

To give the best results a room should be so designed that the speaker's voice may go to each person in the audience in a straight line. Sound travels around obstructions to a certain extent, but loudness is very much impaired if the sound is required to turn through large angles. In general, a listener understands with difficulty a speaker whose mouth he is unable to see. The application of this principle to the chamber will be discussed elsewhere.

The Committee has asked my opinion of the effect on the acoustic properties of a room of wires stretched across it. Although I know that they are used extensively, I have never observed any uniformity in the method of wiring. Inquiries about the effect, beneficial or otherwise, are answered quite inconsistently by speakers and listeners. No accurate measurements of their effects have been made, to my knowledge. I can see no reason for expecting wires to alter the sound, and it is my definite opinion that they have no effect whatever. If it please the Committee I shall be pleased to make an experiment with wires.

Criticism of the Acoustics of the Chamber.

1. Considered from the standpoint of acoustics the design of the galleries is not the best. The height of the galleries above the floor of the House, the way in which they project over the body of the space below, and the height of the woodwork in front of them contribute to make it impossible for people in the galleries to see all of the members. From certain positions the voices of the members can reach the gallery directly only by turning through nearly a right angle. The Speaker's Chair and the Press Gallery are in this relation. It follows, therefore, that in such cases distinct hearing is possible only with the assistance of the echo. Persons sitting in the corners adjacent to the Press Galleries are at a great disadvantage.

2. Although it is not difficult to design a large auditorium with good hearing-qualities, it should be remembered that the qualities will not be good if one speaks from parts of the room other than the stage. In the chamber members speak from all positions. It may safely be said that the size of the chamber is sufficiently great, considering the method of use, to present a difficult acoustic problem to the architect.

3. The mean reverberation-time of the chamber as used during the last session, but without a curtain in the gallery, is 1.96 seconds. It is greater for high pitches than for low ones, the average difference over five octaves being 0.10 seconds. Both of these times are excessive. Interference gives considerable trouble.

Suggestions for Improving the Acoustics.

As a result of experiments in the chamber, including over five thousand determinations of the time of reverberation under various conditions, I am able to make suggestions for improving the acoustic properties of the chamber as follows:—

Absorbing-materials equivalent to 300 square yards of hair-felt $\frac{1}{2}$ in. thick should be introduced. This may be done in various ways:—

- (1.) Very much better seats in the gallery, provided with hair cushions, and well upholstered on back and arms with thick, well-padded material, are desirable. Absorption provided in this way will be about the same whether a large or small audience is present. Each seat of this kind may be considered equivalent to one-fourth of the square yard of $\frac{1}{2}$ in. felt.
- (2.) Heavy carpets may be used, carpet being considered equivalent to its weight of $\frac{1}{2}$ in. felt.
- (3.) Felt may be used on the walls and ceilings of the galleries. It may be covered with tightly stretched cloth, which need not touch the felt, presenting a pleasing appearance, and the cloth may be filled with calamine or a similar substance if desired. Asbestos paper, or a combination of paper and cloth, may be used as a covering. If very thick felt is used its equivalent in $\frac{1}{2}$ in. felt may be estimated by reference to the following table:—

Thickness.					Relative Absorption Co-efficient.
$\frac{1}{2}$ in.	...	...	...	...	1
1 in.	...	...	...	...	1.8
$1\frac{1}{2}$ in.	...	...	...	...	2.4
2 in.	...	...	...	...	2.8

No one of these suggested methods should be considered sufficient. The correctness should be distributed. Carpets should be placed on the floor of the chamber, on the gallery passages, and over the entire floor of the Press Gallery. At least one-third of the correction should be made on the walls and ceiling of the galleries. It can be put conveniently into the panels of these places, which have an area of about 130 square yards.

In addition to these general suggestions the following specific ones are submitted:—

1. In order to exclude noise from the corridors very heavy curtains should be placed around entrance-doors, and the spaces thus enclosed should be covered at the top with heavy material. The short passage leading to the Public Gallery should be deadened with felt.

2. No great benefit would result, in my opinion, from costly alterations necessary to exclude the gallery-corners near the Press Gallery. The seats in them will probably continue to be undesirable, but if special attention is given to deadening the walls, ceiling, and floor in these corners they will have no undesirable effect upon the rest of the room.

It may be well to mention in this connection that curtains such as were used during the last session in the galleries do not acoustically cut off the space behind them; that they have no more effect upon sound than they would have if placed against the walls; and that about 8 square yards