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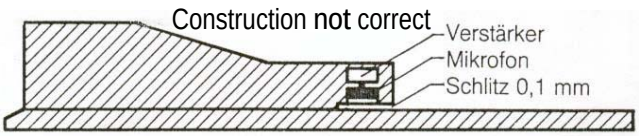
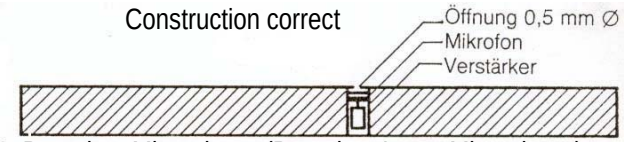
Two different boundary microphone types

German version: "Zwei verschiedene Grenzflächenmikrofon-Bauarten"

There are microphones on the market, that can be summarized under the term boundary microphones. Different names, such as boundary layers, barrier layers or pressure zone are used for this, but only the first microphone series produced on the market lead to the trademark name PZM ® as "Pressure Zone Microphone".



Pressure Zone Microphone PZM = registered trademark of the company Crown Audio, Inc. This was patented.

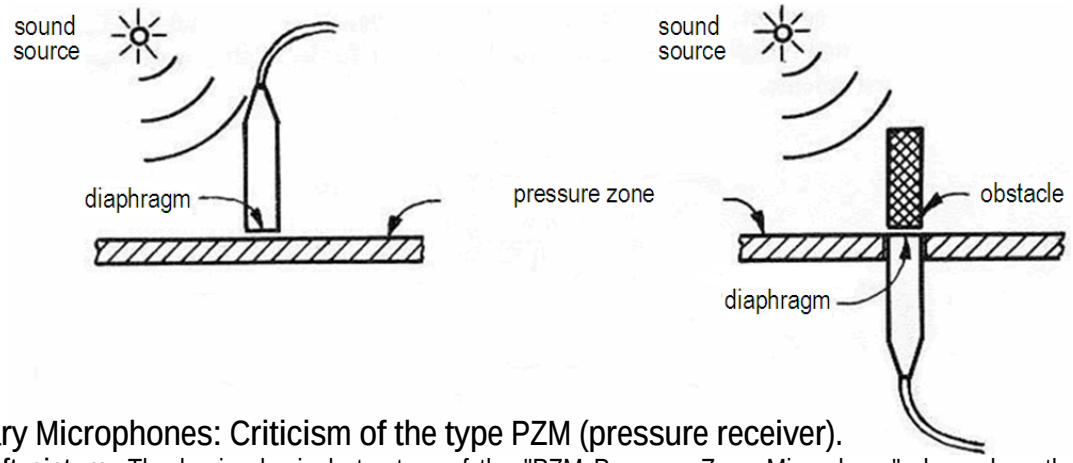


Boundary Microphone (Boundary Layer Microphone) No patent protection - That means it is free.

The shortcomings of the microphone type "PZM" were revealed in AES preprint 1796 (F-5), May 1981: "The Acoustical Behavior of Pressure-Responding Microphones Positioned on Rigid Boundaries - a Review and Critique" of Lipshitz and Vanderkooy, University of Waterloo / Ontario (Canada). There follows a brief extract the most important items of this article:

The sound at the Crown PZM type (left) cannot reach the vibrating diaphragm directly because it is directed to the sound-reflecting boundary. The microphone is located there in its own sound path. The justification for this developer's assumption is that a normally front-facing membrane of the microphone principal axis in the free field results in an increase in the high frequencies, that is eliminated by covering. It is proven that this assumption is incorrect, and that the frequency response and polar pattern are strongly negatively affected by covering the vibrating microphone diaphragm.

Boundary Microphones: Criticism of the type PZM (pressure receiver).



Boundary Microphones: Criticism of the type PZM (pressure receiver).

To the left picture: The basic physical structure of the "PZM Pressure Zone Microphone" shows how the vibrating diaphragm focuses on the boundary.

To the right picture: The acoustic equivalent of a state aligned with the boundary of the microphone, but with an obstacle in front of the vibrating diaphragm, that hinders the direct sound path.

A large and non-absorptive boundary shows for the coherent addition of the reflected signal and the direct signal close to the boundary of a doubling of the sound pressure. This results in a peak gain of 6 dB and is true only if the surface - to which the microphone is attached - is large compared to the acoustic wavelength. At lower frequencies, the hemispherical polar pattern turns into a sphere pattern, that leads to a loss of the pressure build-up and shows a 6 dB socket below the crossover frequency. In addition, insufficient hardness of the boundary and its finite size effects are not negligible.

The idea to attach microphones to a boundary was investigated because comb filter-like deletions are prevented from occurring between the direct and the reflected sound wave from a hard surface. The obvious and patent-free solution is to have a complete pressure transducer flush with the effective boundary. For stereo recordings such boundary microphones are only usable in an AB set-up. This naturally leads to the well-known reduction of the localization sharpness, phase problems and its incompatibility to mono.

The name of the pressure zone microphone PZM is derived from the pressure zone which is only available very tight to a boundary. This is an area in which the sound velocity perpendicular to the boundary surface is zero and the sound pressure is at a maximum. If the area is small, or the wavefront is not perpendicular to this one, the result is a travelling acoustic wave with a velocity vector which is directed tangentially to the boundary.

The left image shows how this version of the PZM a pressure receiver diaphragm is mounted so that it faces the boundary, rather than completely flush with the boundary and facing forward. From the right image, it is clear that this arrangement of a flush surface membrane vibration is acoustically equivalent, in front of which is an obstacle. Except through the circular gap around the edge of the obstacle the sound cannot reach the diaphragm of the microphone.

This is a tragic example of an "unclean" idea, where we can see that a patent does not always bring money.

See the PZM-30D: http://www.coutant.org/pzm30d/index.html with the incorrect microphone type.

Note: A boundary microphone shows also an effect on the recording ratio of direct sound to room sound, namely 3 dB in favor of the direct sound (hemisphere). This can often be quite advantageous for sound recordings. Thus, boundary microphones are not particularly suited for the reception of room signals - but this is sometimes applied.

See also (German): http://www.sengpielaudio.com/UntereGrenzfrequenzbeimGrenzflaechenmikrofon.pdf