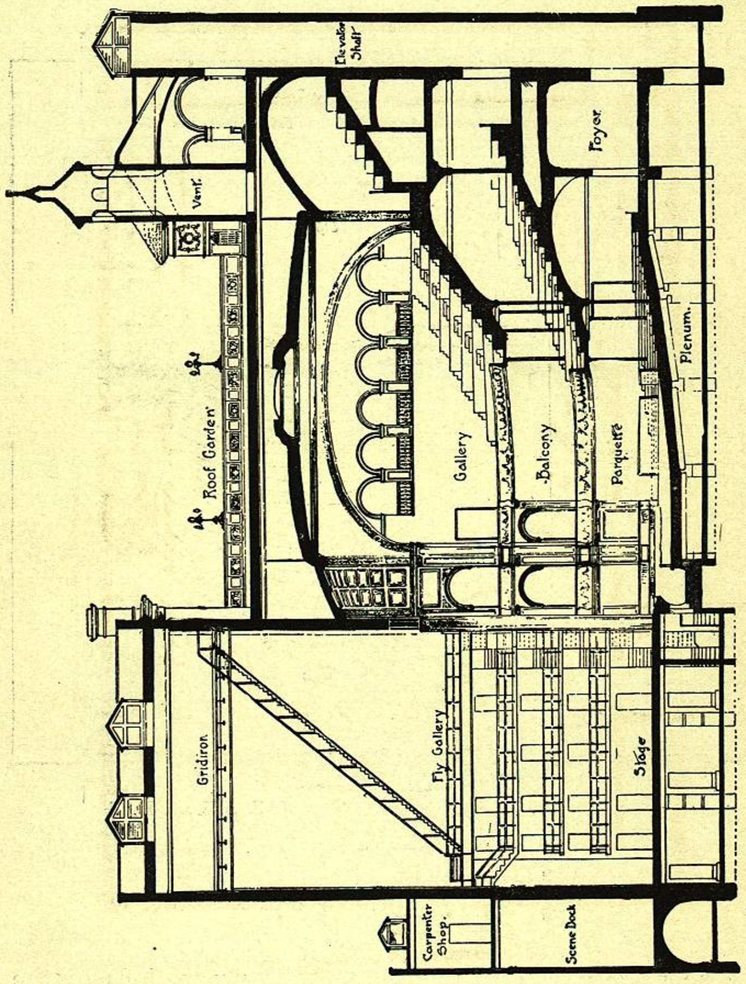
There are seven small dressing-rooms, fitted up with toilets and every convenience, opening upon the stage level, two of which are for star actors.



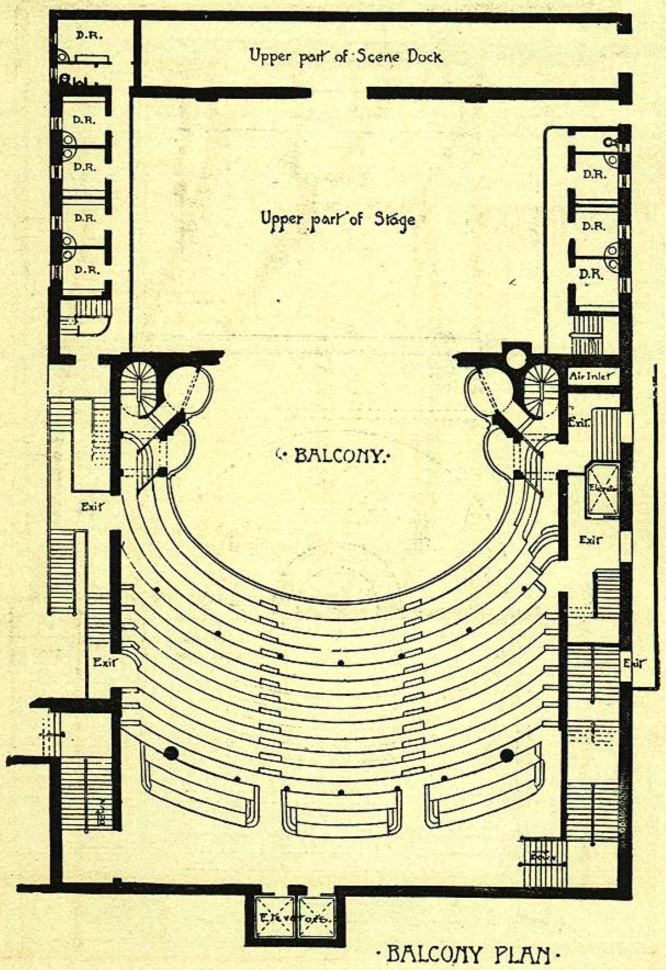
LONGITUDINAL SECTION.

