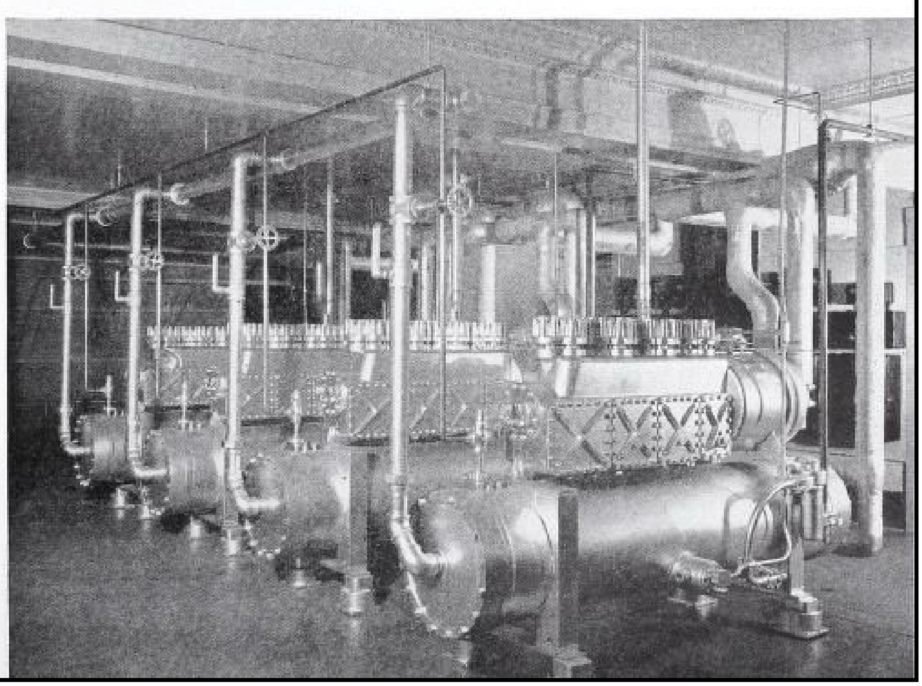
(Continued on page 41)



Right—The Mont Clare Theatre in Chicago uses this central plant air conditioner in connection with four 20 h. p. condensing units in creating comfort for the patrons.



Above—Compactness of modern equipment units made possible this trim air conditioning installation at the Rosetta Theatre in Miami, Florida. The two 40 h. p. condensing units which serve the air conditioner. (Both photos courtesy General Electric Co.)



The State Lake Theatre installation in Chicago, comprising four 40 h. p. condensing units, saved over 800 square feet of floor space over the previous installation and effected many other savings. (Photo courtesy Kroeschell Engineering Co.)

Cover Illustration

Petite Miss Dorothy Streitz pushes the button to start a "doll house" air conditioner modeled after the system in National Broadcasting Company quarters in Radio City, Rockefeller Center, New York City. This operating model, described by N. B. C. Engineer Robert Close as being "correct in every detail" for the huge system serving all National Broadcasting studios and offices was built by hand by Machinist David Hillegas of the Carrier Corporation plant at Syracuse. Hillegas, whose hobby is modeling intricate machinery, plans to install the miniature air conditioning system in a doll house for permanent exhibit at the factory. Meanwhile, it will be on exhibit at the NBC Studios at Radio City. The model is in operation complete with water sprays, motors, fans, outlets, filters and other necessary air conditioning parts. (Photo courtesy Carrier Corp.)

Comments on the Rejuvenation of an Air Conditioning System

Box Office
1940

Comments on THE REJUVENATION of AN AIR CONDITIONING SYSTEM

SEATING is fundamentally important, of course, yet it is not by any means the sole comfort requirement of the modern theatre. There's another year-round comfort phase of operation that very nearly approximates that of the comfy theatre seat in sustaining boxoffice receipts at profitable levels throughout the work-a-day year.

Air conditioning gradually has become, since its first inception and application some fifteen or twenty years ago, one of the chief contenders with seating comfort for the concern of theatre ownership and management. Today, air conditioning assumes greater importance in respect to theatre prestige than at any time in the past.

