THEATRES *and* PICTURE HOUSES

By
ARTHUR S. MELOY

Cele Byrnes

I. SAXE THEATRE, MINNEAPOLIS, MINN.
Chapman & Magney, Architects

THEATRES
and
Motion Picture Houses

A PRACTICAL TREATISE ON THE PROPER PLANNING AND CONSTRUCTION OF SUCH BUILDINGS AND CONTAINING USEFUL SUGGESTIONS, RULES AND DATA FOR THE BENEFIT OF ARCHITECTS, PROSPECTIVE OWNERS, ETC.

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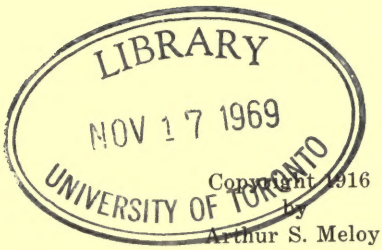

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LIST OF ILLUSTRATIONS

LIST OF PLATES

CONTENTS

PREFACE

AS there are a great number of theatres being built in this, and other countries yearly, and an increasing demand for many more in the future, and as there has been no treatise on the subject published in book form for the past twenty years, the author realizes the need for a book that will give to the architect, prospective owners and managers, some general information in the proper planning of various types of theatres. This work has been prepared for the benefit of those who are interested in this type of structure, and the author hopes the desired end may be accomplished.

The author wishes to acknowledge with thanks the many valuable suggestions furnished by the following gentlemen in reference to the stage and its equipment.

Mr. J. H. M. Dudley, of the Lee-Lash Studios, N. Y. City.

Mr. J. R. Clancy, of Syracuse, Mfr. of stage hardware.

Mr. J. H. Kliegl, of the Universal Stage Lighting Co., of N. Y. City.

Any criticism by the reader, or any suggestions for improvements in this book for future editions, will be kindly received by

THE AUTHOR.

Bridgeport, Connecticut, January, 1916.

PRELIMINARY

THERE are a great number of theatres in this country devoted to opera, drama, vaudeville, stock, etc., which we are all familiar with, and many of them are beautifully designed and properly and successfully planned.

This type of theatre has been in use for centuries and probably will always be in demand so that new theatres for all purposes will be built from time to time.

Houses devoted to the legitimate plays and for combination vaudeville and pictures, will continue to be in demand, but the greatest demand at present is for the motion picture theatre.

There are about 25,000 picture houses in this country alone, and representing an investment of about 175,000,000 of dollars, with an average daily attendance of about 6,000,000 of people.

The business is going ahead with great strides, and is continually being developed, and improved. It combines pleasure and amusement with instruction. The growth has been phenomenal and unprecedented.

The larger theatres are being converted to its use in many of the large cities.

Very few people are able to travel the world over on account of the time and expense required, but it is within the reach of everybody to see the scenes gathered from all over the world and displayed on the screen at a low cost while he sits in comfort.

Pictures offer one of the best kinds of entertainment to-day, and will continue till someone can invent something better for the same admission fee.

SELECTION OF SITE

IN selecting a site for a theatre, the first and most important thing to be considered, after the matter of surrounding population, regular and transient traffic, and its relative position to other theatres is concerned, is the lot upon which the house is to be built.

It should be on a prominent street, convenient to passing trolleys, and in no case on a dark side street. People will always walk on the main or principal streets that are well lighted.

The lot should be of such size as to give the desired seating capacity, as well as provide the necessary exits on one or both sides, or in the rear to a street or alley as required by law.

PLANNING A THEATRE

In planning a theatre building, the skill of the architect is probably taxed more than in any other type of building on account of its complex features. His talents are brought into play to create a safe, comfortable and pleasing result. The architect not only has to work out the best arrangement of the building regarding seating, sight lines, heating, ventilation, lighting, etc., but has to give special attention to the construction, foundations, safety of the public and many other intricate problems.

The laws of each state and each municipality vary in regard to exits, etc. Therefore, it is necessary to look up all state and local laws relative to safety, health, fire, licenses, etc., before any attempt to plan the house is started. (See Extract of State and Municipal Laws, on following pages.)

If two theatres are located side by side, the larger and more pretentious house will draw the greater crowds. One reason for this is that they will go where the crowd goes, and they feel that there are better chances for getting a seat in the larger houses. There are probably other reasons.

If the proposed theatre is to be a large one for drama, vaudeville or stock, besides pictures, it may be placed on a rear lot with stores in front and offices above the entrance, if desired, but if it is a small theatre it is not advisable to have stores in front as the space occupied by the stores may be used to much better advantage by increasing the seating capacity, and the extra seats gained will bring in much more revenue than one or two small stores, no matter how valuable the land might be. It is very easy to figure out the differences in the rent, and the additional capacity obtained. Then again, the front of the theatre may be made much more attractive if the building is devoted to amusement purposes only. It will also give an opportunity for a wider lobby which all theatre managers desire.

For a regular theatre equipped with a stage, a wide house is desirable up to and not exceeding 80 ft. A width of from 70 to 75 ft. is ideal, and on account of the extra width the depth of the house may be shortened and still give the required seating capacity; this form of house brings the audience nearer the stage. The depth of any theatre where speaking parts are to be given should not exceed 75 ft. from the curtain line to the rear seats, as the human voice will not carry more than that distance without straining. The front of the balcony should not be nearer than 30 ft. from the curtain line. The nearer it is to the curtain line, the higher it

will be at the rear, or the last row of seats, and therefore more stairs to climb.

Picture houses are generally built on a 50 ft. lot, and may be considerably longer than a regular theatre.

While the limit of "throw," or distance from the machine to the screen, is 150 ft., the proper distance for good results is from 60 ft. to 85 ft. (See table of distances.) No screen should be nearer than 35 ft. from the machine.

Most picture theatres are built on inside lots. Only occasionally are they built on a corner lot or on a lot running through from one street to another. Therefore, courts or passageways must be provided. Some cities require passages on both sides, while others on one side only. (See extract of laws.)

Very few theatres, in proportion to the number built, are properly planned, on account of lack of practical experience of the designers, and the misguided demands of the owners.

No living rooms should be placed above any theatre, but club rooms, dance halls and offices are permissible.

The rule for estimating the approximate seating capacity: find the sq. ft. area of auditorium and divide by 6, this will give capacity of main floor. For balcony area, divide by 7. This rule is safe. Of course, the only correct way is to lay out the aisles and space for seats on the plan and count them. (See article on "Aisles and Seats.")

The average capacity for large houses is from 1200 to 1800, and for small houses from 400 to 1000.

Provisions should be made for a manager's office, also toilet and retiring rooms, and sometimes check rooms. In the larger theatres provision is made for rooms for the stage manager, store rooms for the stage carpenter and electricians,

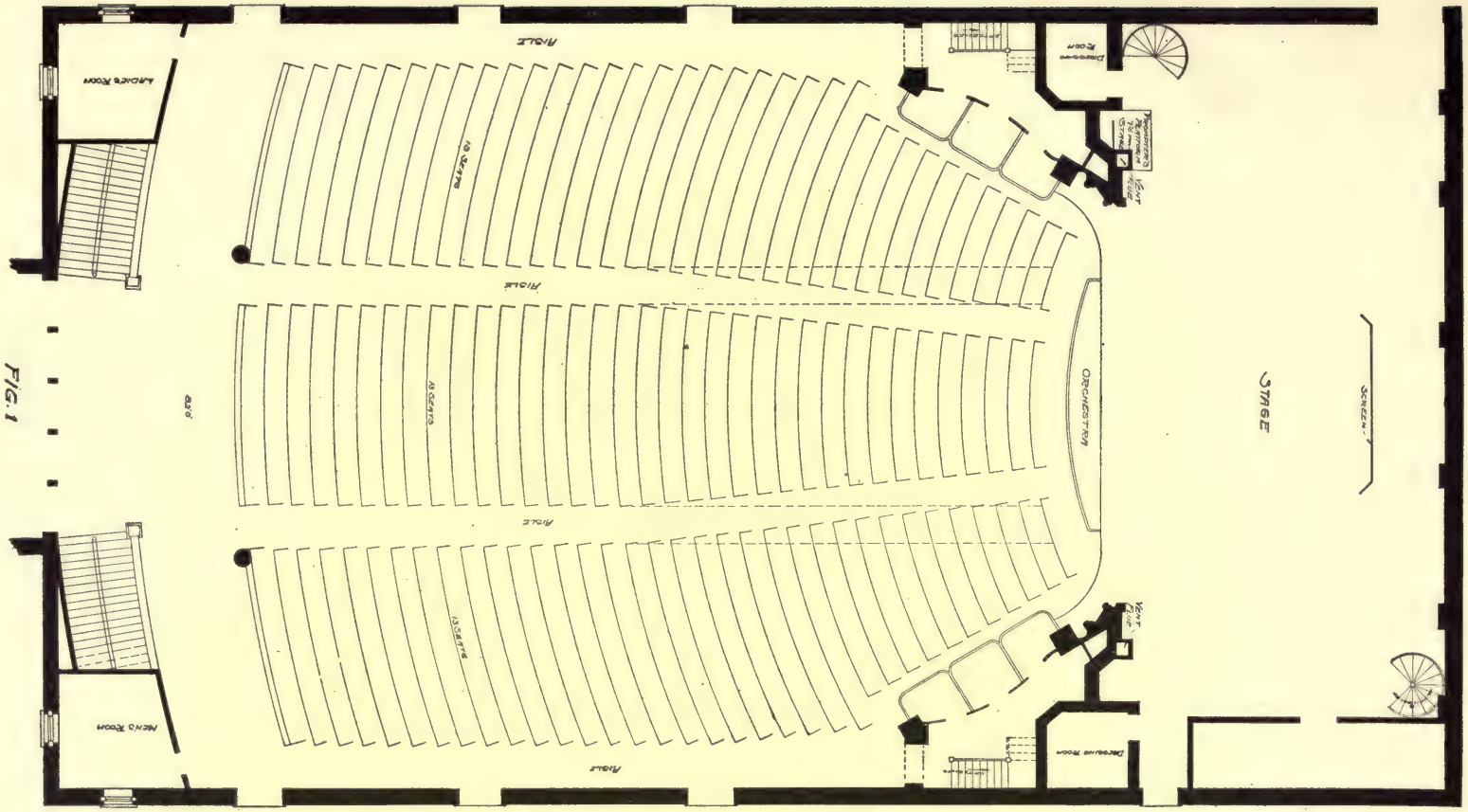


FIG. 1

Showing a well laid out house, with the best arrangement of aisles, method of seating, a good arrangement for boxes, etc.

wardrobes and toilets for actors, trunk rooms, etc., also room for the orchestra below the stage.

In picture houses where there is no regular stage, it is better to make a false stage so as to be able to set the screen as far away from the front seats as possible, otherwise the first few rows of seats are of little value as the picture does not show up well at a close range.

DESIGN

While the plan and layout of the houses are often faulty, the exterior designs are in a great many cases beautiful, so that it is not the intention of the author to treat on the design for either the exterior or interior, as these features may well be left to the architect in charge, only suggesting that due thought and care should be made in the placing of lights on the exterior, and spaces provided for the advertising of the show.

Managers are bound to make a lavish display of posters and will invariably cover up some architectural features unless ample provision is made for the purpose.

CONSTRUCTION

It is, of course, obvious that a theatre, to be structurally safe, should be built entirely of fireproof materials and all steel beams, girders and trusses should be protected with fireproof materials. All external and internal walls should be of bricks or hollow tile or other approved fireproof material. Special attention should be paid to the construction work of the stage as nearly all fires have their origin there.

There are various types of fireproof construction on the market that are suitably adapted to theatres.

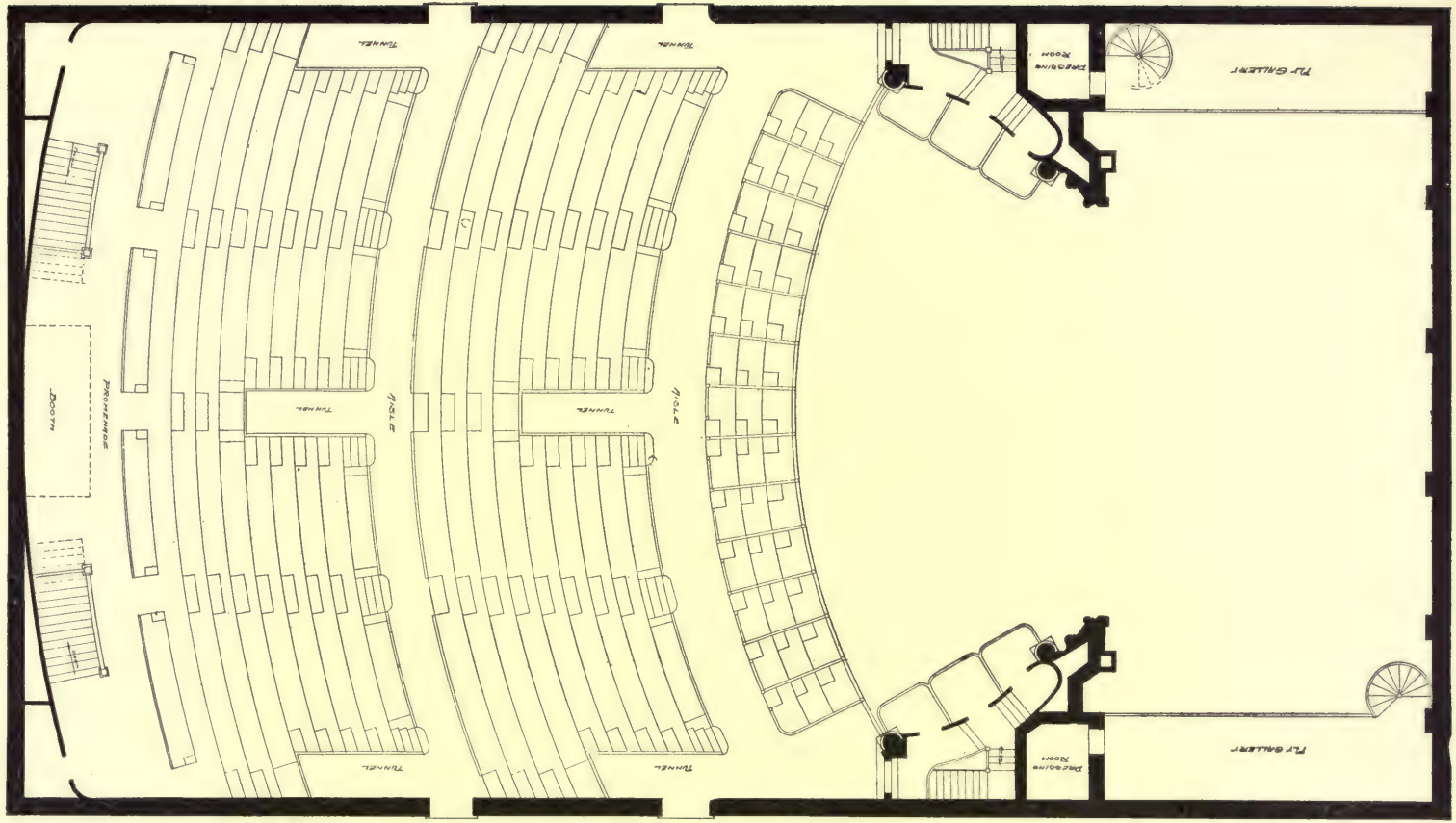


FIG. 2

This is the balcony plan for Fig. 1 and shows passageway or tunnels from the lobby and stairs to the cross aisles. This method saves climbing stairs all the way to the top of the balcony and then descending. It also shows a good arrangement for loggias.

FIREPROOF CONSTRUCTION

All architects understand the meaning of the term fireproof, while the average layman has a very vague idea of its meaning, and often considers cost prohibitive, but from the fact that lumber is getting scarcer, of poorer quality, in shorter length and more costly every year, and as the various methods of reinforced concrete construction are getting better and cheaper every year, the difference in the cost is not so great when all things are considered.

The walls, both exterior and interior, of a large theatre should be constructed entirely of brick or concrete. The interior walls may be built of hollow tile, and minor partitions of metal studs and lathed with metal lath and plastered with hard plaster.

Stairways should be built of iron or concrete and enclosed where possible with fireproof walls. Roofs may be constructed of hollow tile or concrete slabs and covered with fireproof asbestos, plastic cement or waterproof tiles laid in cement.

The floors may be built of hollow tile, poured concrete or slab construction.

There are not so many doors and windows in the average theatre, but what the extra cost of making them of metal would be money well expended, also the trim around same.

The windows, particularly if exposed to inflammable surrounding buildings, should have metal frames and sash, glazed with wire glass. These are better than swinging shutters. Exposed exterior walls may also be protected by a perforated sprinkler system that will allow a sheet of water to form down on the face of the wall. (See article on "Sprinklers".)

II. ORPHEUS THEATRE, CHICAGO, ILLINOIS

Aroner & Somers, Architects

SIGHT LINES

One of the most important things to be considered in planning a theatre is the sight lines or radius of vision, and it is even more important in a picture house than in a regular theatre, for the reason that a person sitting in the audience of a regular theatre, if he can see the actor between the heads of the people in front of him as he moves from one part of the stage to the other, and can hear his voice, he will be contented, whereas in a picture theatre he must be able to see the entire surface of the screen or he will lose the full benefit of the play and if the patrons are unable to get a full view of the screen they will make complaint to the management and will also publish the fact to their friends of this defect, and the receipts will suffer accordingly. Therefore much thought should be given by the architect to the proper laying out of the sight lines.

The vision should not be limited to the area of the screen only, as the people in the last row of seats should be able to see at least 2 or 3 feet above the top of the screens from underneath the balcony. In a regular theatre a person sitting in the last row should be able to see at least 16 ft. high on the curtain. The people in the balcony, while they may have an unlimited vision above the screen, should also be able to see the tops of the heads, at least, of the orchestra. Therefore, the first thing to do after determining the floor plan of the house, stage, exits, etc., will be to establish the sight lines. The best method to proceed in this is to first locate the position of the eye on the sectional drawing of the person sitting in the last row of seats and then draw a line to a point about 3 ft. above the top of the screen; this line establishes the lowest point of the underside of the balcony (see Figs. 3, 4, 5, 6 and 7).

Due consideration should be made for persons standing in the rear. The pitch of the auditorium floor is also to be taken into consideration, and the height of the stage or the bottom of the screen, as this will regulate the position of the sight lines. The bottom of the screen is generally set from 1 to 4 ft. above the stage, according to conditions.

The pitch of floors, heights, etc., will be described under a separate heading.

After having established the location of the front of the balcony, draw a line from a point about 4 ft. below the stage on the curtain line through the top of the first riser of the balcony to the rear of the house (in a theatre the rear is the front), or, in other words, the rear of the people. This line determines the lowest pitch for which the steppings of the balcony may be made and represents the edge of the nosings of the risers, but as the steps go towards the rear, they should be slightly increased from the straight line and should be on a slight rising curve.

Next locate the eye of the person in the front row of the balcony and the person sitting in the last row and draw a line through these two points to the apron of the stage and see that it strikes well below the same. The eyes of a person sitting is 4 ft. from the floor, and 5 ft. when standing. In picture theatres, the starting point of 4 ft. below the stage may be modified somewhat, depending on conditions.

Now, if entirely satisfactory results have not been obtained, raise or lower the pitch of the main floor and the stage, and lay out the sight lines again and in the same manner, and it will be found that a slight change in the main floor will make considerable change in the balcony, as to its height in the rear.

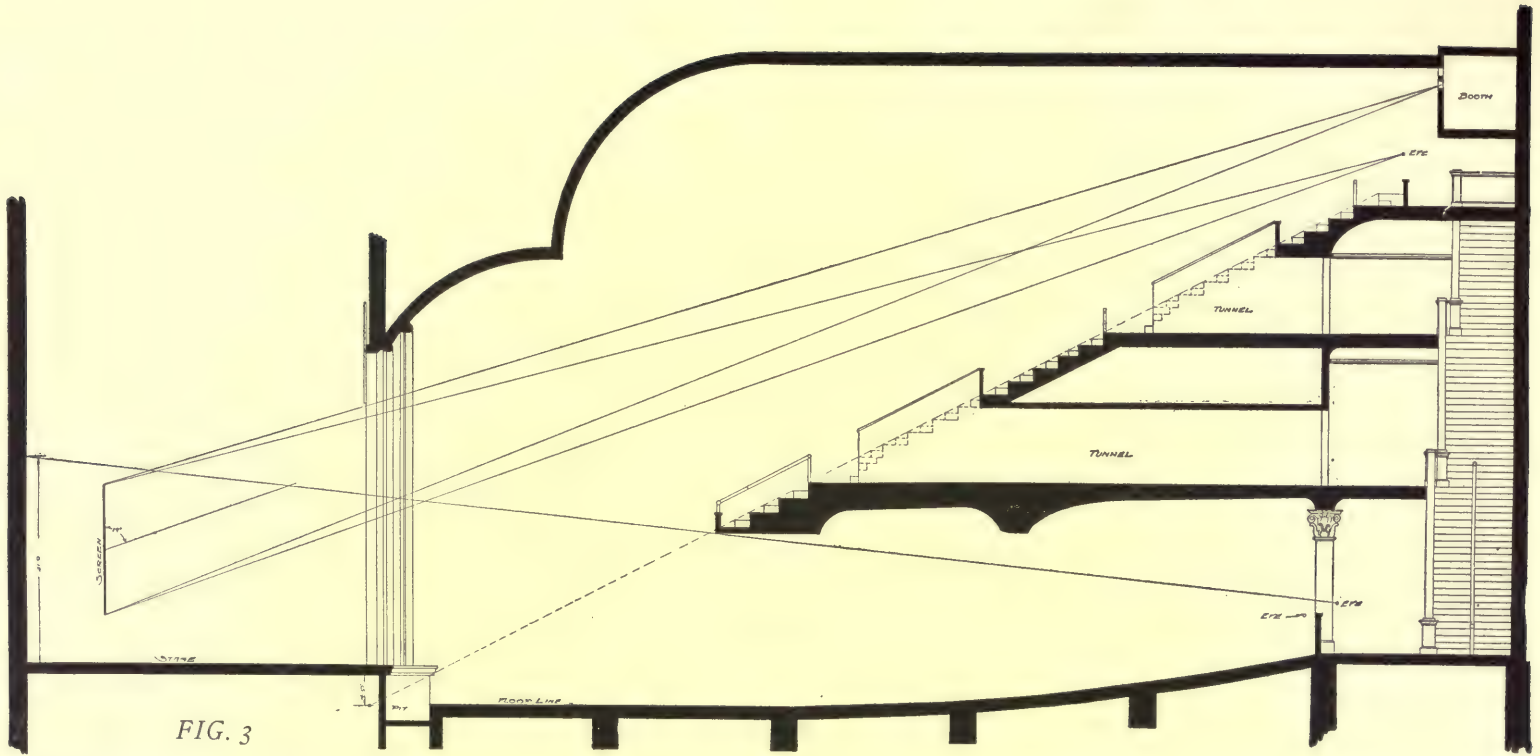


FIG. 3

This is a sectional drawing of Fig. 1 and 2 and shows the passageways to cross aisles, arrangement of aisles and seats, loggias, boxes, etc. The stairs leading to the top of the balcony are not intended for entrances, but for exit only. It gives a good idea of sight lines, projection lines, and location of the booth, which is suspended from the roof and projects up through the ceiling a little.

It is better to work out these lines in two or three different ways before determining the exact position of the balcony, and having done so you will have almost perfect conditions as far as sighting is concerned.

Do not make the balcony so high that it will require too many steps to ascend, as this is a detriment. The arrangement of balcony stairs will be described under another heading.

The steppings of the balcony should be not less than 2 ft. 5 in. wide, allowing a few inches extra for the first and last rows.

The risers may start with a 4 in. riser and be increased toward the rear, but in no case should the last riser exceed 18 in., and it is very seldom necessary to go as high as that except in a second balcony or gallery, which may be 21 in. (See table of "Comparative Laws of Various Cities.") Galleries are not in such demand now as they used to be, especially in low priced houses, because the extra cost of the construction of the gallery, the extra height required for the walls, and the extra heating required makes it impracticable from a financial standpoint, except in special cases where the land area is limited or where a large seating capacity is required.

Extra steps are required in the aisles of the balcony where the risers are over 10 in. high.

In a wide house it is necessary to lay out sight lines on the side of the balcony as well as in the center. This will bring the front rail of the balcony on a downward curve towards the sides.