Directly back of the stage is placed the scene-dock, 11 feet 4 inches wide by 25 feet 8 inches clear height, for the storage of scenery used in large spectacular plays.

Under the entire stage and not shown in any of the

illustrations are spacious rooms used for various purposes, such as bill-rooms, toilets for stage hands, orchestra, etc.

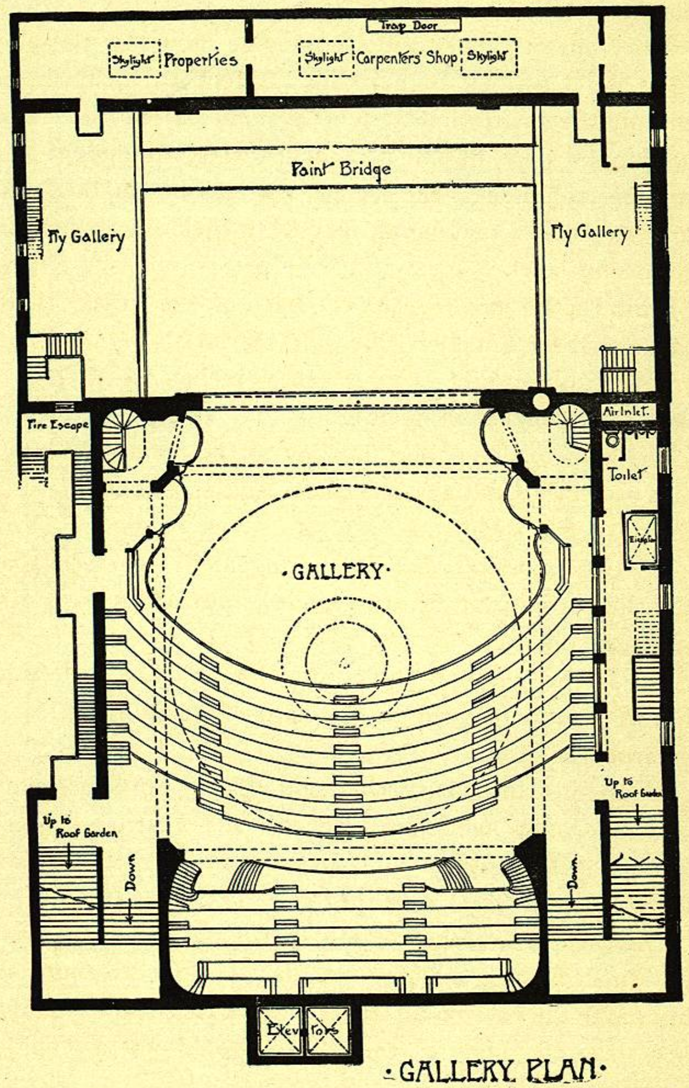
The balcony, being directly over the parquette circle, is



·BALCONY PLAN·

somewhat similar in plan, with the exception that the four rear rows of seats are raised above the balcony-level.

The four emergency exits shown upon the plan lead to the outside fire-escapes. All the dressing-rooms above the stage-level, some of which are also shown in the plan, are reached by iron and slate stairways.