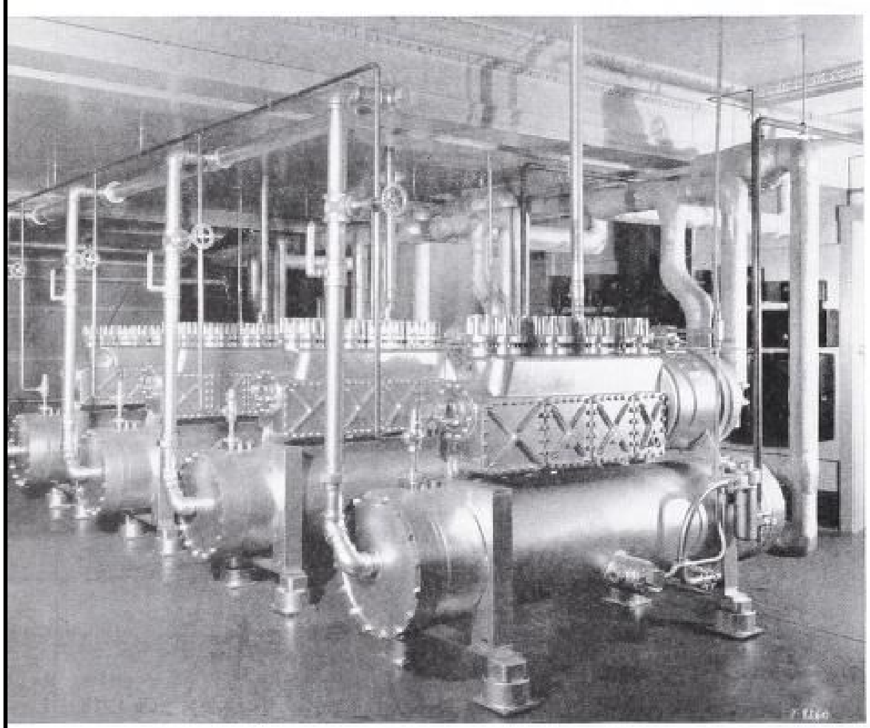
PRIDE OF THE LOOP

Some fifteen years ago, an air conditioning system of the latest and therefore the highest type then known to the practice of temperature control was installed in the State-Lake Theatre of Chicago. The big "loop" theatre was spared no expense in securing the highest type of weather control for the comfort of its patrons *of that period*. Air conditioning being then more of a novelty than it is today, the expense of application was a considerable item; but of even greater consequence was the high cost of operation, still a marked characteristic of air conditioning equipment that has become antiquated.

The original State-Lake installation was a huge affair consisting of two 125 h.p. CO_2 refrigerating units which weighed 83 tons, not including the required heavy foundations. It required 250 horsepower for operation and occupied over 1,000 feet of floor space. Besides, there were huge banks of double piping, countercurrent, CO_2 condensers which operated in conjunction with the refrigerating units. And to further complicate matters, the system involved a maze of 1¼-inch, extra heavy, electrically welded direct expansion coils and a massive cooling tower on the roof of the theatre building.

By reason of enormous capacity and overpowering strength, the State-Lake plant was adequate to protect the comfort of its patrons for fifteen years prior to its recent replacement by a modern-to-the-minute air conditioning system. The new plant was installed by Kroeschell Engineering Company of Chicago late last spring. The Kroeschell Company are successors to the pioneer Brunswick-Kroeschell Company who had installed the original State-Lake job about 1924 when the theatre was then operated by the Orpheum vaudeville circuit. The Kroeschell Company and its principals are early settlers in theatre air conditioning, having engineered and installed many of the outstanding air conditioning plants in Balaban & Katz and other houses, among which was the "world premiere" of air conditioning at the Chicago Theatre in 1922.

This view shows the four condensing units, 40 h.p. each. (All photos courtesy Kroeschell Engineering Company).