The location of the projection rooms or machine booth is important and will have some effect on the height of the

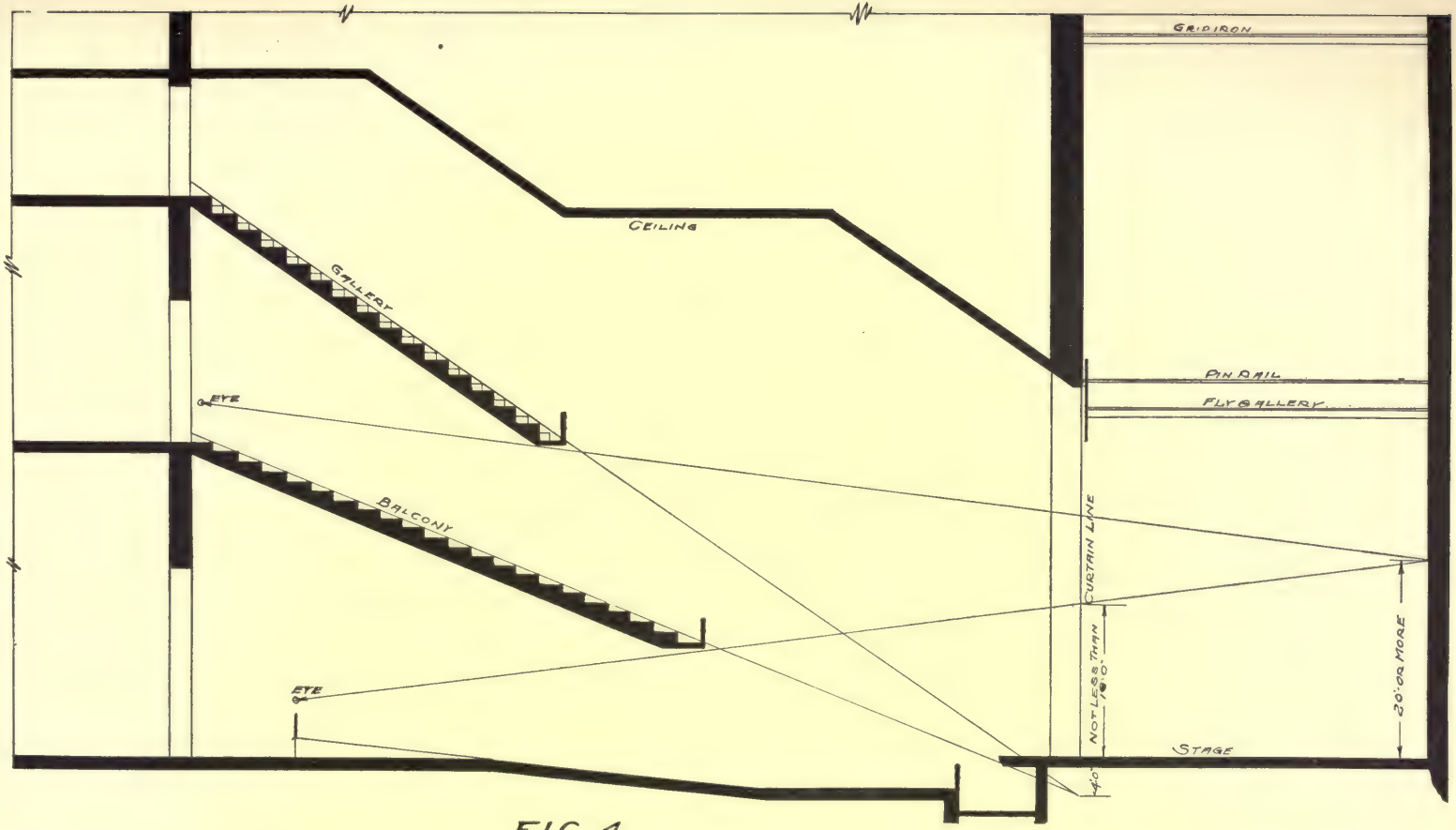


FIG. 4.

This section shows a house with a good pitch to the floor. The sight lines are laid out right down to the limit, but no provision is made for a projection room, as there is not height under the balcony or gallery. If one is placed in the gallery it would be too high for good results on account of the angle of projection being greater than 20 degrees.

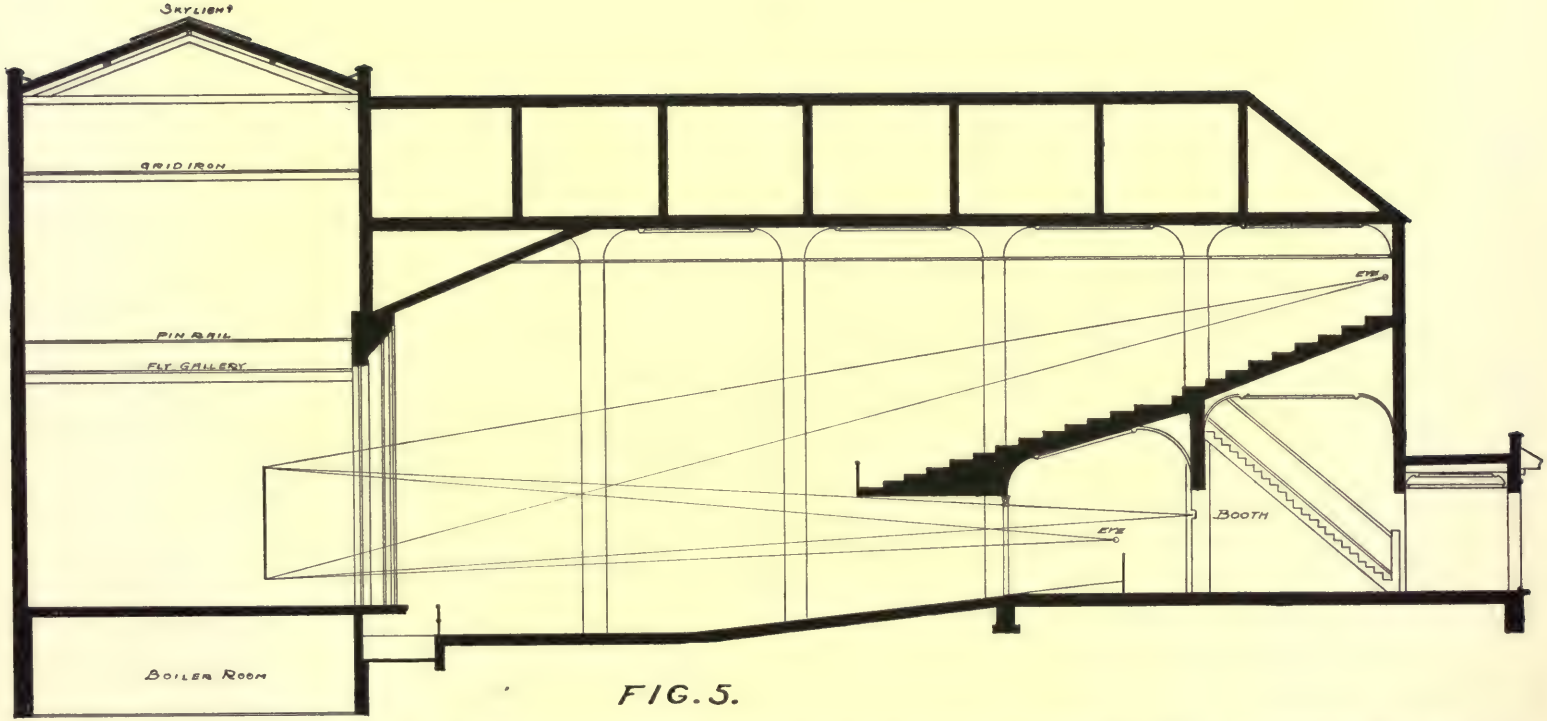


FIG. 5.

Showing sight and projection lines, with the booth made under balcony and all height reduced to the limit. The screen could be placed on the rear wall without affecting the sight lines of the projection line, but the pictures would be somewhat larger. If the balcony were a little higher it would be an improvement. The balcony stairs land about midway on the balcony. The rear seats on main floor are raised above the aisles. This tends to keep the floor out of the ground.

balcony, as will be described under heading of "Projection Lines."

As no two theatres are alike, the sight lines must be worked out to fit the individual case and not follow any set dimensions of any other house. The operation is comparatively simple and not as difficult as it appears.

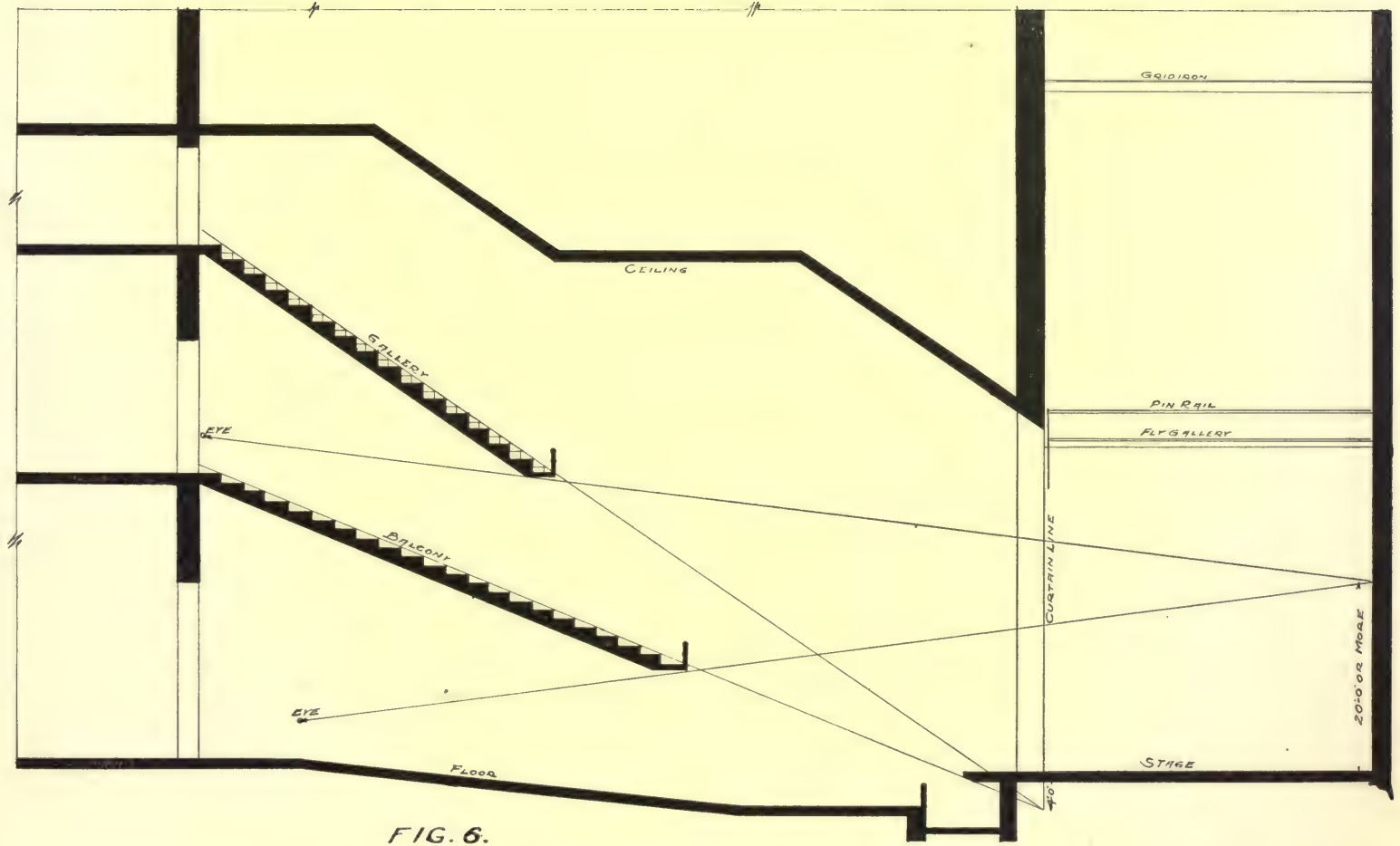


FIG. 6.

This section is simi'ar to Fig. 4, except that the floor is not raised in the rear.

PITCH OF FLOORS

The location of the main floor in a theatre depends somewhat on local conditions. For instance, if the grade of the ground is much lower in the rear or stage end, it gives ample opportunity for a good slope to the floor without throwing the rear exits below ground, in which case the main entrance lobby may be level or even pitch slightly downward if necessary. (See Figs. 4 and 5.) If, on the other hand, the ground is higher at the stage end, it is often necessary to grade the entrance lobby up considerably so as to bring the rear exits out above grade. (See Figs. 7 and 8.)

A good slope to the parquet floor is desirable, as it gives a better view of the stage and helps in working out the sight lines. No steps should be placed in the aisles on the lower floor. While it is desirable to have a good pitch to the lower floor, this pitch does not have to be continued to the stage but about two-thirds of the way and the rest may be level, because the people in the first ten or twelve rows are looking up while the people in the rear are looking over their heads. The floor in the extreme rear may be raised above the aisles. This also helps to keep the side and rear exits out of the ground. (See Figs. 4, 5 and 8.) Exits below grade are bad. The laws in some states limit the pitch of floors to 1 in. to the foot. In many cases this is not enough for good results.

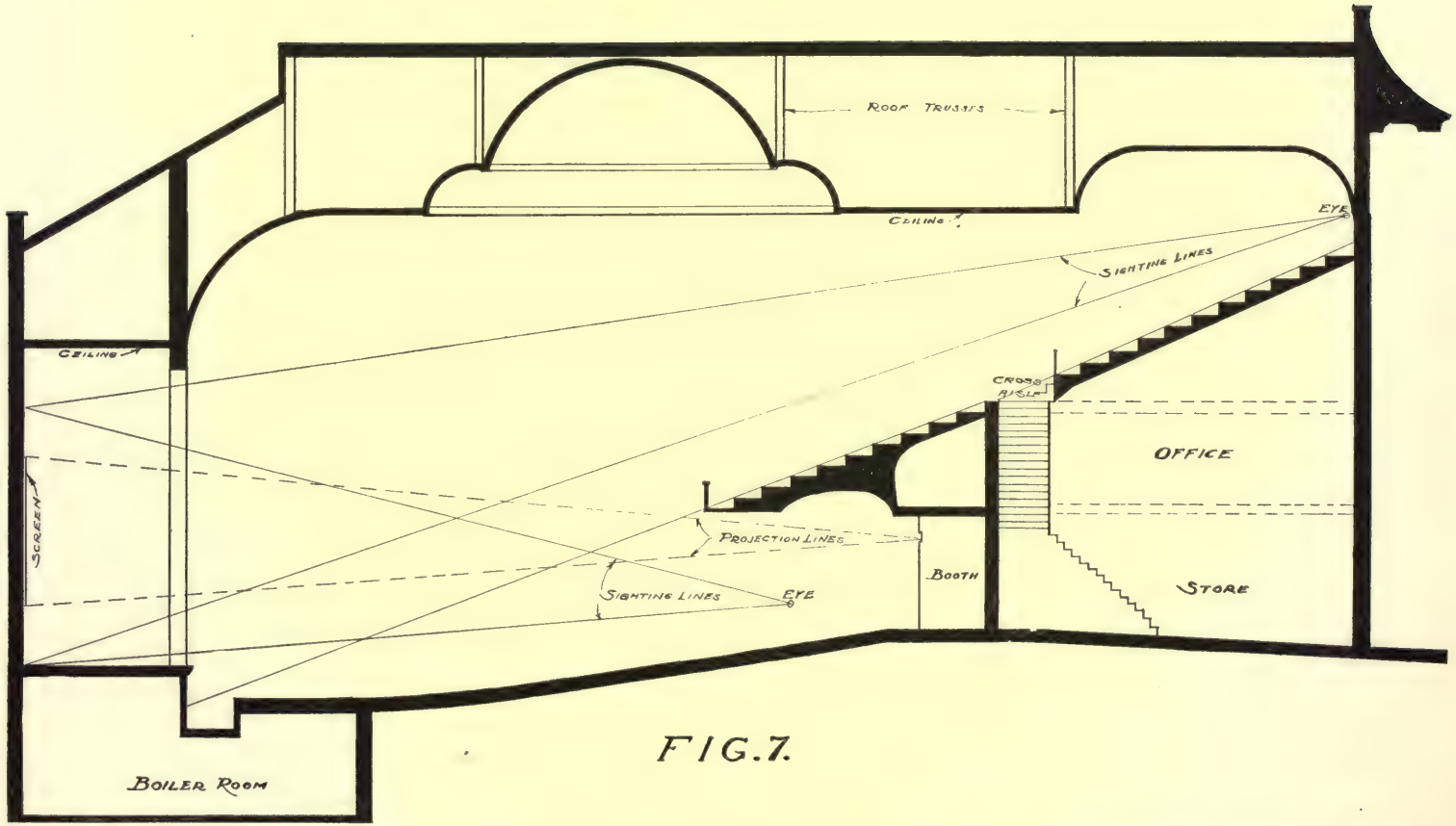


FIG. 7.

This a layout for a picture house only with no stage except a recess for the screen. The booth is located underneath the balcony. Stores may be located either side of the lobby with office above. The floor has a good slope. The rear part of the balcony is slightly raised with a little more pitch. The stairs land about midway in the balcony.

BALCONY

The balcony in a theatre should be easy of access, and without having to ascend too many steps. Balconies are planned in a great variety of ways. A curved front in a wide house or a straight front in a narrow house. It may also be divided into two sections, about midway between front and rear with an aisle or passage running crossways, and the stairs should land on the passage.

It is not a good plan to have the stairs land at the highest point of the balcony as it makes a longer climb and the people do not like to climb to the top and then walk down again, but if the stairs land near the center or below the center, then the people may pass to the front and rear from the cross aisle. (See Figs. 5, 7, 8 and 10.) A good scheme is shown in Fig. 3, wherein tunnels are used at two different levels.

It is better to avoid the use of posts to support the balcony by using trusses or heavy girders from wall to wall, although it adds considerably to the cost of construction on account of the span requiring heavy steel girders, but the owner and patrons would appreciate the benefit derived by not having posts to obstruct the view. Balconies may overhang about one-third their depth if necessary, but must be well anchored to the rear walls to prevent any overbalancing. The balcony rail should be trussed so as to give additional stiffness to the overhang.

Loggias are a good feature, both for convenience and decorative features.

In Pennsylvania no balconies are allowed in picture theatres.

PROJECTION LINES

The line of the axis of light should not be more than 20 degrees off the center to give good results. (See Figs. 3, 7 and 8.) Any greater angle will give a contorted picture, unless the screen is tilted so as to reduce this angle, but a tilted screen is not desirable as it gives an unpleasant effect to the stage and proscenium arch, and while the picture itself may be in true focus at all parts of the screen, and will give a perfect picture from the balcony, it will appear distorted to the spectators in the front rows of the lower floor on account of the variation in distance between the top and the bottom of the picture and the eye.

The position of the projection machine and its relation to the screen is important. The best results are obtained when the center line of the lens is opposite the center line of the screen or nearly so, and the center of the beam of light is at right angles to the screen. If the light strikes the screen at any angle other than a right angle, the picture will be contorted, and the greater the angle the greater the contortion. Thus, if the machine is set, say 20 ft. above the center of the screen, the result will be a wide picture at the bottom and narrow at the top and only a part of the picture will be in a true focus. If the machine is greatly to one side of the center of the screen, the picture will be wide on one side and narrow on the other.

If the picture is shown on a movable curtain at front of stage part of the time, and on a fixed screen at the rear of the stage at another time, it will require an additional set of lenses on account of the difference in "length of throw."

Do not locate the booth nearer than 35 ft. from the screen, as the result will be cloudy. (See "Table of Distances.")

BOXES AND LOGGIAS

Boxes are not always a success in the way of vision because one can only get a view of one side of the stage from the boxes.

They are used more as a decorative feature to fill up a waste corner that is good for no other purpose. For decorative purposes they offer great opportunities.

Boxes or stalls arranged along the side, however, as shown in Fig. 17, are useful as far as vision is concerned, and the corner space can then be used for dressing rooms or other purposes, if separated by a fireproof wall from the auditorium.

These stalls should be somewhat elevated from the main floor.

Loggias in the front of the balcony add much to the attractiveness of the balcony plan as well as to the decorative treatment from below, and on account of their exclusiveness, have the advantage of bringing better prices for the seats, as they are, in fact, the best seats in the house.

STAIRS

Considerable care should be exercised in the planning and location of stairways so as to give a safe and quick means of egress in case of panic.

Stairways incased with fireproof walls are most desirable. Entrance to the balcony may lead from the main floor in lobby, but should also lead direct to the street.

No stairway should be less than 4 ft. wide, where the balcony serves fifty people, and the width increased 6 in. for every additional fifty people.

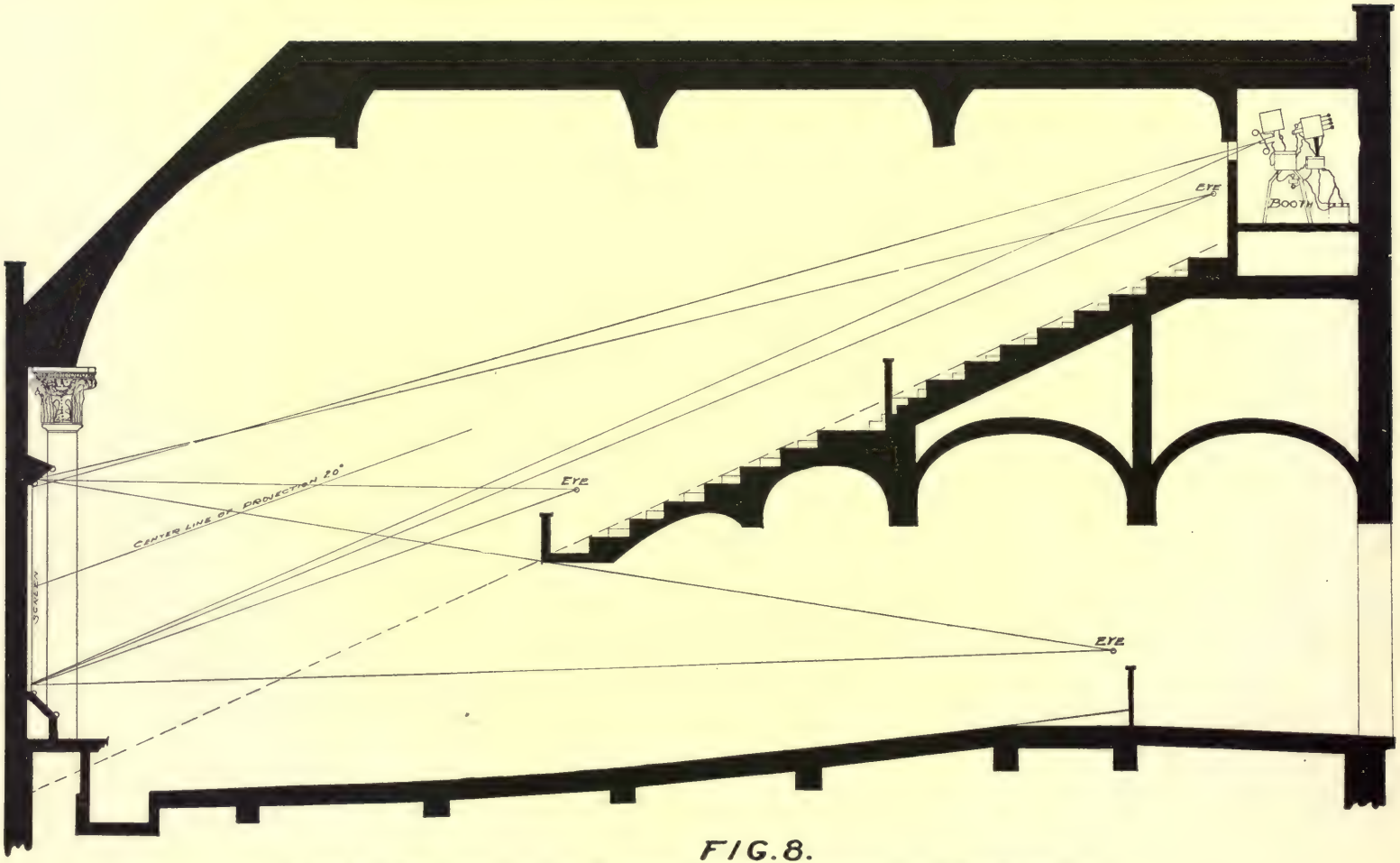


FIG. 8.

This is a very good plan for a picture house. With sight lines well worked out.

No winding stairways should be allowed.

The risers should not exceed 7¾ in. and the treads never less than 9½ in. run. Provide hand rails on both sides of all stairs.

Stairways over 6 ft. in width should have a hand rail in the center as well as the sides, and strongly supported and secured to the treads or risers. Long stairways should be broken with one or more landings, at least 4 ft. wide.

Eighteen steps is about the limit without a landing. No matter how small the theatre, allow at least two separate stairways from the balcony, leading to the outside, and one fire escape.

The stairs from the second balcony should be separate from the first balcony so as to avoid jams, and no stairways should communicate with the people from the main floor. The more the streams of people can be kept apart, the more quickly the house may be emptied and the less danger in case of panic. Single steps must be avoided in all cases. Angles on landings should be rounded.

FIRE ESCAPES

There should be at least one fire escape from each balcony, not less than 4 ft. wide and increased in width in proportion to the seating capacity of balcony. The fire escape should not be allowed to obstruct any passage unless there is ample width outside of same. All outside fire escapes should be covered as a protection against snow and ice. Fire escapes to be efficient must, of course, be regular stairways of iron or other fireproof construction, and not ladders that cannot be used by ladies and children.

EXITS

There should be plenty of exits of proper width and location, with doors to swing outward in such a way as not to block the passage or alleyways.

No exit door should be locked during any performance, but should be provided with panic bolts. These lock the doors from the outside but can always be opened from the inside.

The balcony and gallery should be especially provided with exits, as the people occupying them are more endangered from fire or panic than those occupying any other part of the house.

The exits on the main floor should be arranged so as to best serve the people.

In case of panic, people would naturally look to the main entrance or the way in which they came in first, and then to the exits afterward, therefore the main entrances should be as large as is consistent with the conditions.

Besides the main entrance, there should be at least one exit on the stage end of the house either at the back or on the side. When the seating capacity of the main floor exceeds 500 people, there should be one additional exit for each 500. No exit doorway should be less than 5 ft. wide. No exit should lead to any enclosed space, or through any other building. Municipal laws of most of the principal cities regulate the number of exits.

No blind aisle or architectural feature that looks like an exit or doorway should be permitted, nor should any mirrors be placed so as to appear to be an opening where there is no such opening.