· GALLERY PLAN ·

The height of the balcony is 21 feet from the foyer floor-level, being 9 feet $1\frac{1}{2}$ inches to the first stepping; eleven steppings take up the remaining height of 10 feet $10\frac{1}{2}$ inches.

The first fly-gallery is 8 feet 9 inches from the stage, the second 7 feet 9 inches, and the third 7 feet 9 inches from the second.

The front of gallery and stepping as shown by the plan of gallery are described by a radius 38 feet 10 inches from a point on the centre-line 5 feet 4 inches from the curtain. The steppings are all 2 feet 6 inches wide, the height of the first being $17\frac{1}{4}$ inches, the second $18\frac{1}{4}$, the last at the gallery-level, $20\frac{1}{4}$ inches, making 14 feet $6\frac{3}{8}$ inches, or 16 feet from the balcony-level.

From the 16-foot level at the back of the gallery there is a passage 6 feet 4 inches wide, and placed above this passage there are six rows of seats 2 feet 6 inches wide, from $18\frac{7}{8}$ inches to $20\frac{7}{8}$ inches in height.

The halls of this gallery leading to the main stairways are 8 feet 6 inches wide, and the doors leading to the fire-escape stairs are 6 feet wide.

It is also possible, by the arrangement of steppings, to reach the lower floor by the circular stairs at the rear of the six boxes.

The stage side of the auditorium at the gallery-level contains the paint-bridge, the two large fly-galleries, and the carpenter-shop.

All the heating, ventilating, and lighting appliances known to the mechanics' world are placed in this theatre. In designing the ventilating plant no expense was spared to make the system a perfect one.

The theatre is heated mainly by the indirect system, while a few direct-heating radiators are placed in the dressing-rooms, lobby, and the rear of the stage, where the heated air that is blown into the body of the theatre would not be liable to penetrate.

There are about 1400 square feet of heating surface of direct radiators in the building, and about 2500 square feet of heating surface in especially designed coils for the heating-chamber in the basement. About 2,000,000 cubic feet of air per hour is drawn from the heating-chamber by the fan and forced into the theatre, thus giving about 660 cubic feet per person per hour, assuming the theatre to hold 3000 persons.

The fresh air for the indirect system enters by a loggia or open gallery near the roof, and descends to the heating-chamber in the basement by means of an $8\frac{1}{2}' \times 3'$ duct. An iron damper, placed in the duct and controlled from the heating-chamber, prevents an upward current when the fan is at rest.

The air enters at one end of the chamber near the floor, and, rising, passes between the inclined coils to the fan.

There is, however, an unobstructed passage at one side of the coils, which allows the greater part of the air to pass directly to the fan. This passage can be closed by a switch-valve or door swinging on a vertical axis, and by the partial opening or closing of this door the temperature of the air entering the theatre can be regulated.

The coils also being in separate sections, each controlled by a valve, allows the operator to use any number at a given time. An opening through the wall of the coil-chamber allows the passage of air to the plenum-chamber.

A cone-wheel fan 8 feet in diameter is placed opposite the opening above mentioned, the shaft carrying the fan being supported by a pillow-and-spider bearing, the fan being driven by a belt from a $9'' \times 10''$ engine.

The plenum-chamber, as shown on the section, occupies all the space in the basement under the auditorium, the air being delivered to the parquette and circle by means of 341 openings under the seats, the same method being used for the balcony. These openings are approximately under every seat in the lower floor and every third seat in the balcony, a

hood being placed over each opening to diffuse the air for the comfort of the occupant, each opening having a sectional area of seven square inches. The air is carried to the balcony from the plenum-chamber by vertical ducts built in the walls of the auditorium, the largest of which has a sectional area of 16 square feet, and also supply fresh air to the main halls. Radiators, or what may be termed secondary coils, are placed in branch ducts to increase the temperature of the air supplied to the halls.

The foul air is taken from under the galleries by horizontal ducts leading to vertical ones, and finally combine and form one circular flue 30 inches in diameter.