ANOTHER MILESTONE

Last spring, a contract was awarded Kroeschell to replace the old State-Lake plant in its entirety with a system embodying all the newest ideas of present-day air conditioning and positive temperature control. This is believed to be the first major replacement job in Chicago theatre air conditioning circles and for that reason it undoubtedly marks another milestone in the progress of theatre air conditioning locally, if not nationally.

For the past decade and more, complete renovation of theatre air conditioning plants has occurred rarely, activities being largely confined to adding and trying out new gadgets. The result has not always justified the enormous expense involved. The case at hand, therefore, assumes interesting importance in that it may indicate a new method of approach to the air conditioning problems of many existing theatres. Complete replacement of antedated or inadequate equipment may prove to be the answer.

The old State-Lake equipment was torn out completely. Despite the fact that all equipment was in good operating condition, it had become so out-moded by advances in engineering and manufacture during the past few years that it had no salvage value whatever. It was simply carted away as junk.

The old system was replaced by four freon condensing units of 40 h.p. each, the whole system weighing but ten tons; requiring only 160 horsepower at peak load and occupying but 200 square feet of floor space.

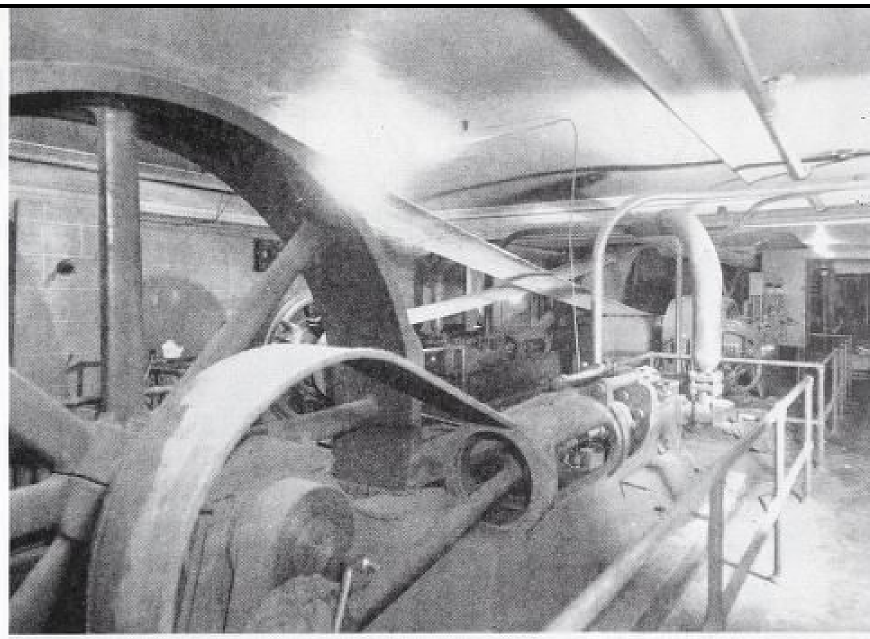
The new condensing units are unique in that they are hermetically sealed and provided with gas-cooled motors. At no time during the past summer were the machines taxed, and three units carried the load most of the time. The system is fully automatic in operation and operates essentially in synchronism with the boxoffice. The new installation includes copper finned coils and filters which are easily cleanable.

NO FOUNDATIONS NEEDED

It is interesting to note that the new State-Lake condensing units do not require any foundations. In fact, they are not even fastened to the floor. Each unit is equipped with spring mountings and mufflers. These units operate with such freedom from noise and vibration that when standing next to them it is necessary to place a hand upon the units to determine which of the four is operating. This new installation provides air conditioning at an operating cost of one-third to one-half that of the original installation.