III. NEW ORPHEUM THEATRE, KANSAS CITY, MISSOURI
G. Albert Lansburgh, Architect

AISLES

Provide as many aisles as is consistent with the width of the house. It is preferable to have two center aisles and one aisle on each side next to the wall. One aisle in thc center of the house is not desirable as it causes the loss of the best seats in the house, and furthermore the actors prefer to look into the faces of a solid body of people rather than face down the aisle.

Do not place seats next to the wall, as it interferes with the side exits unless cross aisles are provided, and that is a bad feature, especially in picture houses, as people are constantly passing in front of those sitting.

The minimum width of any aisle with seats on both sides should be 3 ft. and widen toward the rear, 1½″ to every 5 ft. in length, as it has to serve more people in exit. Aisles with seats on one side only may be 2-4 at the starting point. It is better to make the main aisles straight from one end to the other, so that the seats may be regular and all on one width. It also gives additional seats in the central bank, which is most in demand. (See Fig. 1 dotted lines.)

There should be no steps in aisle or passageways on the main floor. All seats must be securely fastened to the floor. Do not allow movable chairs in any aisle or passage that will obstruct same in making a hasty exit.

Standing room is always desirable in any theatre from the manager's point of view. Aisles or passageways must not be obstructed by radiators unless over head. They may be recessed into the walls.

SEATING

The old method of horseshoe curves in laying out seats has practically gone out of style. The seats in most of the modern houses are arranged in long curves and in many cases almost straight. In narrow houses the rows should be straight.

There should not be more than thirteen seats between two aisles, so that there will not be more than six seats to pass to get to either aisle.

The widths of opera chairs vary from 18″ to 22″ and, while they are made even narrower, they are not recommended, as an 18″ seat is narrow enough. Only in a few cases do they exceed 22″. All widths are used on center to center measurements. The character of the house determines the width of seats.

The spacing of seats from back to back varies from 28″ to 32″. Where heavy upholstered seats are used the spacing must be at least 32″ on account of the fact that the chairs themselves take up about 2″ additional space. But for veneered chairs 29″ or 30″ is considered good, while 28″ is all right for cheaper class picture houses.

Allow two inches more for spacing in balconies where the risers are high, as the back of the chair will hit knees of the persons in the next row.

Always purchase seats with a foot rest, especially if there is an incline to the floor.

This does not apply to balcony seats.

A house with comfortable seating is talked about by the patrons on the outside, and the house gets a good advertisement in this way.

No matter how nice the decorations and other features may be, if the seats are so close together that the knees touch the backs of the seats in front, and the seats are so narrow that a broad gage man has to squeeze in, it is detrimental to the house, therefore do not try to gain too many extra seats at the sacrifice of comfort. (See table of comparative laws.)

An electric signal system has been invented for use in dark houses so that a patron may locate vacant seats by signal lights on the back of the seats. These are all connected to an indicator in the box office, so that it may be seen at a glance which seats are occupied and which are not.

SEATING CAPACITY OF VARIOUS HOUSES

Name of Theatre	Orchestra	Boxes and Loggias	Balcony	Gallery	Total
Academy of Music, Philadelphia	....	....	.....	.....	3100
Academy of Music, Baltimore	750	....	464	600	1710
Academy of Music, Chicago	....	....	.....	.....	2450
Alhambra, Milwaukee	780	165	750	800	2495
American, N. Y. City	740	....	609	800	2400
Amphion, Brooklyn, N. Y	655	74	419	568	1716
Auditorium, Chicago	....	....	.....	.....	4200
Auditorium, Philadelphia	1672	78	504	900	3044
Auditorium, Minneapolis	....	....	.....	.....	7000
Baker, Rochester, N. Y	650	100	350	700	1800
Broadway, N. Y. City	....	....	.....	.....	1700
Boston, Boston, Mass	....	....	.....	.....	3172
Broad St., Philadelphia, Pa	631	....	398	600	1629
Broadway, Denver, Col	456	130	502	536	1624
Casino, N. Y. City	560	....	500	300	1360
Century, St. Louis	600	70	565	433	1600
Colonial, N. Y. City	750	....	450	555	1750
Colonial, Boston, Mass	650	60	552	368	1653
Columbia, Washington, D. C	600	....	350	500	1350
Coliseum, St. Louis	....	....	.....	.....	12000
Empire, N. Y. City	....	....	.....	.....	1100
Garrick, N. Y. City	344	....	248	218	910
Grand Opera House, Boston	....	....	.....	.....	2600
Keith's, Boston, Mass	....	....	.....	.....	2700
Illinois, Chicago, Ill	586	....	380	338	1304
Madison Square Garden, N. Y	....	....	.....	.....	12137
Majestic, N. Y. City	592	....	460	652	1704
Manhattan, N. Y. City	....	....	.....	.....	1100
New Amsterdam, N. Y. City	384	....	272	252	....
Proctor's, 23rd St., N. Y. City	....	....	.....	.....	1551
Proctor's, 58th St., N. Y. City	....	....	.....	.....	4400
Proctor's, 125th St., N. Y. City	....	....	.....	.....	3450
Pabst, Milwaukee, Wis	....	....	.....	.....	2092
Power's, Chicago, Ill	....	....	.....	.....	1318
Park, Indianapolis, Ind	....	....	.....	.....	2275
Orpheum, New Orleans, La	....	....	.....	.....	2800
Shubert's, N. Y. City	586	50	400	361	1395
Shubert's, Boston, Mass	618	....	473	401	1492
Shubert's, Minneapolis, Minn	601	50	379	451	1533
Shubert's, St. Louis, Mo	646	60	467	456	1681
Shubert's, Kansas City, Mo	650	32	423	411	1603

PROSCENIUM ARCH.

The proscenium arch is the opening between the stage and the auditorium.

It varies in width according to the width of the house, and the height varies in proportion to its width. (See table.)

The older houses have high arches; the modern houses have low arches.

The arch is generally elaborately moulded and decorated, as this affords one place where the designer may spread himself.

It is often studded with electric lights.

The general angle of the proscenium arch is 45 degrees, but it may be carried back on the wall as far as desired and squared back on the stage a few feet and widened out over head as much as the designer desires. The wider the opening, the greater the distance required between side walls of the stage. It also requires a deeper stage. 40 ft. is considered a good width for the opening.

There is no fixed proportion of height of proscenium arch to its width; it may vary with the style of architectural treatment. If the opening is square or the height equal to the width, there is generally a permanent drapery hung outside of the curtain that reduces the height to a proper proportion. The proportionate widths and heights for the proscenium arch as recommended by the author are as follows:

In a 40 ft. house make the arch about 24 ft. wide by 18 ft. high.
" 50 " " " " " " 28 " " " 22 " "
" 60 " " " " " " 32 " " " 28 " "
" 70 " " " " " " 38 " " " 32 " "
" 80 " " " " " " 44 " " " 36 " "
" 90 " " " " " " 48 " " " 40 " "

These dimensions may be varied to suit the design.

The sounding board which surmounts the proscenium arch is often elaborately embellished and painted with appropriate scenes and figures.

The primary object of the sounding board is, first, to reflect or transmit the voice; second, to save excessive space aloft to be heated.

PROSCENIUM CURTAIN

All theatres where scenery is used on the stage should be provided with a fireproof curtain just inside of the proscenium wall, separating the auditorium from the stage. Asbestos and steel curtains are the most common in use.

STEEL CURTAIN

Steel fire curtains are sometimes used in the larger theatres to cover the proscenium opening. These are constructed of sheet steel plates re-enforced with angle iron frames and overlap the sides of the opening about 1½ ft. on each side, running in channels or smoke grooves, and are suspended and operated similar to the asbestos curtains. These steel curtains have to be operated by special machinery on account of their height. They are much more expensive than the asbestos curtain.

ASBESTOS CURTAIN

Asbestos curtains should be made of asbestos cloth, with or without brass wire reinforcement, and should weigh not less than two pounds to the square yard. If possible the curtain should be so arranged that it may be raised straight up, or wall fashion, rather than to fold or roll. A curtain which goes up straight should be fitted with pockets at the top and bottom to take not less that 2½″ iron pipe battens and there should be rings or snap hooks at the sides for attachment to guide wires.

The curtain should overlap the proscenium opening at the sides and top not less than 18″ and iron smoke grooves should be installed on each side of the proscenium opening securely fastened to the walls. These smoke grooves should extend right up to the gridiron. The seams in an asbestos cloth curtain should run perpendicularly and all sewing done with pure asbestos sewing twine. Curtains are suspended by means of iron cables which run over sheaves on brackets securely bolted to the proscenium wall, the cables then turning over a head block and being fastened to counterweights sliding in a track which will balance the curtain so that it may be raised or lowered by means of the manila rope hand line from either side of the stage or from the fly galleries. The curtain should outweigh the counterweights just enough to insure the automatic dropping of the curtain at the proper speed in the event of the hand line being cut in case of emergency. Good curtains are made by manufacturers that cover the laws of any state and they will set them up complete and in good working order.

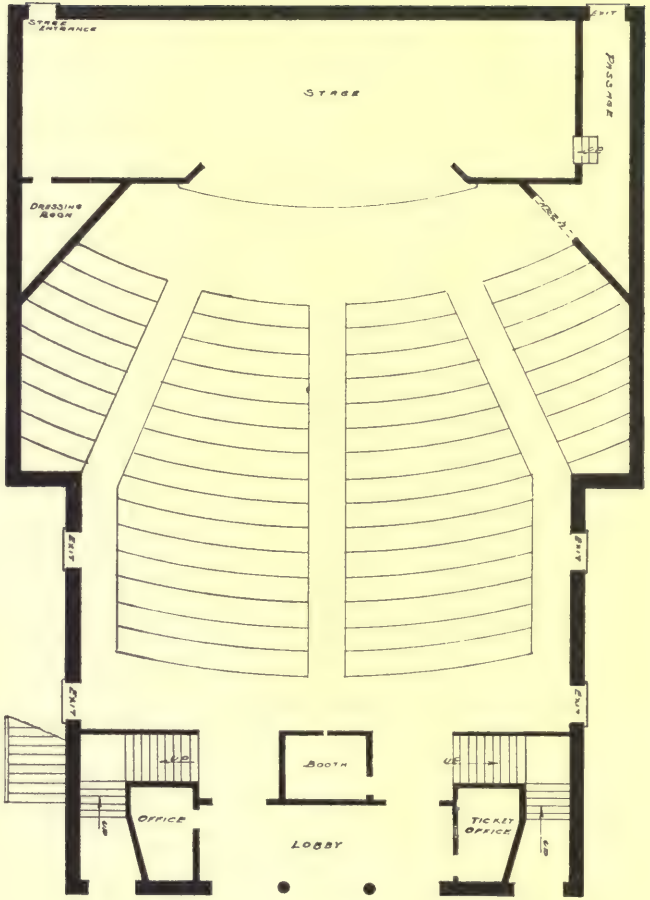


FIG. 9

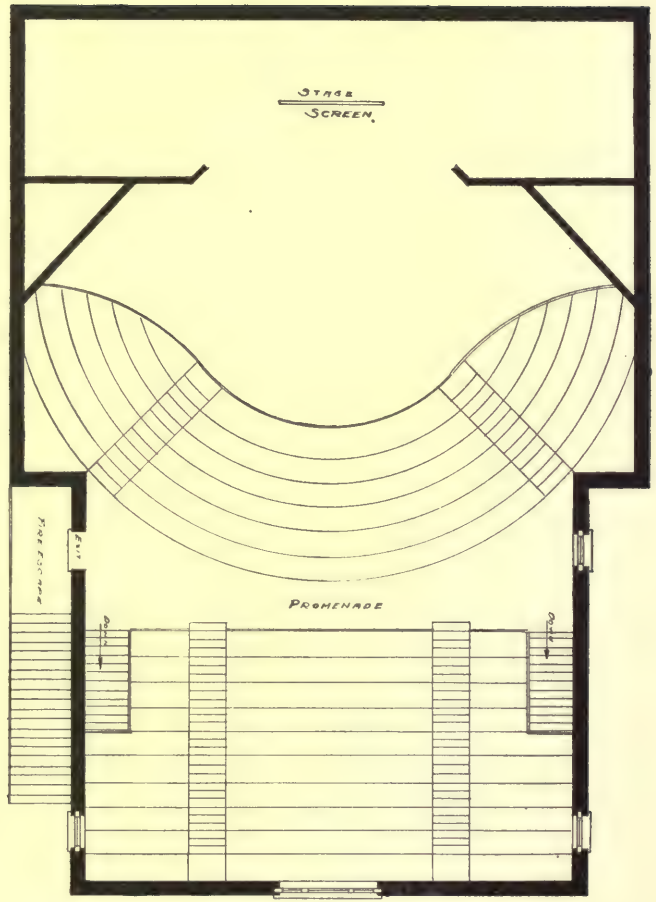


FIG. 10.

This represents the main floor and balcony of a small theatre with stage for dramatic productions and for pictures, with the booth located on the main floor. The balcony stairs land midway in the balcony. The stairs from balcony to street are well arranged and connect with the landing on the inside stairways.

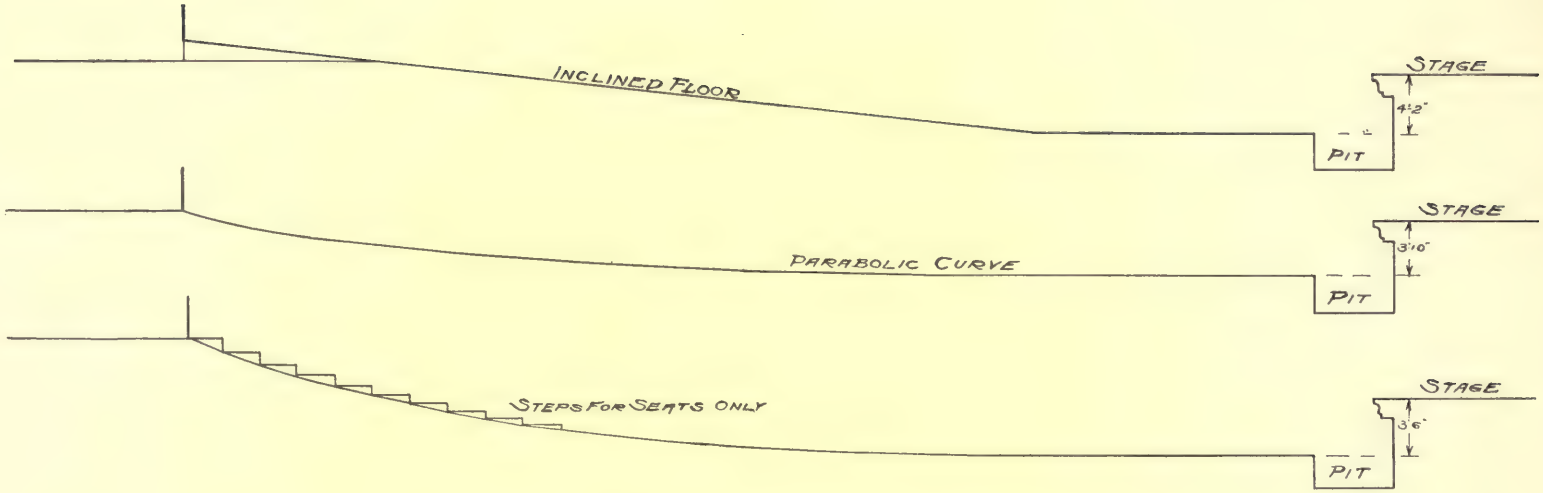


FIG. 11.

Suggesting different grades of floors. The grade of floor depends largely on the local conditions of the building site, its means of exit on sides or rear, etc.

THE STAGE PROPER

In thinking of your proposed new theatre, your mind must often revert to the really important part, the stage proper. In reality the audience sees but a small portion of a theatre. What goes on in the vast space above, beneath, behind and on either side of the stage? Are not the unseen regions of a theatre more interesting and important than those that are seen by the audience? What a degree of curiosity is aroused in the theatre lover when the stage is mentioned—that mysterious region to which access is denied to the unitiated, who would most willingly pay double price to penetrate the innermost recesses of an opera house of the first rank—an establishment, a tour of discovery behind whose scenes reveals all the resources of the modern stage; inasmuch as one finds there not only everything pertaining to a theatre, but also the numerous and varied contrivances which have been devised for the presentation of the modern production. Today much of this material is carried by the touring company, but a special line of mechanical contrivances needed for the proper putting on of these productions must be found in the local playhouse, or the best effects must be cut out, to the disappointment of the usual auditor and the displeasure of the more enlightened neighbor who may have seen the original production and who immediately proceeds to tell how much better the show was in New York.

Younger ingenuity has grafted many improvements on European designs so that our opera houses of later years can show in stagecraft many improvements upon old established foreign theatrical construction.

The regions in which the labor of putting on a modern scenic production is performed as a veritable beehive of activity. They embrace, besides the stage proper, the rooms or the heads of the various departments, viz., stage carpenter, scenic artist, stage manager, musical director, property master, costumer and electrician.

The stage, properly speaking, is that portion of a theatre which can be seen from the auditorium and the space on either side behind the proscenium arch, upon which the performers stand and upon which is placed framed scenery and "set stuff." The stage is usually divided width-wise into three parts. The side from which the curtains are worked and on which should be located the switchboard is called the prompt-side. The stage manager stands here, so as to be in easy and direct communication with the curtain man and electrician. Midway across the stage is the point designated as the "center of the stage," usually monopolized by the star and at which the novice looks with longing and only too often envious eyes. Then there is the opposite prompt-side or, as it is always called in theatrical parlance, the "O-P side." The depth of the stage is divided figuratively into "entrances," as, since flats running in the grooves have been discarded, there is, strictly speaking, but one pair of entrances, known as the "first prompt entrance," between the proscenium wall and the tormentor wing, and, corresponding with it on the opposite side, the "O-P first entrance." The first wings are known as tormentors, as they are usually built with a flipper, so as to hide the view "off stage" of those sitting in the boxes and front rows.

All these divisions and their appellations hold good not only of width and depth, but also of height. For instance,

the O-P extends from the stage to the gridiron far above, a height from the floor of the stage of seventy feet or more, on which are attached the sheave blocks for running the lines that raise and lower the drops and borders, as described later.

Everything above the proscenium arch is summed up in the term "flies," a word more frequently misused than any other theatrical term, and wrongly defined even in the principal dictionaries of the English language. The uninitiated almost invariably use this term in speaking of the strips of canvas painted to resemble sky, foliage, arches or the ceilings of interiors, suspended across the stage above the wings.

These are the borders, and form but a small portion of the flies, which include the border lights (rows of electric incandescent bulbs running across the flies and illuminating the borders), innumerable ropes, cleats, pulleys, the beams to which they are attached, and the fly galleries on either side, from the lowest of which the drop scenes and borders are worked. These galleries vary in number according to the size of the house. Then, from the "prompt" side across to the O-P side stretch, a story higher, the beams already referred to. These in the aggregate have two names, according to the position of the person speaking of them. Looking upward from the floor of the stage he would call them the gridiron; standing on them he would speak of them as the rigging loft. The drops in large houses are about forty feet high, and as they are raised and not rolled up, the space from the top of the borders on a line with the first fly gallery to the gridiron is about eighty feet high, giving room for the drop, the prompt, center and O-P rope.

While the floor of the stage runs from the footlights to the rear wall of the building, the entire depth is rarely

utilized, because a section extending about eight feet forward from the rear wall is reserved for the paintroom. The floor of the paintroom is a platform call the paint bridge, which extends across the stage and can be raised and lowered between the floor of the stage and the first fly galleries. The canvas to be painted having been hung in position so that its top is level with this gallery, the work of painting begins, the bridge being lowered as occasion requires. Frequently, however, the canvas is hung on a frame working from pulleys from one of the gridiron beams and gradually lowered, the bridge remaining suspended between the prompt side of the first fly gallery and the O-P side, thus forming a convenient crossing from one side of the house to the other for those at work in the upper stories, who would otherwise have to descend to the stage floor, cross it, and ascend several flights of stairs on the other side.

At the production of the play, the audience, comfortably seated, watches the performance unfold itself so smoothly that it suggests no idea of preliminary labor. This is as it should be. For, as an actor must cause the result of his art to seem nature itself, so the theatrical manager must cause the action and its scenic surroundings to appear the spontaneous product of the time in which drama or opera plays. We are apt to credit only the actor with the genius of simulating nature. As a matter of fact, the principle upon which he proceeds governs every detail of a theatrical production. What the actor strives for, the manager, stage manager, scene painter, property master, master machinist, musical conductor, chorus and principal singers are striving for, and each in his respective department is endeavoring to simulate nature. I emphasize *simulate* because the simulation of

nature, as distinguished from the actual reproduction of nature, is the peculiar province of stage art. It is a fact that a real tree upon the stage looks less like a real tree from the auditorium than a tree painted upon a piece of canvas; and that with a bit of canvas and a little paint the scene painter can, at the expense of a few dollars, produce a Persian rug looking costlier and more like the real article than would an actual Persian rug costing a thousand dollars. What in real life would be an exaggeration becomes on the stage perfect simulation of nature; the actor's natural bloom would be ghostly pallor in the glare of the footlights, so that he is obliged to rouge his cheeks in order that their color may look natural. And as in this case the look of nature is produced by exaggeration, so it is with everything pertaining to stage art, voice, gesture, costume, scenery, "properties," light effect. They must all, so to speak, be rouged. A stage production, to be successful, must be prepared with this principle always in view. It can easily be traced through the work going on behind the scenes of an opera house.

The stage in a regular playhouse built for the production of opera, drama or vaudeville has many special requirements.

The stage should be separated from the auditorium by a fireproof wall, with fire doors and a fireproof curtain.

This wall does not necessarily have to be of heavy brick construction, but may be built of steel and terra-cotta blocks, which take less room. The curtain should be kept lowered until just before the performance begins, and lowered again immediately afterward. It should be arranged at the sides and top so as to thoroughly seal the openings, when lowered, to prevent smoke from passing into the auditorium by having the curtain run in grooves at the sides. The curtain should

be heavy enough to withstand the extra air currents caused by fire. It is well that this curtain should be operated both from the stage floor and from the fly gallery.

STAGE FLOOR

The floor should be level. The rear part of the stage is called "up stage" and the front part, toward the footlights, is called "down stage." The working surface or that part of the stage on which the play is produced is usually built of wood, on account of the numerous traps required and the necessity of fastening scenery to the floor, but the construction part may be of steel, while the sides of the stage, beyond the wings, may be entirely of fireproof material.

APRON

Do not make the apron of stage outside of the curtain line too wide. Three feet is plenty in any case, and in most cases less will do. It is better to make the front part of the stage straight, but a slight contour following the radius of the seats may be used if desired, and the corners or ends may be rounded off at sides. The footlights require a space of from 18 to 20 inches in width and from 5 to 10 inches deep, and should be close to the curtain line, with no apron outside of footlights. One theatre expert claims that the footlights should be back of the curtain so that the stage director may see the light effects on the stage setting before the curtain rises. The actor should be kept well back from the footlights so as to get the best effects, otherwise there will be deep

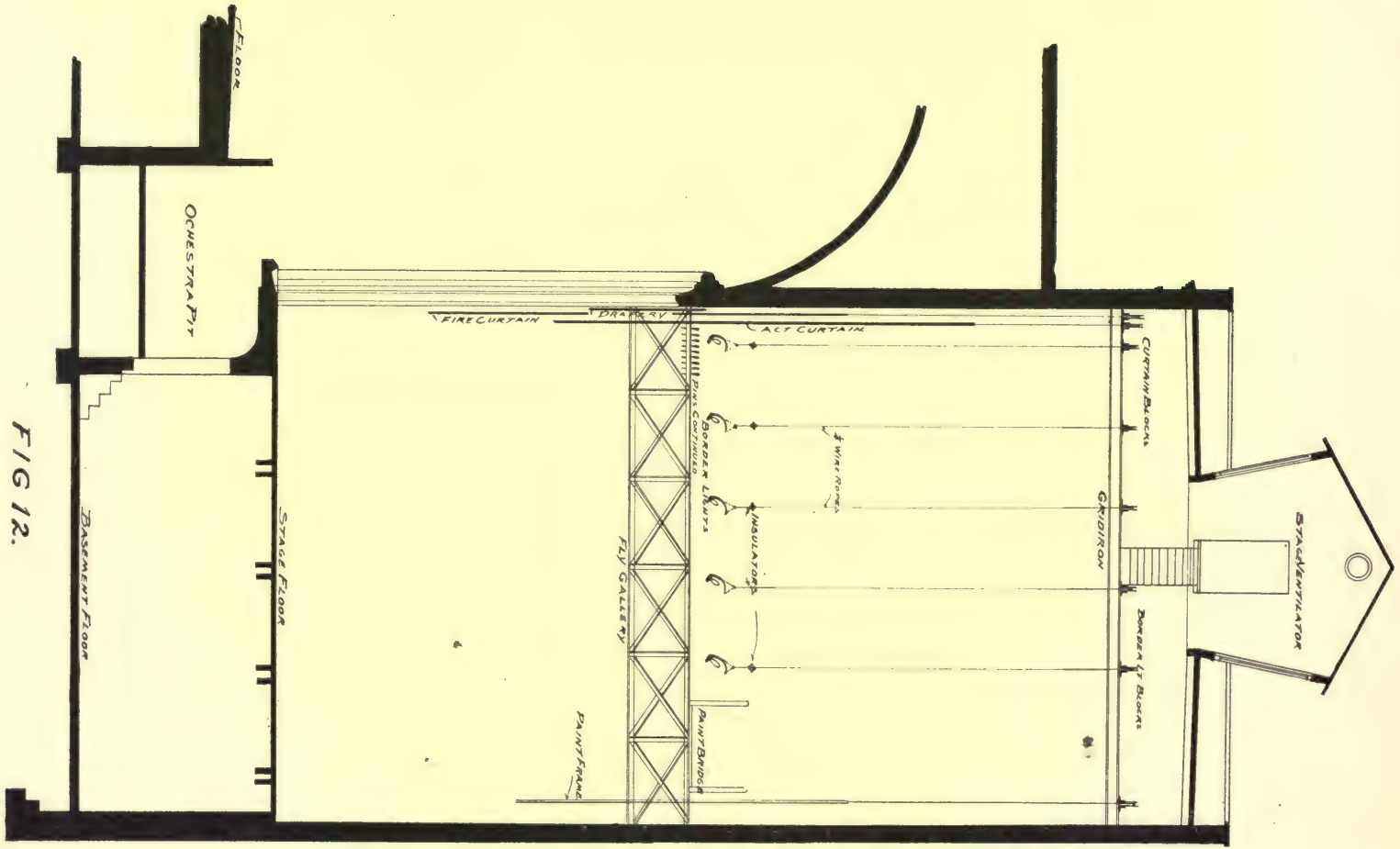


FIG 12.

