degree. What is not appreciated, is the fault of placing the sound-proofing material directly onto a non-absorbing base, – as fabric on a wall or as a carpet covering on the floor. The long wave parts in the tone mixture, be it music, speech or song, are filtered out by the reflection, because the deep notes behave as if only the base stands in their way, but the short wave upper registers are absorbed, each according to the thickness of the porous covering.

The different constructional materials cannot thus be easily divided into two groups, the one reflecting the sound, the other absorbing, but rather the reflection and absorption are frequency dependent occurrences, whereby certainly the porous solid bodies with increasing frequency always absorb greater percentages of the impinging energy. Thus faced masonry or a porous thin roughcast hardly absorbs 1% in the bass notes, but at about 3,000 Hz three to four times the amount. We also call it a non absorbing reflective surface. If such a wall is covered with a fabric without an air-space between, or if a heavy stage floor is covered with a thin velour carpet, then in the bass notes the reflection remains almost unchanged; the absorption can already, at 1,000 Hz achieve the ten-fold, and in the upper range 20 to 30-fold. Tapestries in many theatres have been torn out for some years now following reconstruction, because muscially the muffled tone without bounce was irritating, as speech audibility was made more difficult.

On the stage, the floor strip crosswise in front of the apron always forms the most effective reflector for stage voices – comparable with the sounding board above the preacher –, there, even a thin and narrow carpet runner is acoustically damaging.

The fact that the surface material reflects the top notes better than the low notes, is exceptional in architectural acoustics but not so for large pieces in scenery construction. That a framework covered with sack-cloth or linen is sufficiently reflective for the medium and short wave sound, just with a covering non-porous paint bond, has already been mentioned above. This also applies for the full cyclorama surrounded with very dense cloth material, which is indeed penetrated by the bass notes but which, however reflects a significant part of the high notes.

The fact that hard foam in the form of sheet or solid blocks works equally well for stage acoustics, is one of the reasons why this new material has been accepted for use so quickly and with so little resistance. Hard foam is super-light and comprises more than 90% air, which in real form is enclosed, i.e. polystyrene material seals off the air in enclosed bubbles. Short wave sound transmitted through air hardly penetrates, and can be well reflected with the use of as thick as possible a coating of lime and gypsum additive.

Thin chip-board and plywood sheets, for preference less than 12 mm thick have similar favourable acoustic qualities. This can mostly be explained in analogy with experience in instrument construction with it's capacity for resonance. Above 400 Hz even these characteristics are mostly lost by resonators; everyone at some time has been able to feel the resonance of thin plates, even of heavy window panes, by lightly touching them with the fingers. It is of no importance for the stage technician to appreciate whether the absorption of the bass notes can be explained by resonance or by the penetration of energy. It is, however, a widely held view, that resonance can strengthen stage voices; resonance uses energy and ends immediately following excitation by air sound. Only by mechanical release, – which is very high in energy, – can a resonator cause reflection of sound transmitted by air, as for example, in many theatres, a shot on the stage causes the iron curtain to vibrate for several seconds, the explosion wave having hit the sheeting.

Table of Constructional Materials usually found on the Stage
Assessed according to their acoustic behaviour – more or less reflective or absorbent.

a) reflects all frequencies 0 weak ● stronger ●● almost 100%
b) reflective, however absorbent in part in the low notes
c) absorbent, however – low notes little, towards the high notes, increases significantly
d) absorbs all frequencies 0 weak ● up to 60% ●● up to about 90%

	a)	b)	c)	d)
A Floor Constructional material or fittings				
1. Wooden planking, more than 25 mm thick	●●			
2. Plastic, linoleum or film coverings	●●			
3. Dancing carpets, sprung, but with closed smooth surface	●	0		
4. Coverings of thin textiles, linen, sack-cloth or similar firmly attached	0		0	
5. As 4, however, painted or filled in – pores closed	●			
6. Carpets, woven or knotted thickness 4 to 8 mm			●	0
7. Grass carpets			●●	
B Vertical walls, tables, – Practicalities and Limitations of the Playing Area				
1. Cyclorama – Plaster of Paris cylinder (rarely used now)	●●			
2. Cyclorama of dense textile – hanging unruffled		0		
3. The same, of film or textile with latex on the reverse side	●	0		
4. Drops, transparent, single with few folds		0		●
5. The same, but multiple or with deep folds		0		●●
6. Curtains in scenery, drapery – panoramic curtains few folds		0		0
7. The same, however with folds (for 6 and 7, mostly velour)				●●
8. Drops in the pros. opening, covering the stage, sound transit slightly obstructed			0	
9. Walls and set pieces of plywood or chipboard	●	●●		
10. The same – light construction (frame with painted canvas)	0	0		0
11. The same completely filled in and painted	0	●		
12. Hard foam for walls, architectural parts, rocks etc	0	0		
13. The same, filled in and painted	●	0		
14. Mirror and glass surfaces for windows, also plexiglass		●		
15. Foil mirrors		0		
16. Metal surfaces, usually mostly of sheeting		●		
C Upper area of the stage with grid				
1. Disturbing sound only, where the features are not hung	●			
2. Customary heavily hung features		0		●
3. Vertical borders, acoustically of little use, even when they reflect		0		0
4. Horizontal or slightly tilted ceiling, as B9 or 10	●●			
5. Textile awning		0		0
6. The same, in film, possibly thicker than 1 mm	●	0		0