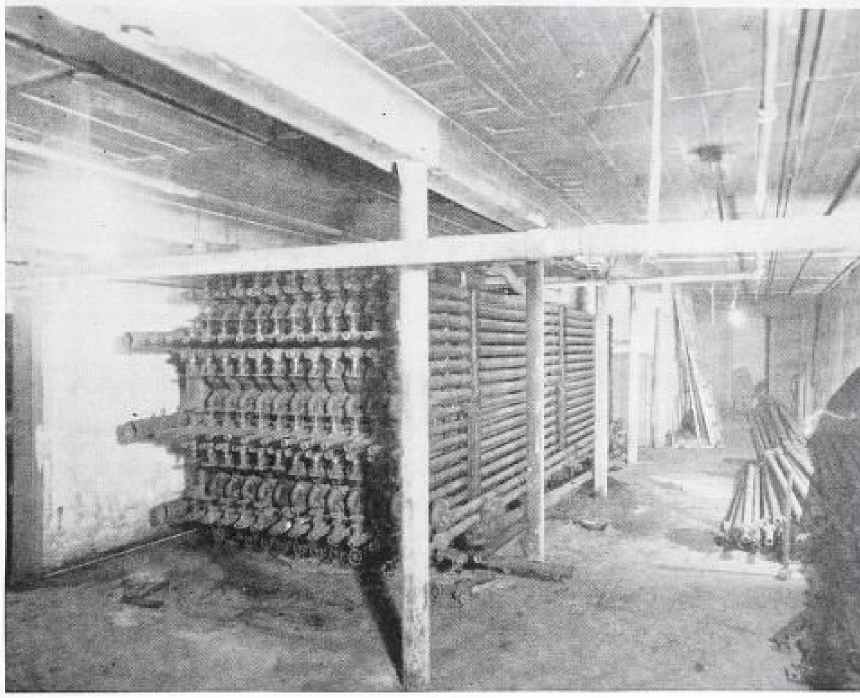
Comments in the foregoing case are inspired by the feeling that successful theatre air conditioning for the future lies definitely in the direction of complete replacement rather than in the too prevalent practice of augmenting out-moded equipment. The science of complete air conditioning has arrived at a stage where any theatre, regardless of size or location, may now provide most economically for the year-round comfort of its patrons.

The result can now be accomplished under sound engineering guidance at a cost far below the extravagance that gave birth to complete air conditioning for theatres just a few years ago.



Obsolescence

This view shows the two 125 h.p. CO_2 refrigerating units which were originally installed about fifteen years ago in the State-Lake Theatre of Chicago.



One of the banks of double pipe, countercurrent, CO_2 condensers which operated in conjunction with the CO_2 refrigerating units.

Seat Covering Material Tested by Experience

Of late, the theatre seating industry is making use of an upholstering material development of the leatherette type which is a combination of leather fabric and rubber. Although developed over twenty years ago by the United States Rubber Company, "Naugahyde," as the product is called, was confined to the luggage trade in its early stages of development.

As a result of the wearability that it demonstrated in its luggage experience, it found its way into the automobile field where it is used as a seat covering material. And as time went on new colors were added, lighter weights were perfected and more flexibility was secured, permitting easier and better tailoring.

In the theatre industry, where perhaps seat upholstery is subjected to more abuse than any other type of wear due to perspiration residue, corner wear, deep seat flexing and "nervous attacks" by patrons, it is said to be particularly adaptable.

The product is a scientific combination of leather and rubber; leather for wear, rubber for elasticity. The surface is protected and tempered by a series of patented chemical treatments which eliminate the necessity of an extra coating added to the surface for desired color and wear resistance. It also sets the grain and color permanently. The material is said to be not merely "skin deep" in beauty of appearance, but uniformly the same from surface to fabric backing, and no oils or inflammable ingredients are used.

This type of material, it is claimed, is ideal for the new breathable type of latex cushions because of its flexibility. It is now available in over 300 different styles in all the popular colors and grains, and when used in striking color combinations of two or more tones or in combination with other upholstery materials, it becomes a most beautiful and practical method of enhancing modern theatre seating.

Antiquated theatre chairs which squeak or wobble are annoying to their occupants and as well to all those who surround them. When such signs of deterioration begin to show up, it's time to investigate what the seating market offers.

Unusual Beauty in New Illuminated Standards

Startling new beauty has been achieved lately in theatre chairs which are available with illuminated end standards. The standards in various designs are illuminated the entire length of the grille in colors of the theatre owner's or decorator's own selection.

Brilliant when the theatre is lighted—suffused to softest glow during showings, they contribute marvelous richness and attractiveness to the interior decoration of theatre auditoriums.