Showing a longitudinal section of the stage, with Fly Gallery, Gridiron, Paint Bridge, also indicating the relative position of the border lights. A type of stage ventilation is here suggested, with sides that fall to roof when released by breaking of the fusible link in case of fire.

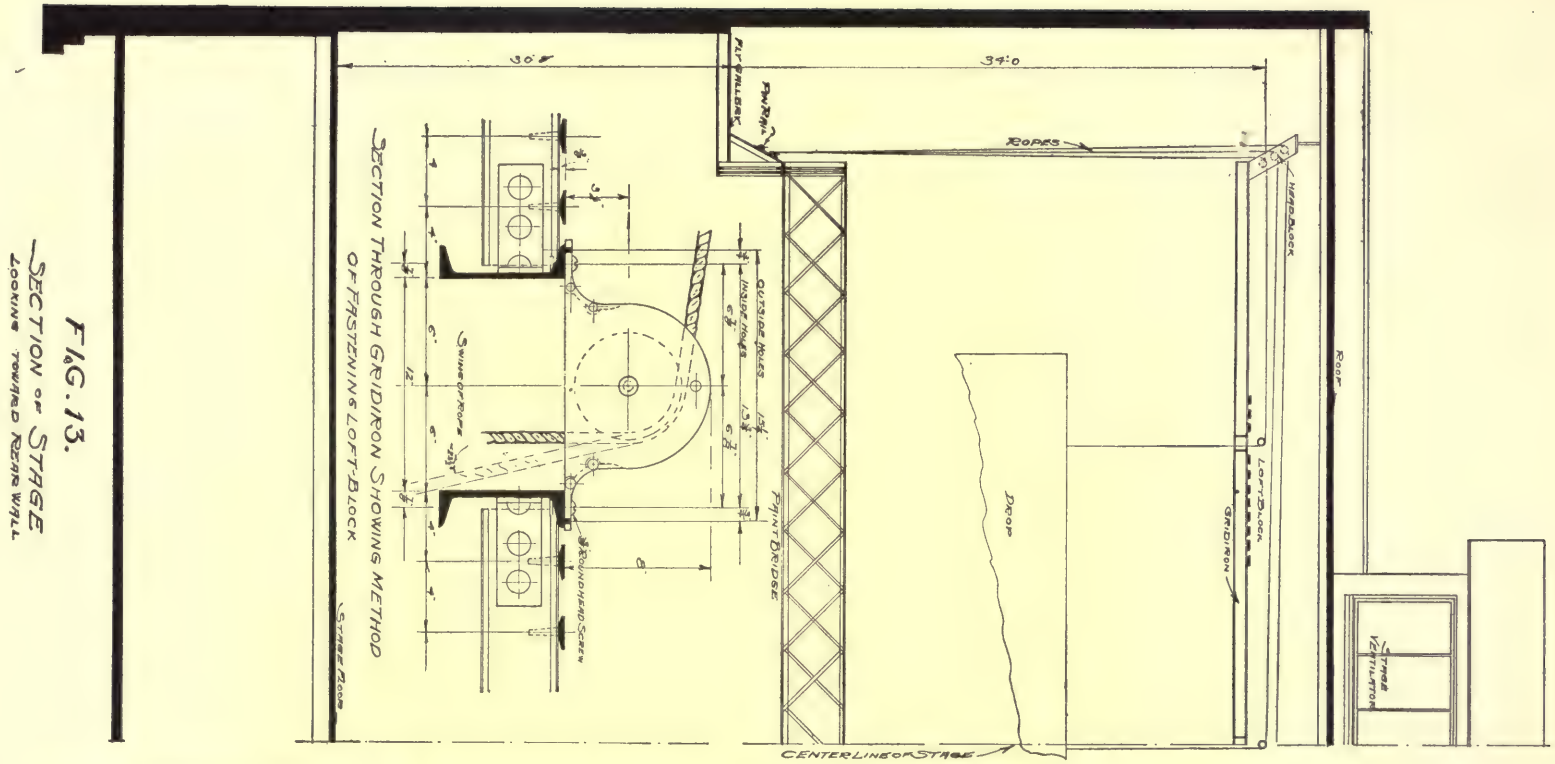


FIG. 13.

SECTION OF STAGE

LOOKING TOWARD REAR WALL

This is a transverse section of the stage, showing method of hanging drops from the gridiron, with detail of loft blocks. This shows three line sets for drops, in wide houses four line sets are better. The slats for gridiron are made of T's resting on cross girder.

shadows on his face. The older type of theatres have wide aprons; the newer houses have very narrow aprons or none at all.

HEIGHT OF STAGE FLOOR

The height of the stage floor above the main floor should be from 3 ft. 6 in. to 4 ft. 2 in., so as to have the top of the stage just below the level of the eye of the persons in the front row. The pitch of the auditorium floor somewhat regulates this variation in height. In halls where the floor is level the height of the stage should be from 3 ft. 8 in. to 4 ft. 8 in.

WIDTH OF STAGE

Do not make the stage any narrower than the auditorium, as all the space is needed on the stage, especially if the dressing rooms are to be located on the stage.

DEPTH OF STAGE

The depth of the stage should be at least equal to the width of the proscenium arch. Dressing rooms are generally located on each side of the stage, sometimes in tiers, one above the other, according to requirements. They may also be located in the rear if space permits, or underneath the stage. Never do any plastering on the walls or ceilings of the stage, except in the dressing rooms. Allow plenty of room on sides of stage between wings and the dressing rooms, 5 ft. or more.

SWITCHBOARD

The switchboard is always located on the right side of the stage (looking toward the audience). Leave at least 4 ft. between opening of proscenium arch and switchboard; 6 or 8 ft. is better. Sometimes the switchboard is set on the prompter's platform, which is set about 7 ft. above the stage floor. This leaves a clear passage to the first entrance without crowding the electrician in front of the board.

FLY GALLERY

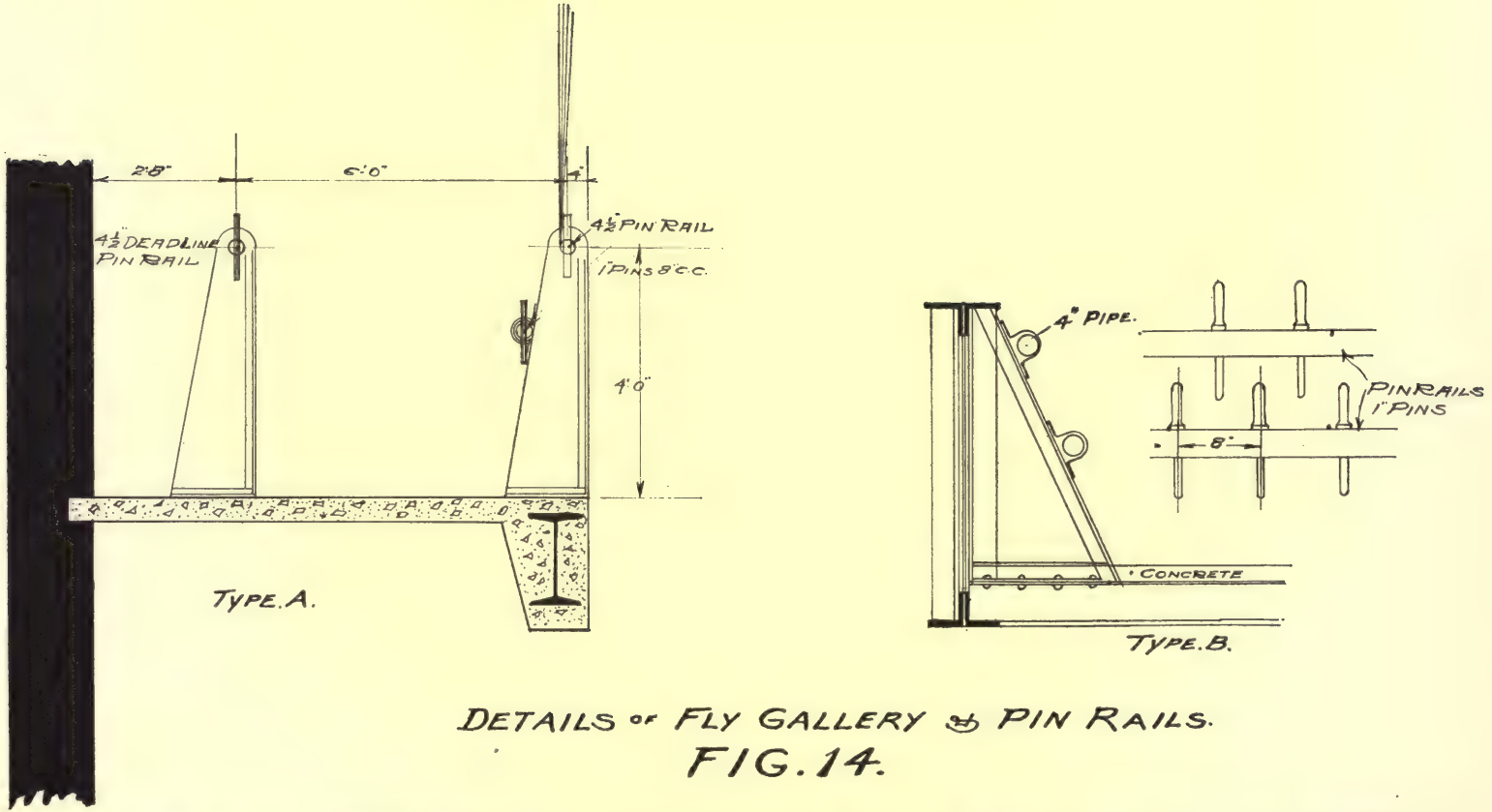
The fly gallery is a stationary bridge or platform set a proper distance above the stage and is for the use of the flyman who operates the drops, etc. This gallery runs from front to rear of stage and is from 3 to 8 ft. wide.

They may be built of any type of construction that the architect wishes to design, as long as the results are accomplished and the proper provisions made for handling the rigging.

The fly gallery is always located on the same side of the stage as the switchboard. In some very large houses there are fly galleries on both sides and sometimes one above the other. They serve also as ties for the walls.

The bottom of fly gallery should be about on a level with the top of the arch or about half way between the stage floor and the gridiron, or rigging loft, and never less than 24 ft. If it is a house that caters to traveling companies, it should be at least 27 ft. above the stage floor.

The fly gallery is equipped with one or two pin rails made of steel tubing, one above the other, with belaying pins about 8 in. apart on which to fasten all the ropes for manipulating



DETAILS OF FLY GALLERY & PIN RAILS.

FIG. 14.

A suggestion for methods of constructing pin rails with the usual dimensions required. In large houses two pin rails are required as indicated with pins set 8" apart and staggered. In smaller houses the lower pin rail may be omitted. Type "A" is built of reinforced concrete on a steel beam running from wall to wall. Type "B" is built of steel angles with a concrete floor.

the borders, drops, etc. A modern tendency is to place the pin rails on the stage floor near the side walls, as the scenery can be operated with fewer men and more promptly.

In halls and small theatres the fly gallery may be dispensed with, working all drops, etc., from the stage floor with counterweights; this of course takes up more room on the stage.

The face of the fly gallery should be at least 6 ft. back from the side of the arch to allow room for the draperies, drops, borders, etc.; 10 ft. to 12 ft. is better in large houses. The grand draperies and borders often extend 5 ft. beyond the opening of the arch. Some large productions carry drops 40 to 50 ft. long. Drops should always be at least the full width of the arch. (See table of stage dimensions.)

No grooves are used in the modern houses, as the various wings are made to stand alone, without bracing.

GRIDIRON

The gridiron or rigging loft is an open floor consisting of slats set 3 to 4 in. apart to allow the ropes to pass through for the drops, borders, etc., which pass over blocks or pulleys secured to the upper side of the slats. Three line sets are always required for scenery. Where the drops are over 45 ft. wide, there should be four line sets.

The slats should run from front to rear of stage and be stiff enough to bear the weight of men walking on them and well supported in the center and at each end or oftener, according to the span. The gridiron may be supported by steel girders running from wall to wall or may be suspended from its roof trusses, as desired.

The gridiron of course carries the weights of all flies, drops, border, border lights and anything that may be necessary to be suspended during any act. One hundred pounds per square foot live load is sufficient. The gridiron only need cover the working portion of the stage, or a trifle more than the width of the arch on both sides. (See Figs. 13, 14.)

The gridiron should be twice the height of the proscenium arch above the stage plus about 5 ft., or high enough for all drops to pass up out of sight behind the borders and draperies with two or three feet to spare. There should be at least 3 ft. of space above the gridiron under the roof; 6 ft. is better, as it allows full head room.

There must be access to the fly gallery and gridiron by means of a stairway or ladder in some out-of-the-way corner. If ladders are used, they should be secured in place at the top and bottom.

When only light vaudeville is put on, the height of the ceiling or roof over stage may be only 3 ft. above the arch to allow for the hanging of draperies, ceiling border, lights, etc. The curtain in this case would have to roll up.

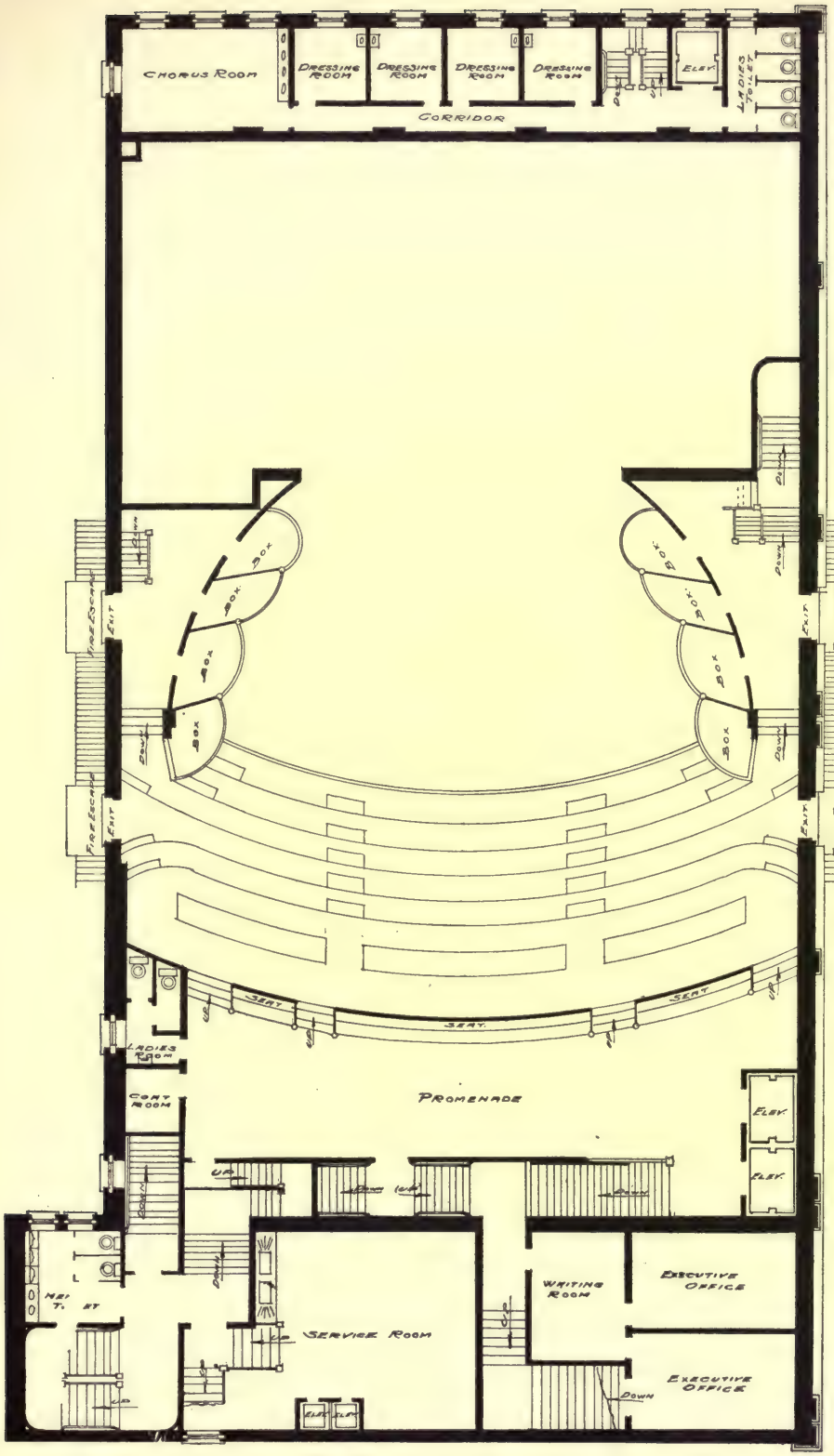

CHORUS ROOM
DRESSING ROOM
DRESSING ROOM
DRESSING ROOM
DRESSING ROOM
ELEV.
LADIES TOILET
CORRIDOR
FIRE ESCAPE
EXIT
BOX
BOX
BOX
BOX
BOX
BOX
BOX
BOX
DOWN
UP
SEAT
SEAT
SEAT
LADIES ROOM
COAT ROOM
PROMENADE
ELEV.
ELEV.
UP
DOWN
DOWN
MEN'S ST.
SERVICE ROOM
WRITING ROOM
EXECUTIVE OFFICE
EXECUTIVE OFFICE
DOWN
ELEV.
ELEV.

FIG. 15.

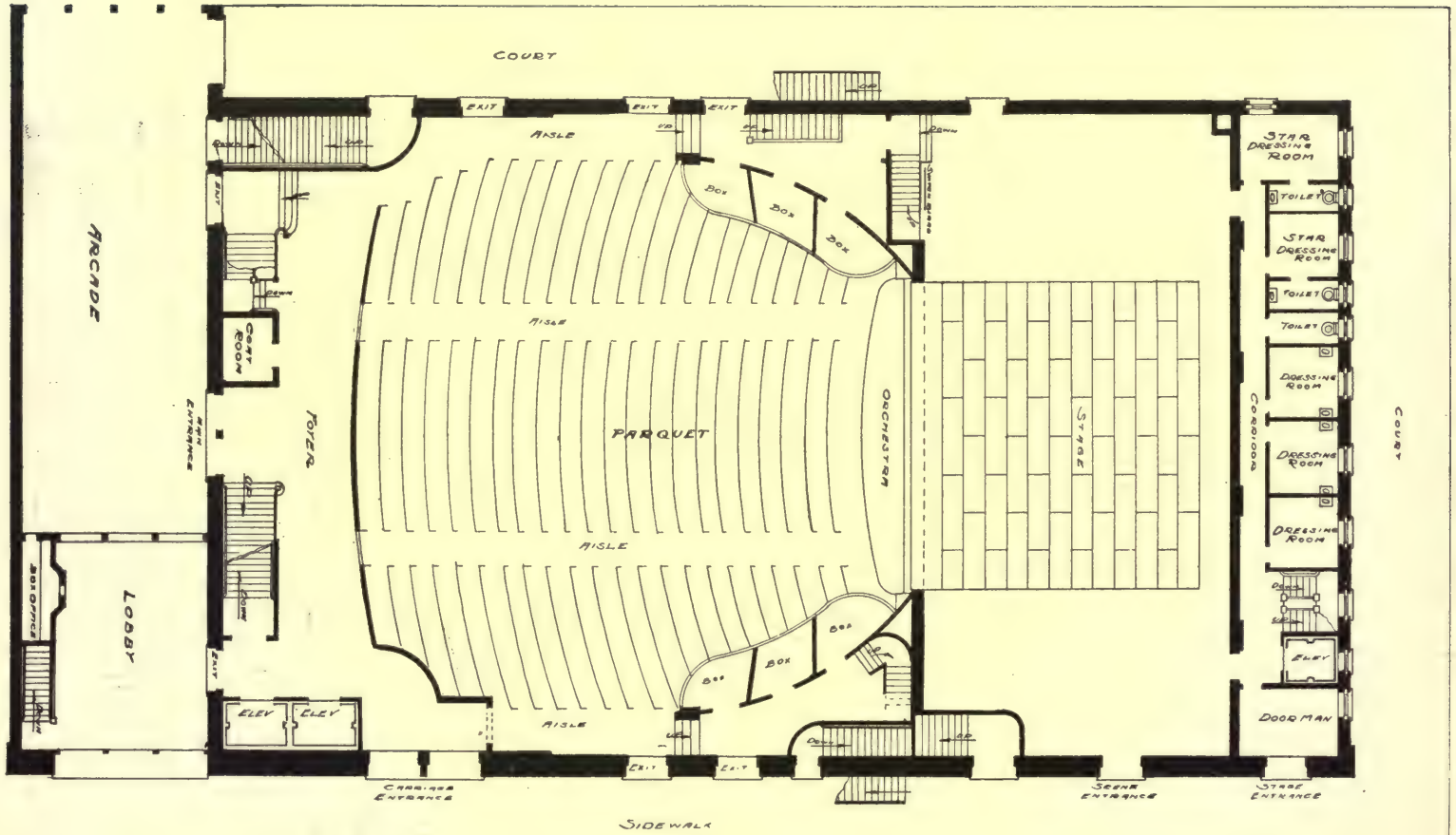

COURT
EXIT
EXIT
EXIT
AISLE
ARCADE
BOX
BOX
BOX
AISLE
COAT ROOM
MEN ENTRANCE
FOYER
PARQUET
ORCHESTRA
STAGE
STAR DRESSING ROOM
TOILET
STAR DRESSING ROOM
TOILET
TOILET
DRESSING ROOM
DRESSING ROOM
DRESSING ROOM
CORRIDOR
COURT
BOX OFFICE
LOBBY
EXIT
ELEV
ELEV
AISLE
BOX
BOX
BOX
ELEV
DOOR MAN
EXIT
EXIT
CARRIAGE ENTRANCE
SCENE ENTRANCE
STAGE ENTRANCE
SIDEWALK

FIG. 16.

STAGE DIMENSIONS OF VARIOUS HOUSES

Name of Theatre	Width Between Walls	Curtain to Back Wall	Width of Arch	Height of Arch	Stage to Fly Gallery	Stage to Gridiron	Curtain to Footlights	Distance Between Flies	Depth Under Stage
	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
Academy of Music, Philadelphia	90	80	50	50	..	73	10	54	25
Academy of Music, Baltimore	80	52	47	40	..	85	2	56	9
Academy of Music, Chicago	75	28	30	30	..	60	4	..	9
Academy of Music, Washington, D. C.	76	73	36	34	..	65	3	48	10
Alhambra, Milwaukee	85	31	44	55	..	70	4	60	10
American, New York City	78	56	38	39	..	72	2	70	16
Amphion, Brooklyn, N. Y	70	37	30	30	..	60	3	47	10
Atlanta, Atlanta, Ga	100	40	34	30	..	70	..	80	..
Auditorium, Chicago, Ill	100	62	47	34	..	90	8	90	18
Auditorium, Philadelphia	75	27	33	34	..	60	3	42	9
Auditorium, Minneapolis	78	36	78	36	..	42	9	..	6
Baker, Rochester	64	35	38	30	..	65	1	46	10
Blackstone, Chicago	100	40	34	30	..	70	..	84	..
Broadway, New York City	75	43	36	36	..	68	5	52	15
Broadway, Denver	67	36	35	35	..	75	4	52	12
Broad St., Philadelphia	60	38	33	36	31	56	4	45	10
Boston, Boston, Mass	90	80	50	48	..	70	10	54	32
Casino, New York City	91	25	39	30	..	40	2	52	27
Century, St. Louis	66	45	32	31	..	68	4	49	13
Cleveland, Cleveland, Ohio	62	36	36	..	27	..	3	44	10
Colonial, New York City	85	40	36	28	30	60	7	50	12
Colonial, Chicago, Ill	100	40	34	30	..	70	..	80	..
Colonial, Boston, Mass	80	41	38	38	..	77	4	52	25
Columbia, Brooklyn, N. Y	82	49	43	43	35	70	3	61	9
Columbia, Washington, D. C	80	36	35	33	..	64	4	48	16
Columbia, San Francisco, Cal	70	45	37	40	26	78	3	45	..
Crescent, New Orleans	65	37	35	33	25	61	3	44	7
Davidson, Milwaukee, Wis	85	37	38	35	..	75	3	51	8
Empire, Syracuse, N. Y	100	40	34	30	..	70	..	80	..
Empire, New York City	67	30	34	33	..	69	4	50	9
Empire Detroit, Mich	50	36	30	29	..	45	3	40	8
Empire, Indianapolis, Ind	80	27	36	31	..	56	3	44	11
Forest,Philadelphia, Pa	120	50	40	34	..	70	3	..	..
Garrick, New York City	60	28	30	30	..	55	2	38	..
Grand Opera House, Boston, Mass	80	40	36	40	..	61	8	44	10
Imperial, St. Louis, Mo	70	36	36	38	..	66	2	50	11
Illinois, Chicago, Ill	70	42	35	36	30	72	2	50	14
Klaw & Erlanger, Seattle, Wash	100	40	34	30	..	70	..	80	..
Knickerbocker, New York City	64	40	35	35	..	70	5	50	10
Keith's, Boston, Mass	..	..	34	34	..	59	..	52	9
Hollis St., Boston, Mass	72	50	38	40	24	60	5	45	12
Lyric, New York City	80	40	38	35	28	66	2	65	14
Lyceum, Cleveland, Ohio	76	33	33	39	23	63	3	48	16
Lyceum, Toledo, Ohio	58	33	35	28	35	60	3	38	9
Majestic, New York City	100	39	37	48	33	70	4	70	10
Majestic, Brooklyn, N. Y	80	38	38	34	28	71	4	52	11
Mason Opera House, Los Angeles	72	43	44	36	30	..	4	56	11
Masonic, Louisville, Ky	70	40	36	36	25	72	3	50	10
Metropolitan Opera House, New York City	100	76	54	54	..	98	13	77	27
New Amsterdam, New York City	80	48	40	36	34	70	2	54	22
New Lyceum, New York City	81	33	34	32	31	80	3	60	30
New York, New York City	70	42	35	38	..	74	4	51	11
Nixon, Pittsburg, Pa	100	46	42	38	33	80	3	58	..
Newark, Newark, N. J	84	37	37	36	31	68	7	55	12
National, Rochester, N. Y	81	34	40	32	30	63	4	60	11
New Curtis, Denver, Col	50	21	30	28	..	..	3	36	15
Park, Brooklyn, N. Y	55	31	30	29	..	55	2	42	13
Pabst, Milwaukee, Wis	72	41	35	32	30	70	3	50	8
Payton's, Brooklyn, N. Y	90	38	32	32	..	..	2	..	18
Power's, Chicago, Ill	62	40	34	36	..	61	2	41	12
Park, Indianapolis, Ind	76	40	34	32	..	60	5	44	12
Prospect, Cleveland, Ohio	70	37	36	37	30	68	5	52	10
Proctor's, 23rd St., New York City	70	36	32	41	..	57	..	..	..
Proctor's, 58th St., New York City	70	25	40	39	..	70	9	50	12
Proctor's, 125th St., New York City	80	40	32	40	..	90	3	..	15
Orpheum, New Orleans	76	32	32	35	35	71	3	45	8
Schubert's, St. Louis, Mo	73	36	36	32	26	60	3	50	..
Schubert's, Boston, Mass	80	43	40	30	30	68	2	55	..
Schubert's, Minneapolis, Minn	69	34	38	30	26	64	4	53	..
Schubert's, New York City	84	34	..	25	32	60	..	56	..
Tourlain, New Orleans	65	37	35	33	25	61	3	44	9

STAGE DOORS

Besides doors for the actors or employees, trunks, etc., there should be a scenery door at least 4 ft. 6 in. wide and as high as the distance to the underside of the fly gallery, to admit the scenery to be carried in on end. This door may be made in two sections.

