inforced Water Tower at Mildura," and "A Reinforced Concrete Bridge," respectively.

Mr. J. A. Smith moved a hearty vote of thanks to the President for his papers.

Mr. F. W. Clements seconded the motion, which was carried by acclamation. A number of questions were propounded, and a brief discussion ensued and terminated.

The President in closing the session said the Institute year had been quite worthy of its predecessors. He wished members the "Compliments of the Season."

Mr. J. A. Smith reciprocated on behalf of members.

The meeting terminated at 10 p.m., and the session closed.

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NOTES ON A NEW LECTURE THEATRE.

By Professor Henry Payne.

Lecture theatres are, or should be, as the name indicates, places for lecturing, demonstrating, hearing, and seeing, and must be arranged for both lecturer and audience.

It may be as well at the commencement to state that the underlying thought of the designer of a lecture theatre should be that the undivided attention of both lecturer and audience can be concentrated upon the subject of the lecture without anything in the design distracting attention therefrom.

It will, therefore, be obvious that ornamentation—if adopted—should be unobtrusive, and in general it is best not to attempt any other style than a severely plain one.

In the new lecture theatre, a sectional elevation of which accompanies this paper, the author has endeavoured to follow the dictum here laid down, and believes that attention to detail alone can bring about the desired result.

Small lecture theatres for an audience of, say, 100 persons—such as the theatre to be described—can best be arranged for entrance at the floor of the theatre through two pairs of large swing doors; but for large theatres entrance should also be provided to the tiers of seats from the top or back, and this can readily be arranged for in conjunction
with the rest of the building, due to such entrances then being on the next ordinary floor-level to that of the floor of the theatre.

The seats are arranged in six rows, every seat facing the lecture bench, and they are divided into three groups, with two passages radiating from the lecture table so as to allow for easy approach to every row. The tiers on which the seats are placed are seen in the section; but the intermediate steps in the two passages and the seats for the audience have been omitted from the section for the sake of clearness. The space below this gallery has been utilised as a store room, with access from a side passage.

Lighting has been considered both for day and night use.

The lighting for the day comes from a clerestory, with a nearly south aspect, and the position of these windows is arranged so that the lecturer whilst facing them is not in any way inconvenienced. If the windows had been placed immediately in the back wall of the theatre, the light would have been disconcerting to the lecturer, and he would then have had difficulty in seeing the back rows of his audience. The bringing forward of the window as a clerestory accentuated the necessity for providing for the adequate lighting of the back of the lecture theatre, and this has been accomplished by the introduction of a partially curved ceiling. The curve in this instance has been designed so that a vertical section of it is a parabola. The size and shape of the curve were chosen so that the reflected ray of light from the clerestory to the back row had approximately the same length as the direct ray to the blackboard behind the lecture table. The effect produced is that of a soft and evenly diffused light throughout the theatre, for even on a dull day the light in the back rows is almost as good as that in the front rows, and one is able to write there with comfort.

To provide for this special ceiling, the roof of the building—the lines of which are shown dotted in the section—had to be modified and constructed so as to carry the wooden parabolic formers to which expanded metal was attached, and which in turn carries the plaster ceiling with a good white surface. The girders of the steel work are shown in the figure, and in order to prevent the slightly sloped roof above the clerestory from lifting under the action of the wind, it has been tied down to
the main steel joists by long bar-bolts between the windows. These bolts are not shown in the drawing, and are not visible in the theatre due to their having been cased-in.

The steel joists are enclosed with wood casing, and all the woodwork in the theatre has been painted a uniform dark chestnut brown, except the side panelling and the galleries, which are of a light leather colour to tone with the chestnut brown.

The clerestory windows do not open, thus permitting of ordinary spring roller blinds being used for darkening the theatre for lantern work.

Artificial light is provided from electric accumulators. Two pendants of 100 C.P. each are placed just in front of the lecture table and blackboard, at such a height as not to inconvenience the lecturer. These lamps are shaded with hemispherical globes, the insides of these globes are white and somewhat reflecting, whilst the backs are of dark green, thus protecting the audience. Three 50 C.P. lamps suspended from curved brackets light the galleries.

Ventilation is natural. It is effected by introducing air through the rectangular airduct placed under the top row of seats, and air is sprayed into the room at the points shown above the panelling, four on each side of the theatre. The air is drawn from outside the building through an opening in the window, adjoining the air-duct, and the vitiated air passes out from three openings in the curved roof.

The acoustics appear to be good, as the voice can be used without effort and as no echo is present. This result is—in a measure—due to the special ceiling formation.

The seats for the audience will consist of chairs fixed to the galleries, the seat and back of chair being shaped for comfort when the individual is sitting back. Each chair will be provided with arm rests, the right hand arm will also carry an extension in the form of a nearly horizontal book rest, so as to allow of notes being taken by the individual whilst seated back in the chair, in a comfortable posture. This method of seating in lecture theatres appears to have originated in the United States, and has the advantage that the audience are not continually raising and lowering their heads whilst note-taking during the lecture, and the consequent physical conditions are improved over the leaning-forward method of taking notes.
FIG. 11.
BLACK BOARDS, LECTURE HALL, MELBOURNE UNIVERSITY.
NOTES ON A NEW LECTURE THEATRE.

