



SPOTLIGHT ON The Electret Condenser Microphone

An electret, or "electrostatic magnet," is a material endowed with a permanent electrostatic potential or dipole moment. Electrets have a wide range of applications, including the detection of ionizing radiation, air filtration, endoprostheses or artificial joints, and sound encoding, as in the electret condenser microphone.

The term was coined by Oliver Heaviside in 1885.

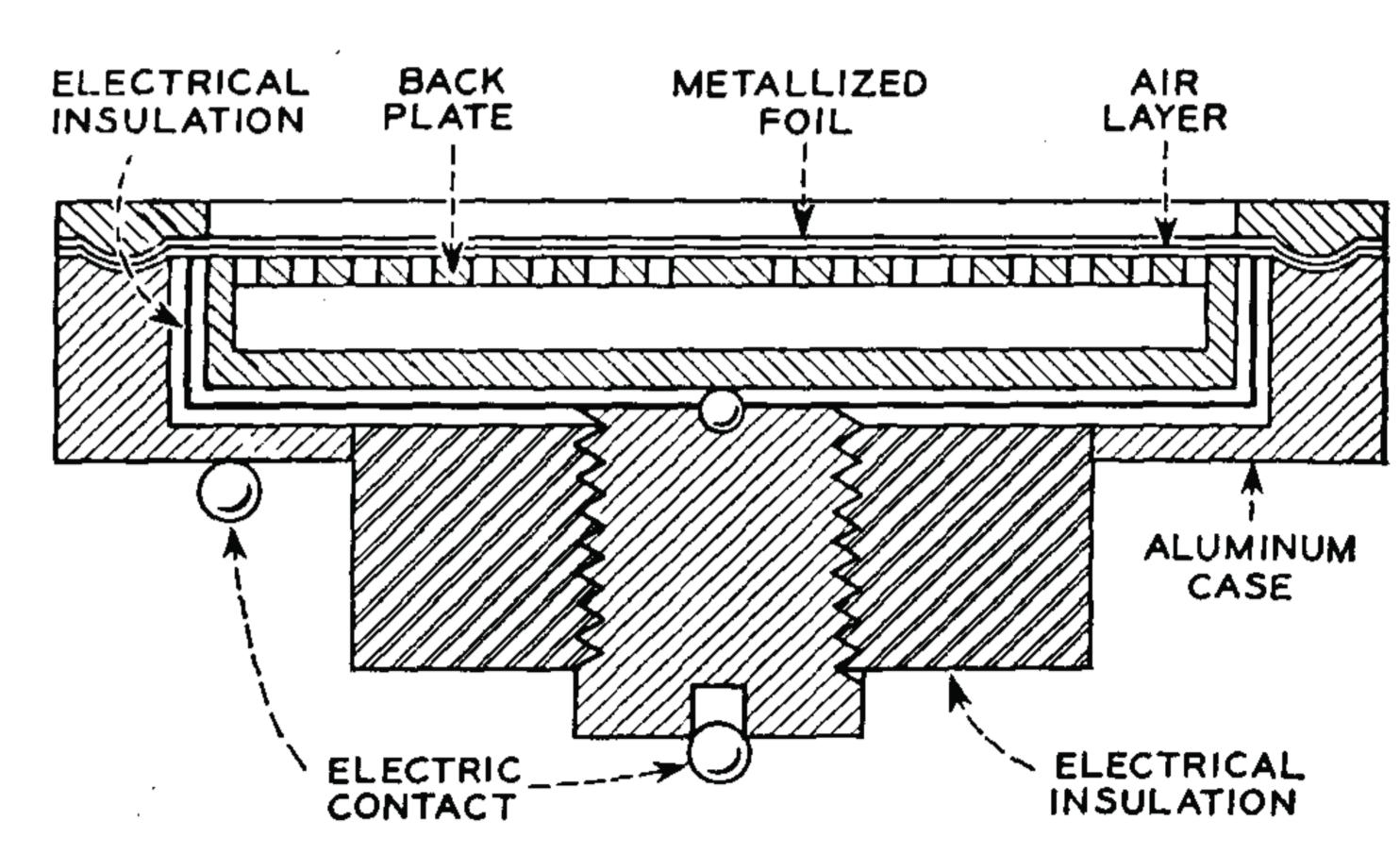
"Certain crystals... are natural electrets; ...solid insulating substances may be made electrets artificially, with a greater or less amount of permanency; ...liquid insulators can only be electrets for a minute interval of time, if at all; while gases, whose particles are always vigorously wandering about, are never electrets."

Oliver Heaviside (1885)

Serendipitous Invention

The electret condenser microphone emerged from a Bell Labs' research project into our ability to discern distinct sounds. In 1962, based on headphones created by James West for this purpose, he and Gerhard Sessler succeeded in creating an electroacoustic transducer that retained its charge without the need for a DC power source. The diaphragm consisted of thin layers of a metallized polytetrafluoroethylene electret film—better known as Teflon. It offered natural sound reproduction and increased reliability while being compact, lightweight and inexpensive to manufacture compared to ordinary condenser microphones.

Cross-section of an electret condenser microphone. The grounded diaphragm and insulated electrode form two plates of a capacitor. As the diaphragm vibrates, its movement alters the capacitance, which modifies the output signal.



1972 RECORD TO SHUT OFF AUTO SHUT OFF

Sony takes the initiative

Bell Labs' parent company AT&T initially underestimated the commercial value of Sessler and West's invention. Focused on telephones, the business saw no advantage over cheap, tried-and-trusted carbon microphones. In 1968, the Japanese electronics company Sony took the initiative by introducing built-in electret condenser microphones into a range of consumer products. They featured in portable tape recorders like the TC-55 "Cassette-corder" pictured from 1972. The lightweight electret diaphragm was far less sensitive to motor noise from the cassette mechanism than carbon microphones. In the early 1970s, Sony rolled out a range of low cost consumer electret microphones that helped to kickstart a movement in home studio recording. The combination of an electret capsule with solid-state circuitry meant that they could be fully battery powered.

AT&T enters the market

In the 1970s Sessler and West pioneered foil electrets as replacements for the electro-mechanical switches in the dialing circuitry of touch-tone telephones. With their market value established, in 1978 AT&T went on to produce the EL2 electret "transmitter" or microphone for use in a new generation of transistor-based, touch-tone telephones and speakerphones. Its smaller size, reduced noise and distortion, and lower DC power consumption now led AT&T to prefer it to carbon transmitters.

Nowadays, electret condenser microphones make up 90 percent of some two billion microphones built into devices like cellphones, hearing aids, and headsets each year.

A hand grips a commercial Western Electric EL2 microphone in front of Gerhard Sessler (left) and James West (right), who hold a strip of Teflon foil. Western Electric was the manufacturing arm of AT&T.