PAINT BRIDGE

In theatres where they paint their own scenery, a paint bridge is constructed across the back of the stage near the rear wall and supported from the gridiron or roof trusses, or may span from the fly galleries. This bridge may be either stationary or made to raise and lower. They are usually made stationary with a space of from 12 in. to 20 in. between the bridge and back wall, and the frames for the scenery suspended and counterbalanced from the gridiron, so as to be raised or lowered at the will of the painter. Sometimes these paint frames are operated by a winch or bullwheel. Where this work is done on a large scale, it is better to provide a separate building or addition for it on account of the danger from fire caused by the painter's materials.

LIGHTING GALLERY

In cases where large and spectacular effects are to be produced, it is advisable to have a "lighting gallery" suspended just above the center of the proscenium arch, from which spot lights and other lighting devices may be operated above and directly in front of the stage setting to produce various lighting effects without casting shadows.

SCENE DOCK

In large houses where a large amount of scenery is used, there should be a scenery dock provided, also a property room. The dock may be at one side or in the rear of the stage or in adjoining wings. There should be an opening between the stage and the dock; also an opening to the street or alley, 5 ft. wide and 24 ft. or more high, so that wings may be brought in on end and not laid on the floor or on edge. These doors to be in two sections, one upper and one lower. The lower section may be double if desired, so that one part may be used for ordinary passage without opening the whole door.

SKY-LIGHT

The roof over every stage should be provided with a sliding or automatically opening sky-light to admit light to the stage and paint bridge, and for ventilating purposes, but principally for use in case of fire to allow smoke and gases to escape. This sky-light should be made to slide or open automatically, and also to be controlled by a hemp cord from the stage floor.

This sliding sky-light, together with the asbestos curtain, also controlled from the stage floor, provide a very good combination for the protection of the audience. Other types of sky-lights, such as hinged sides, may be used if desired. (See Fig. 12.)

If metal ventilators are used in the roof, they should also have counterbalanced dampers operated by a cord that will readily burn in two in case of fire, and thus open the ventilator. The size of the sky-light should be equal to about 10 per cent of the area of the stage.

EGRESS

While the foregoing is for the benefit of the audience, safe means of egress must be provided for the stage hands at work on the fly gallery and rigging aloft, such as windows opening onto outside fire escapes or adjoining roofs.

TRAPS

The construction of the stage floor should be made in such a manner that traps may be taken up or cut through at desired points. Some of the most modern theatres in the large cities have a very elaborate system of traps, where the whole working part of the stage is supported on hydraulic jacks or other mechanical means and the whole or any section may be raised and lowered by simply removing a lever, but it is not necessary to go into detail on the matter.

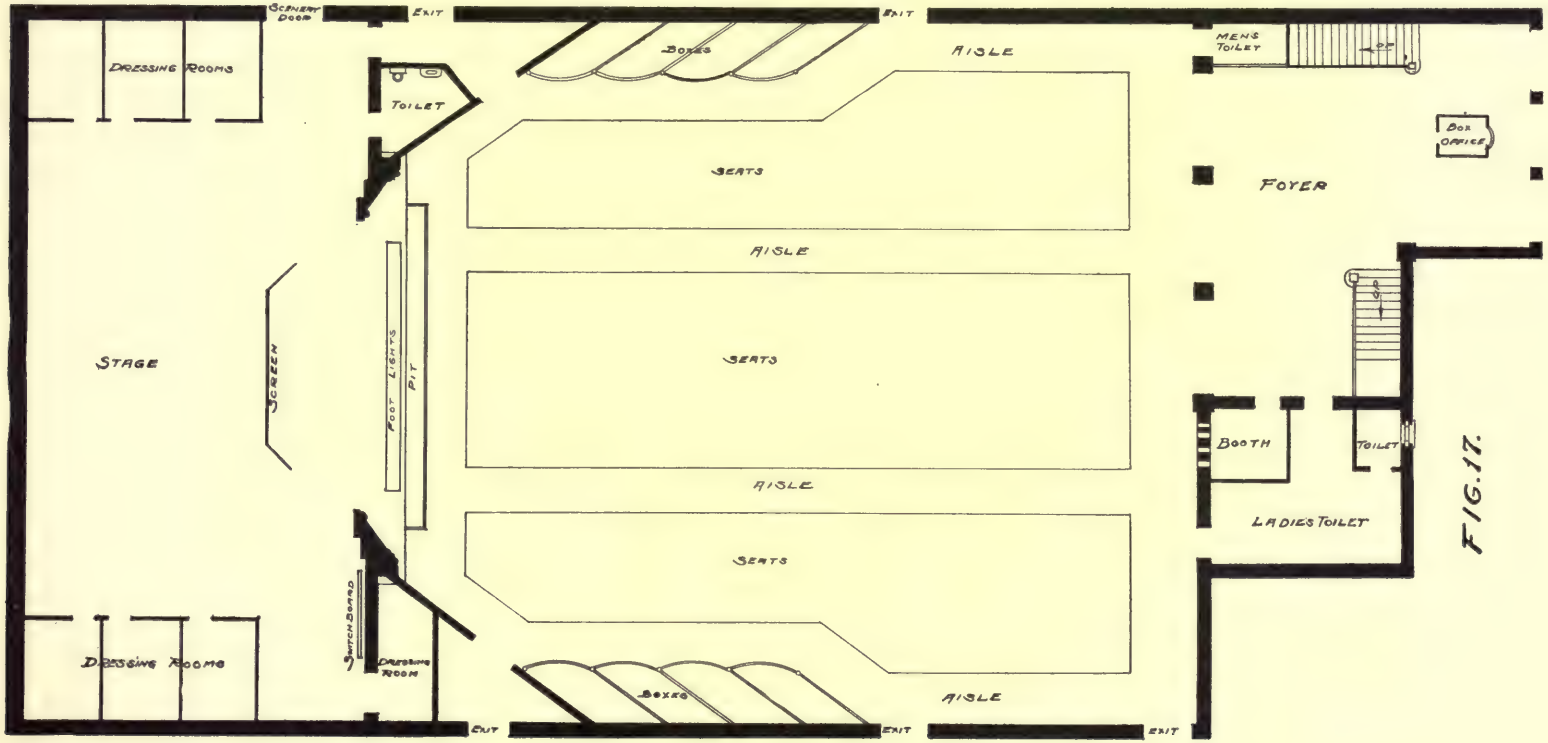

SCENERY DOOR
EXIT
EXIT
DRESSING ROOMS
BOXES
AISLE
MEN'S TOILET
UP
TOILET
BOX OFFICE
SEATS
FOYER
AISLE
STAGE
SCREEN
FOOT LIGHTS
PIT
SEATS
DN
BOOTH
TOILET
AISLE
LADIES TOILET
SEATS
SWITCH BOARD
DRESSING ROOM
DRESSING ROOMS
BOXES
AISLE
EXIT
EXIT
EXIT

FIG. 17.

FLOOR FINISH

There are a number of plastic or composition floor surfacing compounds that make a desirable floor finish, and may be applied over wood, metal or concrete, and by their use a sanitary cove or base may be constructed that may be readily kept clean. The writer has used, with very good results, a composition floor finish, known as "Marbleoid." It is light weight, fireproof, easy to walk upon and is as soft to the feet as a wood floor. It is not cold like concrete or tile. Being plastic, it will not crack on account of uneven settlement of the floors or the vibration of the building. It is made of several colors, principally red, buff and gray. These are fast colors. Other colors may be used for borders if desired, such as blue and green, although these latter colors will fade in time, on account of the character of the coloring pigments. These floors cost a little more per square foot than ordinary cement, but considerably less than tile. The seats may be readily fastened to this floor compound. The same materials may be used for wainscoting, etc.

Ordinary concrete floors should be treated with some suitable treatment to bind the surface and prevent dust from rising.

Wood floors should be oiled with boiled linseed oil or some good floor compound at least once a year.

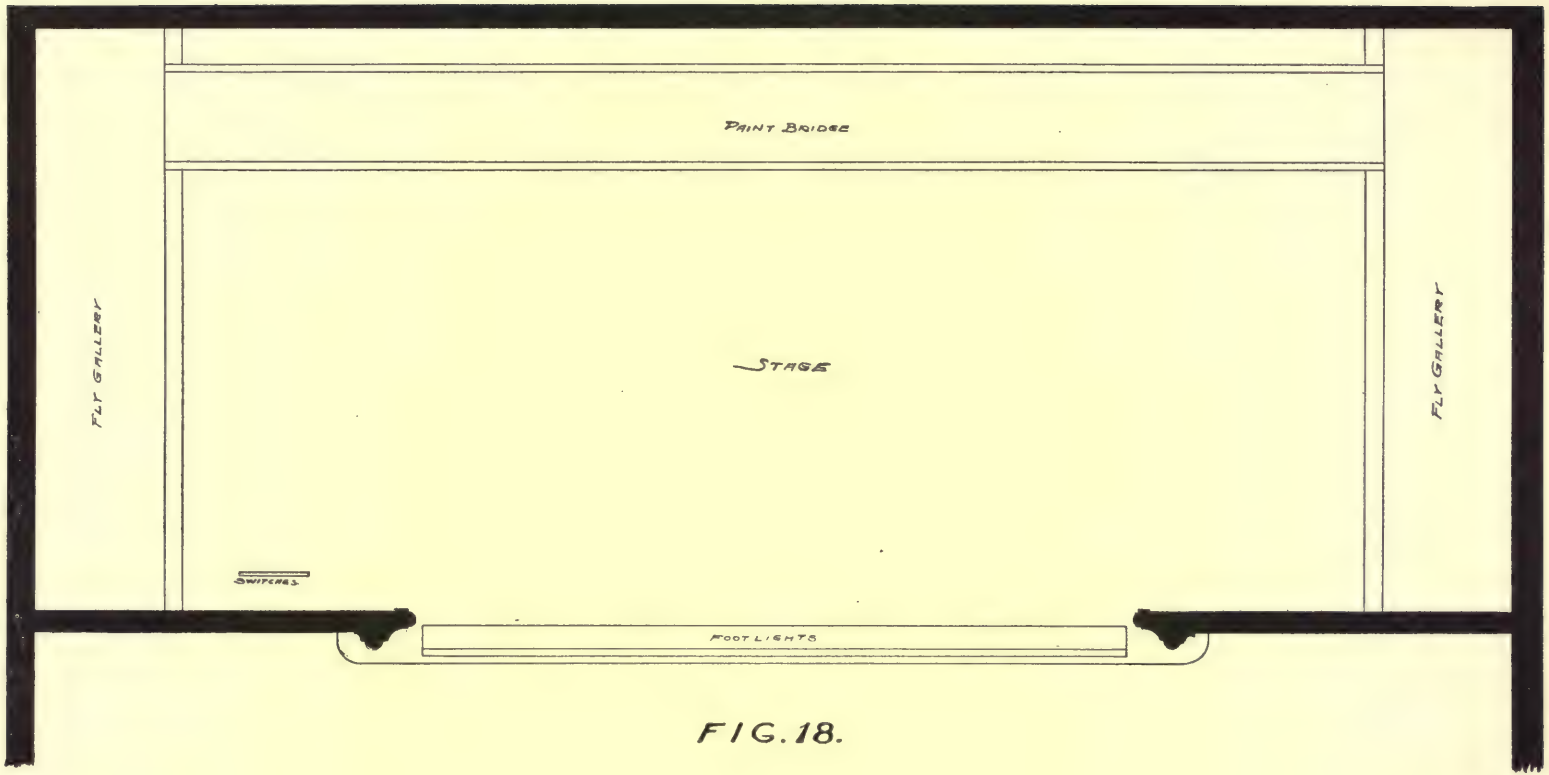

PAINT BRIDGE
FLY GALLERY
STAGE
FLY GALLERY
SWITCHES
FOOT LIGHTS

FIG. 18.

FLOOR LOADS

The safe live load for all theatre floors should be equal to the following, per sq. ft.:

Lobby and Corridors	100
Stairways	100
Auditorium	80
Balcony	80
Stage	250
Scene Docks	100
Property Rooms	150
Gridiron	70
Roofs	40

CEILINGS

The ceiling of the auditorium should not be made excessively high, as it requires much more heat to properly warm the building and renders it more difficult for the actor to be heard, as his voice is apt to be lost.

There are many methods of constructing ceilings that do not require mentioning here.

Plaster and metal are the most common methods used in finishing the undersurface of the ceiling. Plaster ceilings may be richly embellished with plaster ornamentators, paintings, etc.

Metal ceilings may be made in beam and panel effects and may be rendered fire and soundproof by applying same over plaster boards or asbestos, or by filling a portion of the dead space with mineral wool.

IV. AMERICAN THEATRE, CHICAGO, ILLINOIS

Mahler & Cordell, Architects

ELEVATORS AND ESCALATORS

Elevators have occasionally found a place in the theatre for transporting people to the balconies and galleries, but their intermittent service has made them not entirely feasible for this purpose.

Within the last few years, however, the idea of using escalators or moving stairways to induce increased balcony and gallery patronage has gained considerable headway. There are now quite a representative number of theatres that have one or more escalators. Escalators have an advantage over the elevator for theatre use in that they have a much greater capacity; in other words, they will accommodate a much larger number of people within the same period of time.

Escalators are frequently installed to afford direct transportation from lobby to balconies. They are practically noiseless, affording a constant, quiet means of carrying guests to seats in the upper portions of the house. They are made reversible so that they can operate upward before or during the performance and downward after the performance.

The power costs of an escalator's operation approximate, under ordinary usage, $5.00 to $10.00 per month.

Neither the elevator nor the escalator is at present considered an exit under the law, serving only as a means of accommodating the patrons of the theatre. We believe, however, that there would be less danger of congestion on an escalator than on a stairway.

PROJECTION ROOM OR MACHINE BOOTH

The booth is one of the most important features of a picture theatre, as it is here that the operator holds sway, and the operator is the man on whose ability depends largely the proper rendering of the play; therefore the theatre owner should provide everything requisite to facilitate the work of the operator.

The booth must be made of fireproof materials and of sufficient size to provide plenty of working space. While the modern machines are virtually considered safe from danger of fire or accident, it is desirable, and in some states requisite, that the booth should be provided with a 12 in. ventilating tube or flue extending up through the roof or out through the front or side wall, as the case may be, to carry away any flames, smoke or gases caused by the machine, and the tube should be equipped with a 14 in. electric fan in a 16 in. x 16 in. box and always kept in motion while the operator is at work. It is desirable that a space should be provided at one end of the projection room about 2 ft. 6 in. or 3 ft. wide to be used as a rewinding room and made of the same materials as the booth and separated by a partition and an automatically closing door. A non-combustible shelf for rewinding the reels is desirable; also an electric light in the ceiling.

It is not a good idea to do the rewinding in the booth on account of the possible danger from films catching fire, nor should extra films be stored in the booth. The booth should be mounted on a solid floor to avoid vibration, as this affects the picture. Where a booth is placed in the rear of a balcony of wood joist construction that has considerable overhang, the vibration caused by heavy persons descending the steps in the aisles will cause the machine to vibrate, so it is well to

brace this platform in every possible way from below or from roof trusses, whichever is the best available method. In steel or concrete balconies this is not necessary. The machine should be rigidly secured to the floor by wire braces and turnbuckles.

If the legs of the machine are set in a box of sand or on a cork base, the noise from the machine will be deadened. The booths may be built of brick, concrete, terra-cotta, metal studs with metal lath and plaster, or asbestos lumber with a steel angle frame. If made of asbestos lumber, the boards should be ½ in. thick, the steel angles 1¼ in. x 1¼ in. x 3/16 in., bolted together and properly braced. Some manufacturers make these booths in sections ready to ship and are readily bolted together on the job. They are made in standard sizes, and may be enlarged at any time by simply adding more sections. All booths must have air intakes at the bottom covered with wire mesh.

The asbestos booths may be enclosed with studs, and lathed and plastered and made to harmonize with the rest of the house, but plaster cannot be applied directly on the asbestos lumber.

Metal booths have practically nothing to commend them, except that the material, of course, is not combustible. They are likely to become "grounded" electrically, and act as sounding boards, increasing the noise of the operation of the projecting machine. Cases are recorded where metal film reels have come in contact with frames of picture machines and walls of metal booths, causing short circuits and igniting the films. Also there is the hazard of shocking the operator. Despite these obvious disadvantages, sheet metal booths are specified in Maine and Texas, among other places.

Single machine booths should be 6 ft. wide and 8 ft. deep and 7 ft. high. Two machines require 9 ft. wide, 8 ft. deep and 7 ft. high, and three machines require 12 ft. wide, 8 ft. deep and 7 ft. high. All above are for inside dimensions, with about 3 ft. added for the rewinding room. All doors should swing outward and be self-closing and not over 2 ft. wide by at least 6 ft. high.

The floor of the projection room must also be fireproof. If the booth rests on a wooden platform, it must be covered with asbestos lumber $\frac{3}{8}$ in. thick. The openings in front of the booth for the projection and for the operator's view must have a self-closing shutter of heavy steel plate or asbestos to work in a metal groove or channel, and held open by strings or cord with fusible links, and arranged in series so that they may be instantly released when a fire starts in any part of the booth, or by the operator.

The booth should contain a switchboard where the operator may control the house lights. The house lights may also be controlled from the manager's office or from the stage if desired.

Table For Film Projection

Distance from Film to Screen

Equiv. Focus in Inches	15 Ft.	20 Ft.	25 Ft.	30 Ft.	35 Ft.	40 Ft.	45 Ft.	50 Ft.	55 Ft.	60 Ft.	65 Ft.	70 Ft.	75 Ft.	80 Ft.
2	5.1	6.9	8.5	10.1	11.10	13.6	15.2	16.10	18.8	20.4	22.0	23.9	25.2	27.1
	6.9	9.0	11.3	13.7	15.10	18.1	20.4	22.7	24.10	27.2	29.5	31.8	33.11	36.2
2 1/8	4.9	6.4	7.11	9.6	11.2	12.9	14.4	15.11	17.6	19.2	20.9	22.4	23.11	25.6
	6.4	8.6	10.7	12.9	14.11	17.0	19.2	21.3	23.5	25.6	27.8	29.10	31.11	34.1
2 1/4	4.6	6.0	7.6	9.0	10.6	12.0	13.6	15.0	16.7	18.1	19.7	21.1	22.7	24.1
	6.0	8.0	10.0	12.0	14.1	16.1	18.1	20.1	22.1	24.1	26.2	28.2	30.2	32.2
2 1/2	4.0	5.5	6.9	8.1	9.6	10.10	12.2	13.6	14.11	16.3	17.7	19.0	20.4	21.8
	5.5	7.2	9.0	10.10	12.8	14.5	16.3	18.1	19.11	21.8	23.6	25.4	27.2	28.11
2 3/4	3.8	4.11	6.2	7.4	8.7	9.10	11.1	12.4	13.6	14.9	16.0	17.3	18.6	19.8
	4.11	6.6	8.2	9.10	11.6	13.2	14.9	16.5	18.1	19.9	21.4	23.0	24.8	26.4
3	3.4	4.6	5.7	6.9	7.11	9.0	10.2	11.3	12.5	13.6	14.8	15.10	16.11	18.1
	4.6	6.0	7.6	9.0	10.6	12.0	13.7	15.1	16.7	18.1	19.7	21.1	22.7	24.1
3 1/4	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.5	11.5	12.6	13.6	14.7	15.7	16.8
	4.2	5.6	6.11	8.4	9.9	11.1	12.6	13.11	15.3	16.8	18.1	19.6	20.10	22.3
3 1/2	2.10	3.10	4.10	5.9	6.9	7.9	8.8	9.8	10.8	11.7	12.7	13.6	14.6	15.6
	3.10	5.2	6.5	7.9	9.0	10.4	11.7	12.11	14.2	15.6	16.9	18.1	19.4	20.8
3 3/4	2.8	3.7	4.6	5.5	6.3	7.2	8.1	9.0	9.11	10.10	11.9	12.8	13.6	14.5
	3.7	4.9	6.0	7.2	8.5	9.7	10.10	12.0	13.3	14.5	15.8	16.10	18.1	19.3
4	2.6	3.4	4.2	5.1	5.11	6.9	7.7	8.5	9.3	10.2	11.0	11.10	12.8	13.6
	3.4	4.6	5.7	6.9	7.11	9.0	10.2	11.3	12.1	13.7	14.8	15.10	16.11	18.1
4 1/4	2.4	3.2	3.11	4.9	5.7	6.4	7.2	7.11	8.9	9.6	10.4	11.2	11.11	12.9
	3.2	4.3	5.3	6.4	7.5	8.6	9.7	10.7	11.8	12.9	13.10	14.11	15.11	17.0
4 1/2	2.3	3.0	3.9	4.6	5.3	6.0	6.9	7.6	8.3	9.0	9.9	10.6	11.3	12.0
	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.1	15.1	16.1
4 3/4	2.1	2.10	3.6	4.3	5.0	5.8	6.5	7.1	7.10	8.6	9.3	10.0	10.8	11.4
	2.10	3.9	4.9	5.8	6.8	7.7	8.6	9.6	10.5	11.5	12.4	13.4	14.3	15.3
5	2.0	2.8	3.4	4.0	4.9	5.5	6.1	6.9	7.5	8.1	8.9	9.6	10.2	10.10
	2.8	3.7	4.6	5.5	6.4	7.2	8.1	9.0	9.11	10.10	11.9	12.8	13.7	14.5
5 1/4	1.11	2.6	3.2	3.10	4.6	5.2	5.9	6.5	7.1	7.9	8.4	9.0	9.8	10.4
	2.6	3.5	4.3	5.2	6.0	6.10	7.9	8.7	9.5	10.4	11.2	12.0	12.11	13.9
5 1/2	1.10	2.5	3.0	3.8	4.3	4.11	5.6	6.2	6.9	7.4	8.0	8.7	9.3	9.10
	2.5	3.3	4.1	4.11	5.9	6.6	7.4	8.2	9.0	9.10	10.8	11.6	12.4	13.2
5 3/4	1.9	2.4	2.11	3.6	4.1	4.8	5.3	5.10	6.5	7.0	7.8	8.3	8.10	9.5
	2.4	3.1	3.11	4.8	5.6	6.3	7.1	7.10	8.7	9.5	10.2	11.0	11.9	12.7
6	1.8	2.3	2.9	3.4	3.11	4.6	5.1	5.7	6.2	6.9	7.4	7.11	8.5	9.0
	2.3	3.0	3.9	4.6	5.3	6.0	6.9	7.6	8.3	9.0	9.9	10.6	11.3	12.0
6 1/4	1.7	2.2	2.8	3.3	3.9	4.4	4.10	5.5	5.11	6.6	7.0	7.7	8.1	8.8
	2.2	2.10	3.7	4.4	5.0	5.9	6.6	7.2	7.11	8.8	9.5	10.1	10.10	11.7
6 1/2	1.6	2.1	2.7	3.1	3.7	4.2	4.8	5.2	5.8	6.2	6.9	7.3	7.9	8.4
	2.1	2.9	3.5	4.2	4.10	5.6	6.3	6.11	7.7	8.4	9.0	9.9	10.5	11.1
6 3/4		2.0	2.6	3.0	3.6	4.0	4.6	5.0	5.6	6.0	6.6	7.0	7.6	8.0
		2.8	3.4	4.0	4.8	5.4	6.0	6.8	7.4	8.0	8.8	9.4	10.0	10.8
7		1.11	2.5	2.10	3.4	3.10	4.4	4.10	5.3	5.9	6.3	6.9	7.3	7.9
		2.6	3.2	3.10	4.6	5.2	5.9	6.5	7.1	7.9	8.4	9.0	9.8	10.4
7 1/4			2.4	2.9	3.3	3.8	4.2	4.8	5.1	5.7	6.0	6.6	7.0	7.5
			3.1	3.8	4.4	4.11	5.7	6.2	6.10	7.5	8.1	8.8	9.4	9.11
7 1/2			2.3	2.8	3.1	3.7	4.0	4.6	4.11	5.5	5.10	6.3	6.9	7.2
			3.0	3.7	4.2	4.9	5.5	6.0	6.7	7.2	7.10	8.5	9.0	9.7
7 3/4			2.2	2.7	3.0	3.6	3.11	4.4	4.9	5.3	5.8	6.1	6.6	7.0
			2.11	3.6	4.1	4.8	5.3	5.10	6.5	7.0	7.7	8.2	8.9	9.4
8			2.1	2.6	2.11	3.4	3.9	4.2	4.7	5.1	5.6	5.11	6.4	6.9
			2.9	3.4	3.11	4.6	5.1	5.7	6.2	6.9	7.4	7.11	8.5	9.0
8 1/2				2.4	2.9	3.2	3.7	3.11	4.4	4.9	5.2	5.7	5.11	6.4
				3.2	3.8	4.3	4.9	5.3	5.10	6.4	6.11	7.5	7.11	8.6
9				2.3	2.7	3.0	3.4	3.9	4.1	4.6	4.10	5.3	5.7	6.0
				3.0	3.6	4.0	4.6	5.0	5.6	6.0	6.6	7.0	7.6	8.0
9 1/2				2.1	2.6	2.10	3.2	3.6	3.11	4.3	4.7	5.0	5.4	5.8
				2.10	3.3	3.9	4.3	4.9	5.2	5.8	6.2	6.8	7.1	7.7
10				2.0	2.4	2.8	3.0	3.4	3.8	4.0	4.4	4.9	5.1	5.5
				2.8	3.2	3.7	4.0	4.6	4.11	5.5	5.10	6.4	6.9	7.2