All the seats are arranged so that every individual can see experiments carried out on the lecture table, and to further aid the sight the seats are staggered instead of being placed one immediately behind the other.

The lecture table will be fitted with water and a sink, with direct and alternating current, and with gas. The table will also be provided with cupboard and drawers.

The blackboards are as shown on the accompanying two photographs. The fixed blackboard is a sheet of plate-glass with ground surface. The running blackboard is of hyloplate, and is balanced by a lead weight working in a casing in one corner of the lecture theatre. The lead weight is attached to two eyes, one fixed and the other adjustable. Any tension in the two suspension cords can be readily balanced by the adjustable eye, which is in the form of a long bolt passing through the weight and fixed by nuts.

A chalk trough may be seen below the fixed blackboard.

The top of both fixed and running boards is grooved to carry the universal drafting machine adapted for blackboard use. This drafting machine runs on a pair of wheels and the parallelly arranged arms are partially controlled with springs as seen in the photograph.

As the blackboards are high it is necessary to provide a stand for the lecturer when writing on the top part of the fixed board; this has been accomplished by a folding down stand, shown folded down in one photograph and in use in the other. The hinged supports act together by the aid of a connecting bar; spiral springs keep the supports in the out-position.

Above and on each side of the fixed blackboard the white plaster wall forms an excellent background for the projection of lantern views. Diagrams can also be exposed here on the usual lath and tape suspension device.

No special provision has been made for heating this theatre, or for the matter of that for any of the recent extensions to the Engineering School, as the number of days on which heating is required is small, but it may yet be found necessary to attend to this matter.

In conclusion, the author hopes that this theatre will be fully equipped early next year, and that these notes may prove useful to any who may be called upon to design similar work.
In connection with the paper on the Lecture Theatre, he would like to ask Prof. Payne one question: Why was the reflecting surface formed by the ceiling parabolic, and why concave?

Mr. J. T. N. Anderson said he had noticed in architectural work there was great diversity in the size and number of ventilators. He would like to know if Prof. Payne had made investigations as to the volume of air passing through the ventilators. Everyone familiar with architectural work would know the provision different architects made in that direction varied sometimes to the extent of four times as much in one case as in another, and both were regarded as equally good practice. Was there at the University School of Engineering apparatus to find out on different days what approximately was the traffic of air through the ventilators, and what was the actual requirement? He would like to know if Prof. Payne had any data on the matter.

Mr. C. P. Smart asked if any provision was made for sound-proofing the floor below the theatre.

Prof. Payne said the floor was of reinforced concrete.

Mr. F. W. Clements said if a number of lamps were placed along the bottom edge of the window they would provide a very good method of lighting the whole place by indirect lighting, and give a very soft and diffused effect.

The President said on the question of acoustics he could compliment Prof. Payne upon having escaped the errors that occurred in so many instances. A striking local instance was the Dental Hospital. That was said to be hygienic in the highest degree. There were no square corners in any part of the building. But when it was completed, and they tried to speak, it was full of echoes, and acted as one huge sounding-board. It had to be reconstructed, and the sanitary conditions suffered to some extent. He had had the privilege of inspecting Prof. Payne's theatre, and it would pay anyone to make a visit to the University, and see the way in which the whole theatre was equipped.

Prof. Payne, in replying said, in respect to Mr. J. A. Smith's question, the curve towards the audience was essential to diffuse the light to the back, which would naturally be in the dark. The reason for the parabola was that it looked well, and he had taken a fancy to the curve.
With reference to the ventilation referred to by Mr. Anderson, he had not experimented in the matter. The only experiment he had in connection with the theatre was that he had the honour of addressing the Institute of Electrical Engineers in the theatre one night, and instead of the audience being 100, they had something more than 150 present, and he was credibly informed by those who were present that no stuffiness was felt during the 1 ½ hours he kept the audience there. He could not say that it would act in every case. It was natural ventilation. It might be necessary to place a fan there later on, but these were things that could be done afterwards. However, he did not think it would be necessary. As to research on ventilation, he presumed Mr. Anderson was well aware of the classic work by Hallden, of Oxford.

In relation to sound-proofing, the whole of the new portion had been built with a view of securing sound-proofness, and therefore they had reinforced concrete floors, and above these ordinary wooden floors. They had no hollow walls, which accounted for some of the loss of sound-proofness in buildings. They were put in to obtain sound-proofness in the Conservatorium of Music, but they accounted for the loss of sound-proofness.

With reference to indirect lighting referred to by Mr. Clements, it had occurred to him to include a row of lamps for indirect lighting, and it was quite possible that at some future date his arrangements might be modified for that purpose, but in any case he could retain the two comparatively close to the blackboard, and guarded from the audience.

In the matter of acoustics there had been no care taken to remove sharp corners. In fact, they had been left, and it was an interesting thing that in a lecture theatre of Prof. Osborne's, which was practically a square box, the acoustics were bad, because of the echo. And in order to kill that, in his case he had to hang curtains along the back wall. But naturally when they did that they introduced a place for holding dust.
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