The greatest volume of foul air from the auditorium ceiling-bell is carried by a horizontal duct leading to a vertical flue having a sectional area of 24 square feet, supplied with damper and controlled by the engineer.

HEATING AND VENTILATION.

Heating and ventilation are branches of science which have received thus far a general acknowledgment, embodying principles of the greatest importance.

The ordinary comprehension of ventilation as applied to theatres is the introduction of fresh air and the simultaneous removal of vitiated air. Air when once passed through the human system is unfit for reinspiration, that portion which is emitted being not only useless, but deleterious to health. On this account it becomes necessary to remove this vitiated air and to substitute fresh air, which should be at a temperature of 60° to 65°. The vitiated air on being exhaled has a temperature between 80° and 90°, and, being thereby rarefied and rendered lighter, has a tendency to rise.

The fact is, of course, a constant continuous mingling of the vitiated and the fresh air, depending somewhat on their relative temperatures and densities, but mainly on the absolute motion of the air in the room. A process of dilution of the vitiated air exhaled by man and the air in the room is constantly going on, and the fresh-air supply must be adequate to keep the air breathed by the inmates at a proper standard of purity.

We have no mode of measuring the mixed quantities of impurities in the air with precision. To come to any near approximation we must first calculate the amount of carbonic acid contained in the air, and allow that the *quantum* of the organic impurities are proportional to it.

We are informed by the best hygienists that a room to be properly ventilated should not exceed by volume 6 to 8 parts of carbonic acid in the air. When the proportion rises above six—possibly eight—the disagreeable odor experienced by every one who, coming from the fresh external atmosphere, enters a crowded and inadequately ventilated room becomes perceptible.

We are also informed that although, in poorly ventilated quarters the proportion rises as high as 80 parts in 10,000, no room is properly ventilated in which the proportion is higher than 6 in 10,000, or sometimes 8.

Mr. A. R. Wolff, M.E., states in his treatise on ventilation that an ordinary man exhales .6 of a cubic foot of carbonic acid per hour. New York gas gives out 0.75 of a cubic foot of carbonic acid for each cubic foot of gas burnt, or for a $4\frac{1}{2}$-foot burner $3\frac{3}{8}$ cubic feet per hour. An ordinary lamp gives out 1 cubic foot per hour. An ordinary candle gives 0.3 cubic foot per hour. To express it mathematically, one ordinary gaslight equals in vitiating effect about $5\frac{1}{2}$ men, an ordinary lamp $1\frac{2}{3}$ men, and an ordinary candle man.

To appreciate the importance of this it is but necessary to recognize that an air-supply ample for six men when there is no lighting, would be sufficient for one man when the room is lit by a single gas-burner.

And furthermore, the value of an incandescent electric light as an illuminant, in which no vitiation of the atmosphere is caused, is at once evident.

Pure country air contains about 4 parts of carbonic acid in 10,000. Hygienists calculate that 3000 cubic feet of fresh air should be supplied by systematic ventilation per hour to each person. In theatres and large auditoriums, in which the cubic space per individual is great, this may be considerably reduced.

Pure air penetrates in many ways. Windows, doors, and even brick walls, all permit the entrance of the external air, and thus without a systematic air-supply a large amount of external air enters to purify the air in the room.

In theatres where the air enters through the steppings of the galleries and auditorium, and where it can be made to enter through apertures in the decoration, it is a comparatively simple matter to supply from one to two thousand feet per hour to each person at a low velocity, the quantity of fresh air supplied being conditioned on the removal of the same amount of air from the building.

The most active circulation and removal of air by vent-ducts are produced by exhaust fans and blowers. Indeed, for theatres especially, reliance should be placed either on bringing in the fresh-air supply under pressure by means of blowers, or by attaching exhaust fans to the vent-ducts to create a current within them, or a combination of both systems may be arranged.

The ordinary ratings of blowers supplied by the trade range from wheels 4 feet in diameter, with 350 revolutions per minute, and 10,635 cubic feet per minute, to wheels 15 feet in diameter, with 100 revolutions and 160,000 cubic feet per minute.