Table For Film Projection

Distance from Film to Screen

Equiv. Focus in Inches	85 Ft.	90 Ft.	95 Ft.	100 Ft.	105 Ft.	110 Ft.	115 Ft.	120 Ft.	125 Ft.	130 Ft.	135 Ft.	140 Ft.	145 Ft.	150 Ft.
2	28.10	30.6	32.3	33.11	35.7	37.4								
	38.6	40.9	43.0	45.3	47.6	49.9								
2 1/8	27.1	28.9	30.4	31.11	33.6	35.1	36.8							
	36.2	38.4	40.6	42.7	44.9	46.10	49.0							
2 1/4	25.7	27.1	28.7	30.2	31.8	33.2	34.8	36.2	37.8					
	34.2	36.2	38.3	40.3	42.3	44.3	46.3	48.3	50.3					
2 1/2	23.0	24.5	25.9	27.1	28.6	29.10	31.2	32.7	33.11	35.3	36.7	38.0		
	30.9	32.7	34.5	36.2	38.0	39.10	41.8	43.5	45.3	47.1	48.11	50.8		
2 3/4	20.11	22.2	23.5	24.8	25.11	27.1	28.4	29.7	30.10	32.1	33.3	34.6	35.9	37.0
	28.0	29.7	31.3	32.11	34.7	36.2	37.10	39.6	41.2	42.9	44.5	46.1	47.9	49.4
3	19.2	20.4	21.6	22.7	23.9	24.10	26.0	27.1	28.3	29.5	30.6	31.8	32.9	33.11
	25.8	27.2	28.8	30.2	31.8	33.2	34.8	36.2	37.9	39.3	40.9	42.3	43.9	45.3
3 1/4	17.9	18.9	19.10	20.10	21.11	22.11	24.0	25.1	26.1	27.1	28.2	29.2	30.3	31.3
	23.8	25.0	26.5	27.10	29.3	30.7	32.0	33.5	34.10	36.2	37.7	39.0	40.5	41.9
3 1/2	16.5	17.5	18.5	19.4	20.4	21.4	22.3	23.3	24.3	25.2	26.2	27.1	28.1	29.1
	22.0	23.3	24.7	25.10	27.2	28.5	29.9	31.0	32.4	33.7	34.11	36.2	37.6	38.9
3 3/4	15.4	16.3	17.2	18.1	19.0	19.10	20.9	21.8	22.7	23.6	24.5	25.4	26.3	27.1
	20.6	21.8	22.11	24.1	25.4	26.6	27.9	28.11	30.2	31.4	32.7	33.9	35.0	36.2
4	14.5	15.3	16.1	16.11	17.9	18.8	19.6	20.4	21.2	22.0	22.10	23.9	24.7	25.4
	19.3	20.4	21.6	22.7	23.9	24.10	26.0	27.2	28.3	29.5	30.6	31.8	32.10	33.11
4 1/4	13.6	14.4	15.2	15.11	16.9	17.6	18.4	19.2	19.11	20.9	21.6	22.4	23.1	23.11
	18.1	19.2	20.3	21.3	22.4	23.5	24.6	25.6	26.7	27.8	28.9	29.10	30.10	31.11
4 1/2	12.9	13.6	14.3	15.0	15.10	16.7	17.4	18.1	18.10	19.7	20.4	21.1	21.10	22.7
	17.1	18.1	19.1	20.1	21.1	22.1	23.1	24.1	25.1	26.2	27.2	28.2	29.2	30.2
4 3/4	12.1	12.10	13.6	14.3	15.0	15.8	16.5	17.1	17.10	18.6	19.3	20.0	20.8	21.5
	16.2	17.1	18.1	19.0	20.0	20.11	21.11	22.10	23.10	24.9	25.8	26.8	27.7	28.7
5	11.6	12.2	12.10	13.6	14.3	14.11	15.7	16.3	16.11	17.7	18.3	19.0	19.8	20.4
	15.4	16.3	17.2	18.1	19.0	19.11	20.9	21.8	22.7	23.6	24.5	25.4	26.3	27.2
5 1/4	10.11	11.7	12.3	12.11	13.6	14.2	14.10	15.6	16.1	16.9	17.5	18.1	18.9	19.4
	14.7	15.6	16.4	17.3	18.1	18.11	19.10	20.8	21.6	22.5	23.3	24.1	25.0	25.10
5 1/2	10.5	11.1	11.8	12.4	12.11	13.6	14.2	14.9	15.5	16.0	16.7	17.3	17.10	18.6
	14.0	14.9	15.7	16.5	17.3	18.1	18.11	19.9	20.7	21.4	22.2	22.11	23.10	24.8
5 3/4	10.0	10.7	11.2	11.9	12.4	12.11	13.6	14.1	14.9	15.4	15.11	16.6	17.1	17.8
	13.4	14.2	14.11	15.9	16.6	17.3	18.1	18.10	19.8	20.5	21.3	22.0	22.10	23.7
6	9.7	10.2	10.9	11.3	11.10	12.5	13.0	13.6	14.1	14.8	15.3	15.10	16.4	16.11
	12.9	13.7	14.4	15.1	15.10	16.7	17.4	18.1	18.10	19.7	20.4	21.1	21.10	22.7
6 1/4	9.2	9.9	10.3	10.9	11.4	11.11	12.5	13.0	13.6	14.1	14.7	15.2	15.9	16.3
	12.3	13.0	13.9	14.5	15.2	15.11	16.8	17.4	18.1	18.10	19.6	20.3	21.0	21.8
6 1/2	8.10	9.4	9.11	10.5	10.11	11.5	12.0	12.6	13.0	13.6	14.1	14.7	15.1	15.7
	11.10	12.6	13.2	13.11	14.7	15.3	16.0	16.8	17.5	18.1	18.9	19.6	20.2	20.10
6 3/4	8.6	9.0	9.6	10.0	10.6	11.0	11.6	12.0	12.6	13.0	13.6	14.0	14.6	15.0
	11.4	12.0	12.9	13.5	14.1	14.9	15.5	16.1	16.9	17.5	18.1	18.9	19.5	20.1
7	8.2	8.8	9.2	9.8	10.2	10.8	11.1	11.7	12.1	12.7	13.1	13.6	14.0	14.6
	11.0	11.7	12.3	12.11	13.7	14.2	14.10	15.6	16.2	16.9	17.5	18.1	18.9	19.4
7 1/4	7.11	8.5	8.10	9.4	9.9	10.3	10.9	11.2	11.8	12.2	12.7	13.1	13.6	14.0
	10.7	11.2	11.10	12.5	13.1	13.8	14.4	14.11	15.7	16.2	16.10	17.5	18.1	18.8
7 1/2	7.8	8.1	8.7	9.0	9.6	9.11	10.4	10.10	11.3	11.9	12.2	12.8	13.1	13.6
	10.3	10.10	11.5	12.0	12.8	13.3	13.10	14.5	15.1	15.8	16.3	16.10	17.6	18.1
7 3/4	7.5	7.10	8.3	8.9	9.2	9.7	10.0	10.6	10.11	11.4	11.9	12.3	12.8	13.1
	9.11	10.6	11.1	11.8	12.3	12.10	13.5	14.0	14.7	15.2	15.9	16.4	16.11	17.6
8	7.2	7.7	8.0	8.5	8.10	9.3	9.9	10.2	10.7	11.0	11.5	11.10	12.3	12.8
	9.7	10.2	10.9	11.3	11.10	12.5	13.0	13.7	14.1	14.8	15.3	15.10	16.5	16.11
8 1/2	6.9	7.2	7.6	7.11	8.4	8.9	9.2	9.6	9.11	10.4	10.9	11.2	11.6	11.11
	9.0	9.7	10.1	10.7	11.2	11.8	12.3	12.9	13.3	13.10	14.4	14.11	15.5	15.11
9	6.4	6.9	7.1	7.6	7.11	8.3	8.8	9.0	9.5	9.9	10.2	10.6	10.11	11.3
	8.6	9.0	9.6	10.0	10.6	11.0	11.6	12.0	12.6	13.0	13.7	14.1	14.7	15.1
9 1/2	6.0	6.5	6.9	7.1	7.6	7.10	8.2	8.6	8.11	9.3	9.7	10.0	10.4	10.8
	8.1	8.6	9.0	9.6	10.0	10.5	10.11	11.5	11.11	12.4	12.10	13.4	13.9	14.3
10	5.9	6.1	6.5	6.9	7.1	7.5	7.9	8.1	8.5	8.9	9.1	9.6	9.10	10.2
	7.8	8.1	8.7	9.0	9.6	9.11	10.4	10.10	11.3	11.9	12.2	12.8	13.1	13.7

Table furnished by Nicholas Power Co.

SCREENS

In vaudeville houses sometimes used for pictures and not having a permanent screen on the rear wall, a portable screen is made by stretching muslin on a frame of wood or iron with the seams running horizontally and with as few as possible, and then painted to make it opaque with three coats of flat white paint free from gloss. If sprinkled while wet with aluminum dust or powdered glass, it will give a metallic finish and will greatly improve the brilliancy of the picture. This curtain may be hoisted up to the rigging loft out of the way, or if it is rolled it should be properly weighted on the bottom and stretched smoothly to avoid shadows and be free from air currents that would cause wrinkles.

Good screens are made by plastering directly on the rear wall of stage and finished with a white coat of "Plaster of Paris," but must be carefully troweled and free from streaks and scratches. It may then be painted with three coats of flat zinc white and powdered if desired. Do not use gloss paint or enamel.

Notes—The proportionate size of a screen is about three-fourths of the width to height. (See tables.)

The glass screen is probably the best type of screen that may be used for picture projection. It is really a plate glass mirror with silvered or gold back and ground surface. The reflected surface adds to the brilliance and clearness of the picture. They are made in very large sizes, but are sometimes made in two parts, but the joint in the glass shows and is displeasing on that account. This must be fixed in a stationary position and be free from dampness that would injure the

silvering. Mirror screens cannot be used successfully in a house over 50 ft. wide.

After the lights have been turned onto the screen, giving the size of the picture, paint a border outside of the picture all around with dead black. This improves the picture greatly.

If a deep border or shadow box be built around the screen, about 6 ft. wide or more, and on an angle of about 45 degrees, so as not to obstruct the vision, the picture will be further improved.

LENSES AND FOCUSING

Lenses are to-day made to a very high degree of perfection, and are made for almost any distance and for any size screen. If the proper lenses are used, the picture will be free from "ghosts" or color fringes, and the edges of the pictures will be as sharp and clear as the center of the picture.

As conditions are different in nearly every theatre as to "length of throw," the position of the machine relative to the screen, the angle of the axis of the projecting light, etc., it is necessary in ordering a lens to give the correct distance from the machine to the screen, the angle of the center line of light, if not directly in the center of the same, and also the angle at one side or the other.

At a given distance from the screen the shorter the focus of the lens the larger the picture will be, and the longer the focus the smaller the picture will be. The larger the picture is, the less brilliancy by a given number of amperes, and larger pictures are coarser, and show up the defects more than in smaller pictures. For the average house a medium size, clean-cut picture is the best. A 9 ft. by 12 ft. picture is

a good size. A 12 ft. x 16 ft. is as large as is generally necessary, but these sizes may be varied either larger or smaller if the conditions require it.

From the following tables may be obtained:

The length of lens required to give a desired size picture when the "throw" is known, and

The size of picture given by a certain lens when the "throw" is known, and

The length of "throw" required to obtain a desired size picture with certain lens. (See tables.)

SCENERY

The tormentors are the first wings set on each side of the proscenium opening, and are set 5 ft. back from the fire curtain line and consist of three pieces, two folding and one flipper, which returns to the proscenium wall to hide the view from the opposite boxes and the front seats to the sides of stage. The flipper should have a door. The tormentors should extend about 3 or 4 ft. past the opening toward the center of the stage and should be from 18 to 20 ft. high, and are generally painted in drapery designs to harmonize with the overhead grand drapery border. The grand drapery border which comes just in front of the tormentor is arched out in the center for a space of about 6 ft. on the average. The ends of the grand drapery should extend about 6 ft. past the edge of the proscenium arch on each side and then turn forward to the proscenium wall, in order to mask the open awkward space that is often seen from the first row of the orchestra seats. The valance or permanent border is located just inside of the fire curtain, lapping well on both sides of the arch. The floor of the stage may be covered with either ground cloth or a baize extending about 6 ft. on each side of the proscenium arch. This ground cloth may be painted in aniline dye, brown on one side and green on the other, or it may be brown baize on one side and green on the other. The average stage and settings are made in a number of pieces, from 9 to 16, according to the size of the stage to be dressed.

Modern interiors are rarely built more than 16 ft. high, each wing being 18 ft. x 5 ft. 9 in. The doors and arches may be painted scenery, but in the more elaborate stage settings they are built with raised architraves and jambs, showing a reveal, the door being set back in the scene about 12 in. deep. Regular solid paneled wood doors are often provided, as the modern stage calls for a realism that is not found in the old-fashioned canvas door. The drops, consisting of the picture sheet, conservatory, olio and street scene, are made of the same size as the width of the proscenium arch, and are then hung as close to the grand drapery border as possible, as they are called "Drops in One."

They are used only for light acts which uses the 5 or 6 ft. of space between the footlights and the tormentors. Various wings and set pieces are used to make the sides of the stage. The height of these drops are generally a little more than the distance from the stage floor to the underside of the drapery border, or in the average house running from 21 to 27 ft. back of the "Drops in One." The object of the "Drops in One" being to permit changes of scenery without interfering with the procedure of the play.

Many architects and theatre owners are giving close attention to the dressing of the stage for moving pictures. The time has gone by when the public was satisfied with a plain picture sheet painted on a drop or with a mere screen with a border around it, and are becoming more elaborate in their stage settings. In houses where the stage is used for pictures only, the settings can be made of a permanent nature and only need be disturbed when they are replaced by a new setting, perhaps once or twice a year, and are arranged in such a way as to allow the orchestra to be seated on the stage in front

of the picture screen, also allowing for the appearance of concert singers from time to time during the performance. In this case the screens are generally set considerably above the stage floor, which in turn requires more height under the front of the balcony to allow a good view from the rear seats. There is an unlimited amount of suggestions that might be offered in making permanent stage settings for picture houses, such as arches, peristyles, columns, cornices, etc., all of which may be built of wood with deep recesses, etc., and backed up with scenery representing gardens, distant hills and other appropriate designs. A fountain with running water may be placed in the center of the stage in front of the orchestra; also statuary, urns and flower boxes with artificial flowers, etc. The wiring effects of these permanent settings are often made quite elaborate for the reason that they are permanent and, being once adjusted, the lights and wiring do not have to be disturbed. It is well, therefore, for the architect to bear in mind in planning picture houses to equip the stage with a gridiron, fly-gallery, etc., just as carefully as he would for a stage on which regular plays are to be produced.

AVERAGE SCENERY EQUIPMENT—LOCATION AND PLACING

FRONT PIECES:

Asbestos Curtain
Act Drop Curtain
Proscenium Border
Grand Drapery Border
Working Drapery Border
Profile Tormentor Wings
Picture Sheet
Conservatory Drop
Olio
Street

PALACE INTERIOR:

Back Drop
Cut Drop
Arched Borders
Profile Wings and Flippers
Leg Drops (instead of Borders and Wings)
Balustrades

LIGHT AND DARK FANCY INTERIORS:

Center Arch Piece
Arched Piece with Double Doors
Bay Wing
Door Wings
Jogs
Wings, including one with fireplace panel
Set Fancy Backings
Hanging Fancy Backing
Borders or Ceiling
Practical Fireplace
Fireplace Backings

PLAIN CHAMBER INTERIOR:

Arched Piece
Wings, including one with fireplace panel
Door Wings
Window Wing
Bay Window
Jogs
Set Backings
Hanging Backing
Borders or Ceiling
Practical Fireplace

WOOD EXTERIOR:

Light Wood Drop
Cut Wood Drops
6 Profile Wood Wings with Flippers
3 Foliage Borders
Foliage Leg Drops
Set House (with practical door and window)
Porch
Platform and Steps
Rustic Cottage
Cut Tree Tab
Profile Set Tree
Garden Drop
Profile Vases
Profile Statues
Rocky Pass Drop
Horizon Drop

KITCHEN INTERIOR:

Window Wings
Window Pieces
Door Wings
Wings, including one with fireplace panels
Jogs
Set Kitchen Backings
Borders
Practical Fireplace

PRISON INTERIOR painted on the back of Kitchen Interior

THEATRE FIRES

Statistics show that the greatest percentage of fires in theatres start after the performance is over and the house closed for the night. Many fires, of course, start before and during the performance, but on account of the watchfulness of the employees the fires are extinguished before any material harm is done.

Most fires start on the stage, in the dressing rooms, or in the boiler room, and are caused by cigarettes thrown around the dressing rooms or among the scenery, defective electric wiring, leaky gas pipes, carelessness of matches, the discharge of firearms, defective flues or spontaneous combustion of waste paper, oil or paints.

It is a good plan to keep the audience informed either by programs, signs, slides on the screens or by announcements from the stage, that the house is amply provided with all means of safety, such as fireproof curtain, fire walls, fire extinguishers, watchmen on stage, frequent inspections, etc. The audience will appreciate this.

A theatre of inferior construction, if provided with ample exits so that the audience may emerge quickly and safely is more desirable than a thoroughly fireproof building which lacks those features. Remember there is more danger in a theatre from panic than from fire.

PANICS

There is nothing that so arouses the instinct of self-conservation as the cry of "Fire," and this instinct in the face of great danger is the cause of panic. Not many of us have actually experienced such danger, but descriptions and illustrations in newspapers and periodicals so vividly present to our imagination the details of past fire horrors that our fear is none the less acute.

This universal fear has resulted in the spread of panic and injury and death of persons by physical violence despite the fact that the fire itself was small and not destructive.

Panics are more to be feared in a theatre than fire. True, many panics are caused by fire, but many other causes also contribute. A panic may be just as disastrous in a fireproof building as in a cheaply constructed wooden building.

Panics are generally caused by some excited or highly nervous person, and for no good reason other than sudden fright caused by some fire scene on the stage, a loud noise, blowing out of a fuse, the darkening of the house without notice, the sudden lighting of footlights, the noise of passing fire engines on the outside, a thunder storm, a breaking of a seat, a sudden commotion in the auditorium, or other causes.

When a panic occurs, some one is bound to be injured or killed, no matter how many exits are provided. This would even apply to an open lot or park where a great crowd was congregated. Therefore, if the usual number of exits are provided, with doors opening outward, if the stairs are of proper width and free from windows or too many turns, unobstructed aisles, seats well secured to floor, proper lights, etc., the responsibility of the house ceases. Get the audience accustomed to use all the exits.

FIRE DRILLS

Fire drills should be instituted for the employees, so that in case of emergency each man will know the duty he has to perform.

Fire alarm boxes should be installed at various parts of the house, and connected to the central station. If this is not done, notice should be posted, and each man should be instructed as to the location of the nearest fire alarm box, hydrants, fire extinguishers, etc.

BUILDING CODES

Most cities where they have any building codes at all require very similar conditions relative to exits, width of stairs, spacing of seats, fireproof construction, open courts on each side, the number of exits on each side from each floor, fire curtains, the construction of the flies and gridiron, the stage, skylight and vents, dressing rooms in a separate section separated by fireproof walls, boiler rooms, outside of building, standpipes and hose, sprinkler systems, width of aisles, methods of controlling lights, stepping off balcony, construction of booth, floor loads, false arches and number of seats between aisles.

State of Ohio laws require projection machines to be hand driven.

Pennsylvania laws do not allow balconies in picture theatres.

Pennsylvania laws require mechanical ventilation.

New York City laws admit the use of dressing rooms in the fly galleries.

V. LOEW'S NATIONAL THEATRE, 149TH ST. AND THIRD AVENUE, NEW YORK CITY

H. C. Severance and Neville & Bagge, Architects

TABLE OF COMPARATIVE LAWS OF VARIOUS CITIES

	New York	Chicago	Philadelphia	Boston	Cleveland	Washington, D. C.	New Orleans	Bridgeport	Seattle	Minneapolis	San Francisco
Fireproof construction where capacity exceeds	100	500	500	500	100	100	100	500	750	500	500
Minimum width of courts required both sides	10′-0″	10′-0″	10′-0″ one side	6′-0″	6′-0″ one side	8′-0″	6′-0″	....	4′-0″	7′-0″	5′-0″
Minimum width of exits	5′-0″	4′-0″	5′-0″	5′-0″	....	4′-6″	5′-0″	5′-0″	5′-0″	5′-0″	4′-0″
Minimum width of aisles at start with seats on both sides	3′-0″	2′-6″	4′-0″	2′-6″	3′-6″	3′-0″	2′-6″	3′-0″	2′-6″	3′-0″	3′-0″
Minimum width of aisles with seats on one side	3′-0″	2′-6″	3′-6″	3′-0″	3′-0″	2′-6″	2′-0″	2′-6″	2′-6″	2′-6″	2′-0″
Spacing of seats B to B	32″	34″	30″	30″	30″	32″	30″	32″	32″	32″	32″
Width of seats C to C	....	20″	19″	....	20″	....	....	....	....	....	....
Limit of pitch of floor	....	1½″-1′	....	1″-1′	....	....	1″-1′	....	....	....	....
Fire curtains required where scenery is used	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Boilers permitted under building	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Stepping of balcony not to exceed	21″	....	....	21″	14″	22″	....	....	21″	21″	21″
Stage skylight and vent required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stand pipes and sprinklers required	Yes	Yes	....	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fire extinguishers required	Yes	Yes	....	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Live loads on floors	100	100	100	125	....	100	125	90	75	125	125
Live loads on stairs	125	....	150	150	....	....	....	100	100	....	....
Number or seats allowed between aisles	13	13	13	13	13	13	13	13	13	13	13
Number of exits required on each side of each floor	2	2	2	1	....	1	1	2	1	2	2
F. P. paint required on scenery and woodwork	Yes	Yes	....	Yes	....	Yes	Yes	Yes	....	....	Yes
Cross aisle required for each bank of	....	15 rows	....	....	....	22 rows	....	....	20 rows	....	....

LIST OF STATES

Having established laws relative to theatres.

Pennsylvania	Kansas
Mississippi	California
Illinois	Ohio

Other states have no laws at all or have the matter in the hands of the Factory or Labor Commissioners, Chief of State Police or similar officials, with discretionary powers, or with the various municipalities.

DECORATIONS

Plaster relief ornaments need no particular introduction to architects and decorators as this methods has been in use for many centuries in European countries.

Many buildings of all classes in the country are richly ornamented by the use of this material. It is made in plaster for interior and of cement composition for exterior work, and is one of the most pliable and least expensive methods of decoration.

The various concerns that make this material employ experts in design and modeling and are capable of executing any style desired in addition to the multitude of stock designs.

Fibrous plaster casts are generally finished on a backing of cheesecloth or on a solid background, and are easily applied.

ARCHITECTURAL TERRA COTTA

The use of terra cotta for exterior decorative features has developed wonderfully in this country in the last fifty years. It can be worked into wonderful designs, is fireproof and has many beautiful shades such as grays, buff, reds, browns in warm tones and also in mottled and spotted effects, as well as white glazed. It is much cheaper than stone for trimmings, decorations, belt courses, etc., as many pieces may be duplicated from one mould, is easily set and secured in place, being light in weight it is easily handled and does not require heavy hoisting machinery. All pieces are assembled at the factory and fitted and numbered according to a working drawing.

HEATING

There are various methods of heating a theatre, and while it is not the intention of the author to go into elaborate details on the matter of heating, he will, however, make a few timely suggestions as a guide for the architect to follow.

The problem of heating a theatre is different from any other type of building, on account of its peculiar features and the conditions to be met. Successful and proper heating in this character of building requires great care and skill on the part of the designer. There are more draughts in a theatre building than one of any other kind on account of the various differences in heights, slope of the floors, pockets under balconies, excessive heights of stage, etc.

Large theatres are generally heated by mechanical methods of either one of the two systems—the upward or the downward system.

In the upward system the heated air is admitted into the room through numerous small openings in the floor, under the seats, and similar small openings along the balconies, the heated air coming from plenum chamber in the basement. The air from the auditorium is then drawn out at the ceiling through exhaust ventilators operated by fans. Direct radiation is placed in the lobby, stage and other required places.

The downward system consists of admitting the heated air at the high point of the room through ducts in the walls and drawing it out at the low point near the floor, similar to the system used in schools, and these flues should be provided with exhaust fans or else have coils of steam pipes inserted in shafts to create an upward draft. The house may

be heated more quickly if a circulating system is adopted that will draw the cold air out of the auditorium at the lowest point of the floor and back into the heating chamber, with all ventilators closed. This will allow the heat to enter more readily and heat the house more quickly. When the audience has assembled the ventilator should be opened and the lower opening closed. Theatres do not require as much heat as most buildings of other kinds, as the people enter from the colder temperatures outside and are warmly dressed, and the audience, when fully assembled and the doors are closed, will give off bodily heat enough to raise the temperature almost 10 degrees.

The laws and ordinances of some states and cities specify the kind of heating and ventilating to be used in theatres and state the amount of fresh air per person to be admitted per hour. An expert should be consulted in all large theatres in order to get the best results.

Small theatres and picture houses are generally heated by a direct system composed of radiators or coils placed along the sides and sends at suitable points. (See article on "Ventilation.")

After the location of the boiler room has been determined as to its availability and accessibility for getting in coal and the removal of ashes, etc., and the proper depth established to give the proper pitch for the feed and return pipes, the next thing to be considered will be the proper distribution of heat. It is natural to assume that the coldest part of the house will be the lowest part of the floor near the orchestra. It is here that all draughts caused by the opening of the entrance doors will center, because when the doors are continually being opened as the people assemble, the cold air

admitted from the source will follow along the floor and settle at this low point. Therefore, this point is to be provided for to a certain extent by placing radiation along the curtain wall under the stage in the orchestra pit if there be one, but not enough to make the orchestra uncomfortable.

If the lobby and the rear of the auditorium near the entrance is amply provided with heat it will greatly tend to guard against the cold from going to the orchestra pit. Therefore, provide plenty of heat at the entrance.

When the curtain rises at the opening of the performance there is generally a cold draught that comes from the stage and strikes the audience in the face, so that it is necessary to provide against this. It is not necessary to heat the stage to any great extent to overcome this, because the heat would rise to the roof anyway and thus drive the cold air down. A coil along the back wall on the two side walls and a coil along the front of the fly galleries is desirable. The actors do not care for an excessive amount of heat except in dressing rooms and such rooms as may be occupied by the stage hands, but to take care of the cold draught, as before stated, it is well to provide a flue or shaft, say 24″x24″, or some similar area at each side of the proscenium arch and back of the curtain, with an opening into the flue near the floor of stage, this flue to extend to the upper part of the stage or within a few feet of the roof. Each flue is to be equipped with a coil of heating pipes above the bottom opening. This will draw the cold air off the stage floor and keep it in circulation without allowing it to accumulate near the curtain ready to strike the audience when the curtain rises. The plan will produce wonderful results, and is well worth the little extra expense in construction. The flue, of course,

should be fireproof. The size of coils will depend on the size and height of the stage, and other conditions.

Coils so inserted is by no means lost radiation because it is doing much to temper the atmosphere on the stage, and it is better to make the radiation ample rather than underestimate it.

The balcony and gallery generally require little or no heat except in special cases, because the heat rising from the auditorium will take care of the upper part of the house.

HEATING NOTES

No floor registers should be allowed as they collect dust.

No radiator should be located in the aisle that will obstruct passage. They may be recessed or set on walls above the shoulder.

VENTILATION

It is not the intention of the author to treat extensively on the matter of ventilation as that would require a book in itself, and is a subject that is well handled by ventilating experts, but I will state briefly that some suitable means of ventilation should be provided.

Of course, the more elaborate and costly the house the more may be expended on mechanical methods of ventilation if desired by the owners.

One thing to avoid, though, is not to make the openings in the ceiling of the auditorium greater in area than the area of the stage ventilator as it will have a tendency to draw the fire and smoke from the stage into the auditorium. The

stage ventilator, being higher, will, all things being equal, draw smoke and fire that way. All ventilators should be under control at convenient points on the stage to be operated according to conditions and location of fire.

Artificial means of theatre ventilation are not compulsory in any state as far as the knowledge of the author is concerned, provided there are windows or ceiling ventilators and fans sufficient to do the work.

Several of the larger cities have ordinances concerning ventilation. There are a number of ways to provide artificial ventilation without requiring special mechanical methods and to do the work nicely and cost practically nothing to install. The sound of the human voice on the stage is intended to travel to all parts of the house; therefore, do not design any system of ventilation that will obstruct the sound travel by downward or cross currents of air, but on the other hand it should be designed to assist the voice. Thus it is obvious that the logical point from which to exhaust the foul air is at the highest point of the ceiling and in the rear over the balcony. Any ventilating system acting to the contrary will have more or less effect on the acoustics.

The spaces or pockets under the balconies should be ventilated to provide against dead air.

SYSTEMS OF VENTILATION

The so-called "Natural System" of ventilation is in reality no system at all.

For proper and effectual ventilation some system must be designed to supply the required amount of fresh air and to remove the vitiated air, no matter what the direction of the wind or the condition of the weather.

Aspiration shafts with steam coils may be used in smaller theatres with fair results if all conditions are favorable.

The proper system of ventilation is one that will give the requisite supply of fresh air to any and all parts of the auditorium at all times when needed, and in uniform and regulated quantities, and can be obtained only by properly designed mechanical or forced methods by means of a blower or fan and similar methods used for the exhaust. The ventilating system should be made to work in conjunction with the system of heating, particularly in northern climates. (See article on "Heating.")

There are two methods of mechanical ventilation, viz., the "Exhaust System" and the "Plenum System."

The "Exhaust System" requires a fan to withdraw the foul air from the room, and of course means must be provided for admitting an equal amount of air that is exhausted.

The "Plenum System" forces the air into the room at any desired temperature, and in such quantities as may be desired, and may be controlled at will. Provision must also be made for the discharge of an equal amount of vitiated air. The air, before it is admitted into the room, is heated to the proper temperature in cold weather so that this makes a

combination of heating and ventilation. The fresh air supply should come from the outside at a considerable elevation from the ground, and where possible should be taken from above the roof so as to avoid dirt and dust being drawn into the heating chamber.

There are several systems by which the heating and ventilating apparatus may be controlled automatically, and all first-class theatres should be so equipped.

The "Blower System" may be used in warm weather for cooling the house.

LIGHTING

Great advancement has been made in the methods and principles of lighting theatres in recent years.

Proper lighting of theatres requires very careful and thoughtful planning, particularly on the stage.

Electric lighting is, of course, the only proper method to be considered, and if the electric current is not available in the locality of the theatre, a special lighting plant should be installed. This method of service is resorted to very often, even in cities where the public service wires pass the site of the theatre.

There are three systems of distributing light, and are known as the direct, the indirect and the semi-indirect.

The "direct system" is objectionable on account of its glaring effects, and does not produce the desired results, often casting deep shadows where they are not desired, and distorts the colors and decorations, and producing undesirable conditions.

The theory that direct lighting gives 100 per cent of light has been proven by experts to be erroneous.

The "indirect system" is an improvement over the direct system, but is an extreme reverse of the former, and has its faults as well. It is true the light it diffuses is not glaring and hardish, but it is not bright and radiant enough to be used for practicable lighting purposes, except under certain conditions.

The indirect system consists generally of inverted bowls and containers of metal or other opaque materials so that the rays of light are not seen directly by the audience, but are reflected from the container directly to the ceiling of walls

from whence it must be reflected to the lower portions of the auditorium. The ceiling, therefore, must be of light tints in order not to absorb the light. This is not always desirable or suitable to the general decorative or color schemes employed in theatres. Even if the ceiling is of the most advantageous color, indirect lighting fails to light the room with equal diffusion, but often causes the room to appear brilliantly lighted in its upper portions, but only partially lighted below.

The indirect lighting system usually requires about 50 per cent more lighting power than the direct or semi-indirect systems.

The "semi-indirect" lighting system, which in most cases is best for theatres, consists of translucent inverted bowls or containers, allowing a portion of the light to filter through in a downward direction as well as reflecting upon the ceiling.

Thus the upper portion of the room is lighted just as well as with the indirect lighting, while in the lower portion of the room the gloom observed in indirect lighting is dispelled by the soft, white rays that filter through the translucent glass container, giving a perfect, equal distribution of light, producing all the good features of both the direct and the indirect systems, but eliminating all of their evil effects.

It is therefore incumbent upon the architect to take into consideration the practical requirements of the manner and method of lighting, and to adopt such system as will give the best results for the particular case in hand, using perhaps a combination of the three systems mentioned, all of which will be governed to a large extent by the character of the ceiling construction, design and decorative features. It would be wise, therefore, if any complicated features arise,

or any departure from the usual practice is contemplated, for the architect to take expert advice.

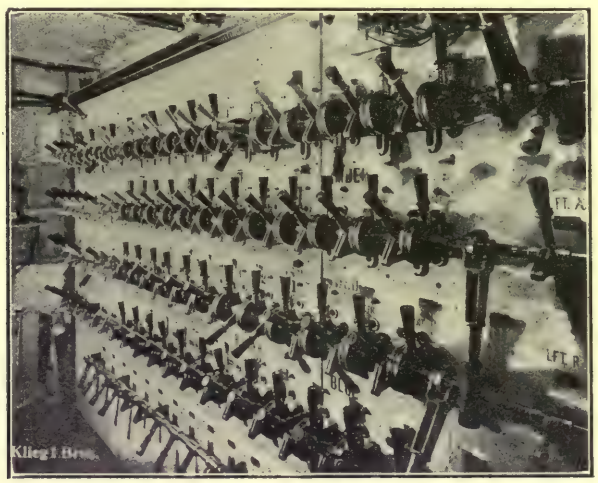
Separate circuits should be provided for all exit lights, also for the auditorium and stage, and a No. 6 gauge wire for the projection machine.

Extra fuses for all circuits should be constantly on hand.

STAGE LIGHTING

The proper lighting of the stage is one of the most important features of theatre equipment, and requires more careful thought and study than any other similar problem. It calls for the proper number and location of lights, according to the character of the house and the plays to be presented. The equipment consists of footlights, border lights, striplights, stage pockets, dimmers, and the equipment for furnishing the electrical effects, such as passing clouds, waves of the sea, lightning flashes, etc. A perfectly illuminated scene is pleasing to the eye, and will call forth applause from the audience, on the rising of the curtain, and is the prime factor in contributing to the successful consummation of the play. To get these results the best and latest improved devices should be used, and an expert consulted in laying it out.

All lights in the auditorium, as well as those on the stage, are controlled from the stage switchboard. The switchboard should be of a dead face type as shown in the cut; that is,



Stage Switchboard, Metropolitan Opera House, New York

there should be no live terminals on the face of the board. Below the switchboard the fuses for the different circuits are generally placed. The switchboard should be at least 3 ft. away from the wall, so that the electrician may have easy access to the rear of the board.

The switches on the switchboard should be placed in gangs, one master switch to control the lights on the entire stage, one master switch to control all the lights in the auditorium. The stage switch controls the different master gang switches, one for each color, and these again control the switches for the different circuits, also the switches for right and left incandescent stage pockets and special switches for the arc pockets. From the switchboard the different circuits must be run through iron conduits.

A bank of dimmers controlling all different colors in border lights, footlights, proscenium lights, incandescent stage pockets, etc., is generally placed above the stage switchboard. This is furnished in one or more rows, as the occasion requires for the number of lamps to be dimmed. A dimmer plate should not have less than eighty steps to give a gradual change of light.

The footlights trough should be straight from end to end. If the trough is curved the occupants of the boxes on the sides are annoyed by the glare of the footlights.

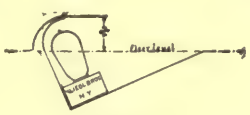


Fig. 22

Fig. 24

For footlights I recommend the semi-flush type (Fig. 22), which allows four 40-watt lamps to the foot in a single row. Figure 24 shows footlight with a double row of lights, allow-

ing eight 40-watt lamps to the foot. There are generally three colors used in footlights.

A space of 2 to 3 ft. should be left between proscenium arch and footlights. Figure 26 shows an inverted type footlight. The new type of footlights for halls, high schools, etc., is a disappearing type. When not in use this footlight is flush with the stage floor and hidden from view.

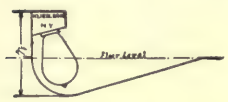


Fig. 26

Border lights are composed of movable metal troughs equipped with electric lights, formed and constructed so as to throw the light downward and backward on the stage, but not seen from the audience. The first border light is placed in front of the grand drapery and behind the valance or permanent border. Other border lights are set from 6 ft. to 7 ft. apart.

Four to six border lights are generally used for illuminating the stage and these should be at least 2 feet longer than the proscenium opening, with the exception of the first border light, which should be 2 ft. smaller than the proscenium opening. This border is generally used for interior sets. The universal type (Figs. 27 and 29) are generally used. Four 60-watt lamps can be placed to the foot in a single row in this type. They are made of galvanized iron, completely wired to cable splicing box on border and furnished with $1\frac{1}{4}$ in. pipe for hanging. They are suspended from the gridiron and made to raise and lower at will. Three colors are generally used in border lights, white, red and blue and occasionally a fourth color, amber, is used.

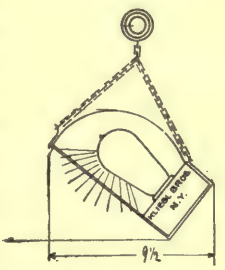


Fig. 27

A flexible electric cable having the number of wires required runs from the border light to the stage switchboard. The border light cable is held by a border light cable support (Fig. 28) to the border light.

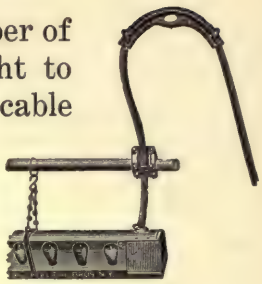


Fig. 28

The border light cradles are for raising and lowering the cables, so that it will not interfere with the side borders.

The stage should be provided with one arc and one or more incandescent stage pockets in each entrance, right and left stage. The arc pocket has 50 amperes capacity, and the incandescent pockets 25 amperes. These are marked on the face of the cover with the proper rating. Arc pockets should be provided on the arc light bridge, right and left proscenium opening, also two to four arc pockets, auto type, should be installed on each fly gallery. On the front of the balcony a panel pocket with four outlets is of great advantage to traveling companies, for spot lights, also as a connection for a portable motion picture machine, if desired. All pockets are connected direct to the stage switchboard.

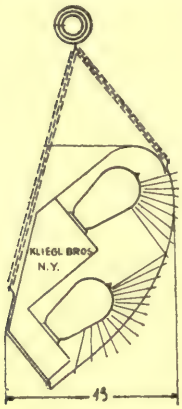


Fig. 30

Fig. 29

The stage should also be provided with several bunch lights and striplights. The striplights are located on the sides of the proscenium arch, back far enough not to be seen from the audience. They are set in enameled metal troughs at a proper angle to throw the light toward the center of the stage.

The striplights start about 6 ft. above the stage floor and extend to the top of the proscenium opening. They are equipped with white and colored lights.

VI. REGENT THEATRE, 116TH ST. AND SEVENTH AVE., NEW YORK CITY
Thomas W. Lamb, Architect

VII. ELSMERE THEATRE, NEW YORK CITY.
Shampan & Shampan, Architects

SPRINKLER SYSTEM OF FIRE PROTECTION

The stage of any theatre where scenery is used should be protected from fire by the use of an automatic sprinkler system. Many disastrous fires have been prevented by the fact that sprinklers had been installed.

The sprinkler heads should be located under the stage roof, gridiron, fly galleries and under the stage, in the scene docks, paint shop, dressing rooms, carpenter shop, property rooms, boiler room, etc. It is not necessary to install sprinklers over the auditorium ceiling unless that space is used for some purpose that requires protection.

There are three systems of sprinklers used, viz.:

1. The ordinary wet pipe system;
2. The non-freezing wet pipe system, and
3. The dry pipe system.

The ordinary wet pipe system is the one most generally used. It is, of course, subject to freezing if the building in which it is installed is not constantly heated. The non-freezing wet pipe system has an open water tank and a small air-tight iron tank to feed the pipes, which are filled with a non-freezing and non-corrosive liquid. The tanks are connected by a syphon, so that the system is supplied automatically when a head opens.

The dry pipe system is desirable in places where the pipes are liable to freeze. This system requires air pumps and frequent watching by an attendant and is expensive to maintain on that account.

Theatres generally are sufficiently heated at all times to insure the non-freezing of the water in the pipes, therefore, the wet system is most generally used. It is the purpose of

an automatic sprinkler system to extinguish the fire in its incipiency, through the agency of the fire itself. A fire, if started opens up only a limited number of sprinkler heads; hence, there is no useless waste of water, no unnecessary damage, and the water discharged is concentrated in the spot just where wanted.

A wet-pipe sprinkler system comprises a wooden Cooper's tank, placed on the highest part of the stage roof, and of a capacity corresponding to the number of sprinkler-heads. The installation for a theatre requires generally from 100 to 300 sprinkler-heads, suitably distributed; several 1½, 2 and 4-inch risers; a separate shut-off valve for each floor or tier; a 2½ to 3-inch riser from the pump to the tank, a watchman's automatic fire-alarm with large gongs—one on the stage, the other on the outside of the building; a low-water alarm with indicator in the pump or engine-room; one or more 3-inch pipes running from the main riser to the outside of the building, to form a fire-department connection (for auxiliary supply), which is provided with check-valves.

It is essential that all sprinkler-systems should have two independent approved sources of supply, of which one should be always turned on. Speaking generally, the supply to the sprinkler system may be either from a roof tank or from reservoir pressure, or from direct pressure from public street mains, or from special sprinkler fire-pumps, or from fire-department steam-engines by means of the outside fire-department connections.

In many of our large cities the street main supply is out of the question, because the available pressure is insufficient. While it is perfectly feasible to use a rotary or direct-acting fire-pump to supply the system, this would, in theatres where

one fire-pump is already provided to supply the stand-pipe fire-valves, require a second pump of large capacity, for, as already stated, the fire pump described heretofore, is only to be used for the fire-valves and hose streams, and to keep the fire-tank on the roof filled. It is therefore usual to choose for theatres the fifth combination, viz., to supply the sprinkler system primarily from a large roof tank, always kept full of water, and as an auxiliary supply to provide one or several outside fire-department connections, which enable the fire department, in case of a theatre fire, to connect a steam fire-engine and to keep the sprinkler system on the stage supplied in case the roof tank has discharged its whole contents.

Sprinkler-heads must be able to sustain a pressure of 300 lb. per square inch without leaking and they must be capable of operating under five pounds of water-pressure.

All sprinkler-heads are provided with distributors or deflectors, which divide the stream of water, as it strikes them, into a heavy shower, which thoroughly drenches the fire. These deflectors are stationary in some sprinklers, in others they are revolving or oscillating. The sprinkler-heads are placed either above or below the distributing pipes, the former position being slightly preferable because it secures perfect drainage and prevents the lodgment of rust, dirt or sediment in the sprinklers.

The ordinary fusible solder-joint, which opens at 155 to 160 degrees Fahrenheit, is not adapted for boiler rooms or drying rooms, owing to the sometimes excessive heat in these rooms, and if automatic-sprinkler protection is desired in such places, a different alloy or solder having a high degree of fusibility should be used.

The number of sprinklers necessary for an equipment depends upon the areas to be protected.

Sprinkler-heads must be set at no greater distance than 10 feet apart, and 5 feet away from walls or partitions, so that they protect an area of 10 feet in diameter. The rules of the New York Board of Fire Underwriters call for all portions of a building to be equipped by sprinklers, unless especially exempted because of being entirely fireproof and containing only non-combustible materials, as, for instance, the loft over the auditorium; but in the stage portion of a theatre it is important that the space between ceiling or rigging-loft and the stage roof be also protected. The largest number of sprinklers in a theatre is required to protect the rigging-loft and under it to protect the stage.

All exposed sprinkler-heads must have guards placed around them to protect them from damage, and this in theatres must be particularly observed in the case of sprinklers placed under the rigging loft and the fly-galleries, with which sprinklers some of the hoisting machinery for the curtain or the borders and drops may come in contact.

Nothing should be permitted to be hung from sprinkler-pipes, nor should the sprinkler-heads be painted, bronzed, or covered with whitewash.

The roof tank, supplying the sprinkler system, should be placed on the highest part of the stage roof, and must be elevated so that its bottom will be at least 12 feet above the level of the highest sprinkler. This location of the fire-tank on the roof is open to the objection that in case of fire the tank will fall with the collapse of the roof or the bearing walls and may thus become a source of danger to the firemen.

Where it can be done, it is preferable to build a separate tank tower.

The roof tank must be of large capacity, so as to be able to supply the sprinklers opened during a fire for a certain length of time.

Exposed exterior walls may also be protected by a perforated sprinkler system that will allow a sheet of water to pour down over the face of the wall.

FIRE STAND-PIPES

At suitable points in the four subdivisions of a theatre, fire stand-pipes, with fire-valves and hose attached, should be placed. The largest number of fire-valves is required on or about the various levels of the stage where a fire is most likely to break out. There should also be fire stand-pipes in the auditorium, in the corridors and lobbies, and near the dressing rooms, and they should be so distributed that the remotest corner can be reached by the fire-hose at each of the outlets.

The number of stand-pipes required and their position depend, therefore, upon the size and area of the theatre and upon the length of the fire-hose attached to the fire-valves. The New York City Building Law requires that one stand-pipe be provided on each side of the stage, with outlets on every floor and gallery, from the understage to the rigging-loft; one stand-pipe on each side of the auditorium, with outlets in each tier from the cellar to the gallery; one in the property-room, and one in the carpenter's shop. Cases are known where fires have started on the stage during the performance and extinguished by the automatic sprinkler, without the audience knowing of it, or without any interruption of the play.

ENGINE ROOM

Where the theatre contains an engine room, for machinery, etc., it must be separated by suitable walls and properly located so as to be free from dirt and dust from the coal rooms, and should have outside windows, toilet rooms, etc., and connected by telephone and signals from the Manager's Office.

FAN ROOM

If fans and blowers are to be installed, the fan room should be of ample height and located so as to accommodate the ducts for the distribution of heat, and also to receive the fresh air from the outside.

ADVERTISING SPACE

As the general thing, patrons are adverse to having to sit and look at a promiscuous lot of advertisements thrown on the screen.

They pay admission to be entertained.

This objection is not so marked in small towns or country theatres.

The manager should advertise himself and his future plays.

It is permissible to have a drop curtain lowered before the performance and between same with a few well-selected ads, as the people do not like to sit and look at a blank white screen when there is nothing going on.

As the theatre is patronized by the same people each week, the ads should be changed weekly and should be attractive and brief, but while you are getting some annual revenue from your paid advertisements, you will please your audience better and get closer to them by advertising your own policies, programs, etc. Talk to your patrons by the use of slides on matters of interest to them and yourself.

ELECTRIC WIRING

[*Extracts from the Rules of the National Board of Fire Underwriters*]

THEATRES AND MOVING PICTURE WIRING

All wiring, apparatus, etc., not specifically covered by special rules herein given must conform to the standard rules and requirements of the National Electrical Code, and the term "theatre" shall mean a building or that part of a building regularly or frequently used for dramatic, operatic, moving picture or other performances or shows, or which has a stage for such performances used with scenery or other stage appliances.

SERVICES

Where supply may be obtained from two separate street mains, two separate and distinct services must be installed, one service to be of sufficient capacity to supply current for the entire equipment of theatre, while the other service must be at least of sufficient capacity to supply current for all emergency lights, where supply feed for emergency lights must be taken from a point on the street side of main service fuses. By "emergency lights" are meant exit lights and all lights in lobbies, stairways, corridors and other portions of theatres to which the public have access, which are normally kept lighted during the performance.

Where source of supply is an isolated plant within the building, an auxiliary service of at least sufficient capacity

to supply all emergency lights must be installed from some outside source, or a suitable storage battery within the premises may be considered the equivalent of such service.

STAGE

All permanent construction on stage side of proscenium wall, except as hereinafter provided, must be approved conduit or armored cable.

FOOTLIGHTS

Must be wired in approved conduit or armored cable, each lamp receptacle being enclosed with an approved outlet box, or the lamp receptacles may be mounted in an iron or steel box, metal to be a thickness not less than No. 20 U. S. sheet metal gauge, treated to prevent oxidization, so constructed as to enclose all the wires. Wires to be soldered to lug of receptacles.

Must be wired that no set of lamps requiring more than 1320 watts nor more than 24 receptacles shall be dependent upon one cut-out.

BORDERS AND PROSCENIUM SIDELIGHTS

1. Must be constructed of steel to a thickness not less than No. 20 U. S. sheet metal gauge, treated to prevent oxidization, be suitably stayed and supported, and so designed that flanges of reflectors will protect lamps.

2. Must be so wired that no set of lamps requiring more than 1320 watts nor more than 24 receptacles shall be dependent upon one cut-out.

3. Must be wired in approved conduit or armored cable, each lamp receptacle to be enclosed within an approved outlet box, or the lamp receptacle may be mounted in an iron or steel box, metal to be a thickness not less than No. 20 U. S. sheet metal gauge, treated to prevent oxidization, so constructed as to enclose all wires. Wires to be soldered to lugs of receptacles.

4. Must be provided with suitable guards to prevent scenery or other combustible material coming in contact with lamps.

5. Cables for borders must be of approved type and suitably supported; conduit construction must be used from switchboard to point where cables must be flexible to permit of the raising and lowering of border.

6. For the wiring of the border proper wire with approved slow-burning insulation must be used.

7. Borders must be suitably suspended, and if a wire rope is used same must be insulated by at least one strain insulator inserted at the border.

STAGE AND GALLERY POCKETS

Must be of approved type, controlled from switchboard, each receptacle to be of not less than 35 ampere rating for arc lamps nor 15 amperes for incandescent lamps and each receptacle to be wired to its full capacity. Arc pockets to be wired with wire not smaller than No. 6 B. & S. gauge and incandescent pockets with not less than No. 12 B. & S. gauge.

Plugs for arcs and incandescent pockets must not be interchangeable.

SCENE DOCKS

Where lamps are installed in scene docks, they must be located and installed that they will not be liable to mechanical injury.

CURTAIN MOTORS

Must be of ironclad type and installed so as to conform to the requirements of the National Electrical Code.

CONTROL FOR STAGE FLUES

In cases where dampers are released by an electric device, the electric circuit operating same must be normally closed.

Magnet operating damper must be wound to take full voltage of circuit by which it is supplied, using no resistance device, and must not heat more than normal for apparatus of similar construction. It must be located in the loft above the scenery, and be installed in a suitable iron box with a tight, self-closing door.

Such dampers must be controlled by at least two standard single pole switches mounted within approved iron boxes provided with self-closing doors without lock or latch, and located, one at the electrician's station and others as designated by the inspection department having jurisdiction.

DRESSING ROOMS

Must be wired in approved conduit or armored cable. All pendant lights must be equipped with approved reinforced cord, armored cable or steel armored flexible cord.

All lamps must be provided with approved guards.

PORTABLE EQUIPMENT

Arc lamps used for stage effects must conform to the following requirements:

1. Must be constructed entirely of metal except where the use of approved insulating material is necessary.

2. Must be substantially constructed, and so designed as to provide for proper ventilation, and to prevent sparks being emitted from lamps when same are in operation, and mica must be used for frame insulation.

3. Front opening must be provided with a self-closing hinged door frame, in which wire gauze or glass must be inserted, except in the case of lens lamps, where the front may be stationary, and a solid door be provided on back or side.

4. Must be so constructed that neither carbons nor live parts will be brought into contact with metal of hood during operation, and arc lamp frames and standards must be so installed and protected as to prevent the liability of their being grounded.

5. Switch on standard must be so constructed that accidental contact with any live portion of same will be impossible.

6. All stranded connections in lamp and at switch and rheostats must be provided with approved lugs.

7. Rheostats must be plainly marked with their rated capacity in volts and amperes, and, if mounted on standard, must be raised to a height of at least 3 in. above floor. Resistance must be enclosed in a substantial and properly ventilated metal case which affords a clearance of at least 1 in. between case and resistance element.

8. A competent operator must be in charge of each arc lamp, except that one operator may have charge of two lamps when they are not more than 10 ft. apart, and are so located that he can properly watch and care for both lamps.

BUNCHES

Must be substantially constructed of metal and must not contain any exposed wiring.

The cable feeding same must be bushed in an approved manner where passing through the metal, and must be properly secured to prevent any mechanical strain from coming on the connection.

STRIPS

Must be constructed of steel of a thickness not less than No. 20 U. S. sheet metal gauge, treated to prevent oxidization, and suitably stayed and supported and so designed that flanges will protect lamps.

Cable must be bushed in a suitable manner where passing through the metal, and must be properly secured to prevent serious mechanical strain from coming on the connections.

Must be wired in approved conduit or armored cable, each lamp receptacle being enclosed within an approved outlet box, or the lamp receptacle may be mounted in an iron or steel box, metal to be of a thickness not less than No. 20 U. S. sheet metal gauge, treated to prevent oxidization, so constructed as to enclose all wires. Wires to be soldered to lugs of receptacles.

PORTABLE PLUGGING BOXES

Must be constructed so that no current carrying part will be exposed and each receptacle must be protected by approved fuses mounted on slate or marble bases and enclosed in a fireproof cabinet equipped with self-closing doors. Each receptacle must be constructed to carry 30 amperes without undue heating, and the bus-bars must have a carrying capacity equivalent to the current required for the total number of receptacles, and approved lugs must be provided for the connection of the master cable.

PIN PLUG CONDUCTORS

Must be of an approved type, so installed that the "female" part of plug will be on live end of cable, and must be so constructed that tension on the cable will not cause serious mechanical strain on the connections.

PORTABLE CONDUCTORS

Flexible conductors used from receptacles to arc lamps, bunches and other portable equipments must be approved stage cable except that for the purpose of feeding a stand lamp under conditions where conductors are not liable to severe mechanical injury, an approved reinforced cord may be used, provided cut-out designed to protect same is not fused over six amperes capacity.

LIGHTS ON SCENERY

Where brackets are used they must be wired entirely on the inside, fixture stem must come through the back of the scenery, and end of stem be properly bushed.

STRING OR FESTOONED LIGHTS

Wiring of same must be of approved type, joints to be properly made, soldered and taped, and staggered where practicable.

Where lamps are used in lanterns or similar devices, approved guards must be employed.

SPECIAL ELECTRICAL EFFECTS

Where devices are used for producing special effects, such as lightning, waterfalls, etc., the apparatus must be so constructed and located that flames, sparks, etc., resulting from the operation cannot come in contact with combustible material.

AUDITORIUM

All wiring must be installed in approved conduit, metal moulding or armored cable.

Exit lights must not have more than one set of fuses between same and service fuses.

Exit lights and all lights in halls, corridors or any other part of the building used by audience, except the general auditorium lighting, must be fed independently of the stage lighting, and must be controlled only from the lobby or other convenient place in front of the house. All fuses must be enclosed in approved cabinets.

MOVING PICTURE EQUIPMENTS

1. ARC LAMP USED AS A PART OF A MOVING PICTURE MACHINE—Must be constructed, so far as practicable, similar to arc lamps of theatres, and wiring to same must not be of less capacity than No. 6 M. & S. gauge.

2. RHEOSTATS—Must conform to rheostat requirements for theatre arcs.

3. TOP AND BOTTOM OF REELS—Must be enclosed in steel boxes or magazines, each with an opening of approved construction at bottom or top, so arranged as not to permit entrance of flame to magazine.

No solder is to be used in the construction of these magazines. The front side of each magazine must consist of a door spring-hinged and swinging horizontally, and be provided with a substantial latch.

4. AUTOMATIC SHUTTER—Must be provided and must be so constructed as to shield the film from the beam of light

VIII. ELTINGE'S THEATRE, NEW YORK CITY
Thomas W. Lamb, Architect

whenever the film is not running at operating speed. Shutter must be permanently attached to the gate frame.

5. EXTRA FILMS—Must be kept in individual metal boxes equipped with tight-fitting covers.

6. MACHINE ENCLOSURE—Machine must be placed in an enclosure or house made of suitable fireproof material; must be properly ventilated, properly lighted and large enough for operator to walk freely on either side of or back of machine. All openings into this booth must be arranged so as to be entirely closed by doors or shutters constructed of the same or equally good fire-resisting material as the booth itself. Doors or covers must be arranged so as to be held normally closed by spring hinges or equivalent devices.

8. REELS CONTAINING FILMS UNDER EXAMINATION OR IN PROCESS OF REWINDING—Must be enclosed in magazines or approved metal boxes similar to those required for films in operation, and not more than 2 ft. of film shall be exposed in booth.

HOW ELECTRICITY IS MEASURED

The measurement of electrical energy is as accurate as the measurement of any tangible substance. The various electrical meters are arranged to show the amount of electrical energy in a circuit through one or more of the effects of the current, such as the heating, chemical or magnetic effects.

The "volt" is the practical unit of electrical pressure corresponding to steam or water pressure. The ordinary pressure on incandescent lamps is about 110 volts.

The "ohm" is the practical unit of resistance and corresponds to mechanical friction, such as resistance to the flow of water in water pipes.

The "ampere" is the practical unit of "rate of flow," such as water flowing at the rate of a certain number of gallons per minute.

The "watt" is the practical unit of power and is obtained by multiplying the number of volts of pressure by the number of amperes flowing. 746 watts equals one electrical horse-power and equals 33,000 foot-pounds.

One kilowatt hour is the practical unit of measurement and is equal to 1,000 watts of energy used for one hour.

The ordinary 16-candlepower carbon filament lamp consumes slightly more than 50 watts, or about 31/10 watts per candlepower.

The new Tungsten consumes energy at the rate of only 1¼ watts per candlepower.

EXTRACT N. Y. CITY BUILDING LAWS

WALLS

Fireproof walls shall separate the auditorium from the entrance vestibule, lobby or other rooms.

DRESSING ROOMS

These may be placed in the fly galleries, with proper exits to the outside, but are to be surrounded with fireproof walls.

No dressing rooms allowed below the street level.

No dressing room windows shall have fixed sash, or have grills or bars over same.

FIRE APPLIANCES

Standpipes required on each side of stage and auditorium with openings on each floor, equipped with one length of 2½ in. hose, ready for use.

Sprinklers supported from roof tanks to be placed on stage, dressing rooms, carpenter shop, paint room and property rooms.

Water casks and buckets shall be placed at suitable places on stage; also fire extinguishers.

HEATING PLANT

The boiler room shall be located outside of the building and enclosed with masonry walls, with fireproof ceilings, windows and doors.

LIGHTING

All parts of theatre shall be adequately lighted and remain so till the audience has left the premises. All lights in corridors, lobbies, or other parts of the building except the auditorium shall be controlled by switches located only in each of said corridors, etc.

MEANS OF EGRESS

1. EXITS TO STREETS. Every theatre accommodating 300 persons shall have at least two exits; when accommodating 500 persons, at least three exits shall be provided; these exits not referring to or including the exits to the open court at the side of the theatre. Every such building shall have at least one front on the street, and in such front there shall be suitable means of entrance and exit for the audience, not less than 25 ft. in width. The entrance of the main front of the building shall not be on a higher level from the sidewalk than four steps, unless approved by the superintendent of buildings. Each exit shall be at least 5 ft. in width in the clear, as hereinbefore prescribed in this chapter. All of said doors shall open outwardly and shall be fastened with movable bolts, the bolts to be kept drawn during performances.

2. EXITS TO COURTS. In addition to the aforesaid entrances and exits on the street, there shall be reserved for service in case of an emergency an open court or space in the rear and on the side not bordering on the street, where said building is located on a corner lot; and in the rear and on both sides of said building where there is but one frontage

on the street as hereinafter provided. The width of such open court or courts shall be not less than 10 ft. where the seating capacity is not over 1000 people; above 1000 and not more than 1800 people, 12 ft. in width, and above 1800 people, 14 ft. in width. Said open court or courts shall extend the full length and height of the building and across on each side and rear thereof where its side or sides does not abut on a street or alley, and shall be of the same width at all points, and exits hereafter specified shall lead into such open courts. From the auditorium opening into the said open courts or on the side street there shall be not less than two exits on each side in each tier from and including the parquet and each gallery. The said open courts and corridors shall not be used for storage purposes, or for any purposes whatsoever, except for exit and entrance from and to the auditorium and stage, and must be kept free and clear during performances.

3. DOORWAYS OF EXITS. Doorways of exit or entrance for the use of the public shall be not less than 5 ft. in width, and for every additional 100 persons or portions thereof to be accommodated in excess of 500, an aggregate of 20 in. additional exit width must be allowed. All doors of exit or entrance shall open outwardly and be hung to swing in such a manner as not to become an obstruction in a passage or corridor, and no such doors shall be closed and locked during any representation or when the building is open to the public.

4. FOYERS, LOBBIES AND CORRIDORS. The foyers, lobbies, corridors, passages and rooms for the use of the audience, not including aisles spaced between seats, shall on the first or main floor, where the seating capacity exceeds

500, be at least 16 ft. clear back of the last row of seats, and on each balcony or gallery at least 12 ft. clear of the last row of seats. The level of said corridors at the front entrance to the building shall be not greater than one step above the level of the sidewalk where they begin at the street entrance. During the performance the doors or gates in the corridors shall be kept open by proper fastenings; at other times they may be closed and fastened by movable bolts or blocks.

5. AISLES. All aisles on the respective floors of the auditorium shall be not less than 3 ft. wide where they begin, and shall be increased in width toward the exits in a ratio of 1½ in. to 5 running ft.

6. GRADIENTS. Gradients or inclined planes shall be employed instead of steps where possible to overcome slight differences of level in or between aisles, corridors and passages. To overcome any difference of level in and between courts, corridors, lobbies, passages and aisles on the ground floor, gradients shall be employed of not over 1 ft. in 12 ft., with no perpendicular rises.

7. GALLERY EXITS. Distinct and separate places of exit and entrance shall be provided for each gallery above the first. A common place of exit and entrance may serve for the main floor of the auditorium and the first gallery, provided its capacity be equal to the aggregate capacity of the outlets from the main floor and the said gallery. No passage leading to any stairway communicating with any entrance or exit shall be less than 4 ft. in width in any part thereof. From the auditorium opening into the said open courts or on the side street, there shall be not less than two exits on each side in each tier from and including the parquet and each and every gallery.

8. STAIRCASES TO GALLERIES. Where the seating capacity is for more than 1000 people, there shall be at least two independent staircases, with direct exterior outlets provided for each gallery in the auditorium where there are not more than two galleries, and the same shall be located on opposite side of said galleries. Where there are more than two galleries, one or more additional staircases shall be provided, the outlets from which shall communicate directly with the principal exit or other exterior outlets. All such staircases shall be of width proportionate to the seating capacity, as elsewhere herein prescribed.

Where the seating capacity is for 1000 people, or less, two direct lines of staircases only shall be required, located on opposite sides of the galleries, and in both cases shall extend from the sidewalk level to the upper gallery, with outlets from each gallery to each of said staircases. All inside stairways leading to the upper galleries of the auditorium shall be inclosed on both sides with walls of fireproof materials. Stairs leading to the first or lower gallery may be left open on one side, in which case they shall be constructed as herein provided for similar stairs leading from the entrance hall to the main floor of the auditorium. But in no case shall stairs leading to any gallery be left open on both sides. No doors shall be open immediately upon a flight of stairs, but a landing at least the width of the door shall be provided between such stairs and such door.

9. STAGE STAIRCASES. At least two independent staircases, with direct exterior outlets, shall also be provided for the service of the stage and shall be located on the opposite side of the same.

10. STAIRWAYS. All staircases for the use of the audience shall be inclosed with walls of brick or of fireproof materials approved by the superintendent of buildings, in the stories through which they pass, and the openings to said staircases from each tier shall be of the full width of said staircases. All stairs within the building shall be constructed of fireproof material throughout. Stairs from balconies and galleries shall not communicate with the basement or cellar. All stairs shall have treads of uniform width and risers of uniform height throughout in each flight. Stairways serving for the exit of fifty people shall be at least 4 ft. wide between railings or between walls, and for every additional fifty people to be accommodated 6 in. must be added to their width. The width of all stairs shall be measured in the clear between hand rails. In no case shall the risers of any stairs exceed 7½ in. in height, nor shall the treads, exclusive of nosings, be less than 10½ in. wide in straight stairs. No circular or winding stairs for the use of the public shall be permitted. When straight stairs return directly on themselves, a landing of the full width of both flights, without steps, shall be provided. The outer line of landings shall be curved to a radius of not less than 2 ft. to avoid square angles. Stairs turning at an angle shall have a proper landing without winders introduced at said turn. In stairs, when two wide flights connect with one main flight, no winders shall be introduced, and the width of the main flight shall be at least equal to the aggregate width of the side flights. All stairs shall have proper landings introduced at convenient distances.

11. STAIRWAY HAND RAILS. All inclosed staircases shall have on both sides strong hand rails firmly secured

to the wall about 3 in. distant therefrom and about 3 ft. above the stairs, but said hand rails shall not run on level platforms and landings where the same is more in length than the width of the stairs. All staircases 8 ft. and over in width shall be provided with a center hand rail of metal not less than 2 in. in diameter, placed at a height of about 3 ft. above the center of the treads, and supported on wrought metal or brass standard of sufficient strength, placed not nearer than 4 ft. nor more than 6 ft. apart and securely bolted to the treads or risers of stairs, or both, and at the head of each flight of stairs, on each landing, the post shall be at least 6 ft. in height, to which the rail shall be secured.

12. FIRE ESCAPES. There shall be balconies not less than 6 ft. in width in the said open courts at each level or tier above the parquet on each side of the auditorium, of sufficient length to embrace the two exits, and from said balconies there shall be staircases extending to the ground level, with a rise of not over 8½ in. to a step and not less than 9 in. tread exclusive of the nosing. The staircase from the upper balcony to the next below shall be not less than 48 in. in width clear, and from the first balcony to the ground 4 ft. in width in the clear where the seating capacity of the auditorium is for 1000 people or less, 4 ft. 6 in. in the clear where above 1000 and not more than 1800 people, and 5 ft. in the clear where above 1800 people and not more than 2500 people, and not over 5 ft. 6 in. in the clear where above 2500 people. All the before mentioned balconies and staircases shall be constructed of iron throughout, including the floors, and of ample strength to sustain the load to be carried by them, and they shall be covered with a metal hood or awning, to be constructed in such manner as shall be approved by the

superintendent of buildings. Where one side of the building borders on the street there shall be balconies and staircases of like capacity and kind, as before mentioned, carried to the ground.

13. DIAGRAM OF EXITS. A diagram or plan of each tier, gallery or floor, showing distinctly the exits therefrom, each occupying a space not less than 15 sq. in., shall be printed in black lines in a legible manner on the program of the performance. Every exit shall have over the same on the inside the word "Exit" painted in legible letters not less than 8 in. high.

PARTITIONS AND WALLS

The partitions in that portion of the building which contains the auditorium, the entrance and vestibule and every room and passage devoted to the use of the audience shall be constructed of fireproof materials including the furring of outside or other walls. The walls separating the actors' dressing rooms from the stage and the partitions dividing the dressing rooms, together with the partitions of every passageway from the same to the stage, and all other partitions on or about the stage shall be constructed of fireproof material approved by the superintendent of buildings. All doors in any of said partitions shall be fireproof.

PROSCENIUM CONSTRUCTION

A fire wall built of brick shall separate the auditorium from the stage. The same shall extend at least 4 ft. above the stage roof, or the auditorium roof if the latter be the higher, and shall be coped. Above the proscenium opening there shall be an iron girder of sufficient strength to safely support the load above, and the same shall be covered with fireproof materials to protect it from the heat. Should there be constructed an orchestra over the stage above the proscenium opening the said orchestra shall be placed on the auditorium side of the proscenium fire wall and shall be entered only from the auditorium side of said wall. The molded frame around the proscenium opening shall be formed entirely of fireproof materials; if metal be used, the metal shall be filled in solid with non-combustible material and securely anchored to the wall with iron. No doorway or opening through the proscenium wall from the auditorium shall be allowed above the level of the first floor, and such first floor openings shall have fireproof doors on each face of the wall, and the doors shall be hung so as to be opened from either side at all times.

PROTECTIVE CURTAIN

The proscenium opening shall be provided with a fireproof metal curtain or a curtain of asbestos or other fireproof material approved by the superintendent of buildings, sliding at each end within iron grooves securely fastened to the brick wall and extending into such grooves to a depth not less than 6 in. on each side of the opening. The proscenium curtains shall be placed at least 3 ft. distant from the footlights, at the nearest point. Said fireproof curtain shall be raised at the commencement of each performance and lowered at the close thereof and be operated by approved machinery for that purpose.

ROOF OF AUDITORIUM

The roof over the auditorium and the entire main floor of the auditorium and vestibule, also the entire floor of the second story of the front superstructure over the entrance, lobby and corridors, and all galleries and support for the same in the auditorium shall be constructed of iron and steel and fireproof materials, not excluding the use of wood floorboards and necessary sleepers to fasten the same to, but such sleepers shall not mean timbers of support, and the space between the sleepers, excepting a portion under the stepping in the galleries, which shall be properly fire stopped, shall be solidly filled with incombustible material up to underside of the floorboards.

SEATS

All seats in the auditorium excepting those contained in boxes shall be not less than 32 in. from back to back, measured in a horizontal direction and firmly secured to the floor. No seat in the auditorium shall have more than six seats intervening between it and an aisle on either side. No stool or seat shall be placed in any aisle. All platforms in galleries formed to receive the seats shall not be more than 21 in. in height of riser, nor less than 32 in. in width of platform.

STAGE

1. CONSTRUCTION. All that portion of the stage not comprised in the working of scenery, traps and other mechanical apparatus for the presentation of a scene, usually equal to the width of the proscenium opening, shall be built of iron or steel beams filled in between with fireproof material, and all girders for the support of said beams shall be of wrought iron or rolled steel. The fly galleries entire, including pin-rails, shall be constructed of iron or steel, and the floors of said galleries shall be composed of iron or steel beams filled with fireproof materials, and no wood boards or sleepers shall be used as covering over beams but the said floors shall be entirely fireproof. The rigging loft shall be fireproof.

2. SKYLIGHTS. There shall be provided over the stage metal skylights of a combined area of at least one-eighth the area of said stage, fitted up with sliding sash and glazed with double thick sheet glass not exceeding 1½ in. thick and each pane thereof measuring not less than 300

sq. in., and the whole of which skylight shall be so constructed as to open instantly on the cutting or burning of a hempen cord, which shall be arranged to hold said skylights closed or some other equally simple approved device for opening them may be provided. Immediately underneath the glass of said skylights there shall be wire netting, but wire glass shall not be used in lieu of this requirement.

3. SCENERY AND FITTINGS. All stage scenery, curtains and decorations made of combustible material, and all woodwork on or about the stage shall be painted or saturated with some non-combustible material or otherwise rendered safe against fire, and the finishing coats of paint applied to all woodwork through the entire building shall be of such kind as will resist fire to the satisfaction of the superintendent of buildings having jurisdiction.

MISCELLANEOUS REQUIREMENTS

1. CEILING. The ceilings under each gallery shall be entirely formed of fireproof materials. The ceiling of the auditorium shall be formed of fireproof materials.

2. CEILING COVERING. None of the walls or ceilings shall be covered with wood sheathing, canvas or any combustible material. But this shall not exclude the use of wood wainscoting to a height not to exceed 6 ft., which shall be filled in solid between the wainscoting and the wall with fireproof materials.

3. FRONTS OF GALLERIES. The fronts of each gallery shall be formed of fireproof materials, except the capping, which may be made of wood.

4. LATHING. All lathing, whenever used, shall be of wire or other metal.

5. SHELVING AND CUPBOARDS. All shelves and cupboards in each and every dressing room, property room or other storage rooms shall be constructed of metal, slate or some fireproof material.

STORAGE ROOMS; WORKSHOPS

No workshop, storage or general property room shall be allowed above the auditorium or stage or under the same or in any of the fly galleries. All of said rooms or shops may be located in the rear or at the side of the stage, but in such cases they shall be separated from the stage by a brick wall and the openings leading into said portions shall have fireproof doors on each side of the openings hung to iron eyes built into the wall.

USE AND OCCUPANCY

1. RESTRICTIONS. No portion of any building hereafter erected, used or intended to be used for theatrical or other purposes, as in this section specified, shall be occupied or used as a hotel, boarding, lodging house, factory, workshop or manufactory, or for storage purposes, except as may be hereafter specially provided for. This restriction relates not only to that portion of the building which contains the auditorium and the stage, but applies also to the entire structure in conjunction therewith. No store or room contained in the building or the offices, store or apartment

adjoining, as aforesaid, shall be let or used for carrying on any business, dealing in articles designated as specially hazardous in the classification of the New York Board of Fire Underwriters, or for manufacturing purposes. No lodging accommodations shall be allowed in any part of the building communicating with the auditorium. When located on a corner lot the portion of the premises bordering on the side street and not required for the uses of the theatre may, if such portions be not more than 25 ft. in width, be used for offices, stores or apartments, provided the walls separating this portion from the theatre proper are carried up solidly to and through the roof, and that a fireproof exit is provided for the theatre on each tier, communicating with balconies and staircases leading to the street in manner provided elsewhere in this section; said exit passages shall be entirely cut off by brick walls from said offices, stores or apartments, and the floors and ceilings in each tier shall be fireproof.

2. ABOVE THEATRE. Nothing herein contained shall prevent a roof garden, art gallery or rooms for similar purposes being placed above a theatre or public building, provided the floor of the same, forming the roof over such theatre or building, shall be constructed of iron or steel and fireproof materials, and that said floor shall have no covering boards or sleepers of wood, but shall be of tile or cement. Every roof over said garden or rooms shall have all supports and rafters of iron or steel and be covered with glass or fireproof materials, or both, but no such roof garden, art gallery or room for any public purposes shall be placed over or above that portion of any theatre or other building which is used as a stage.