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QUAD ELECTROSTATIC LOUDSPEAKER

AT A GLANCE: The Quad is a full-range electrostatic loudspeaker, covering from slightly below 50 cps to well above the limits of audibility. Having no heavy cone or voice coil, it possesses very low mass and correspondingly fine transient response.

The Quad has several limitations of a technical, aesthetic, and economic nature that may limit its general acceptance. In our opinion, however, it represents, by a wide margin, the closest approach to truly natural reproduction of sound in the home that we have yet heard.

IN DETAIL: An electrostatic speaker differs from the usual dynamic speaker by not using a voice coil in a magnetic field to move a paper cone. Instead, a very thin plastic film, with a conducting metallic coating, is located near a grid of parallel wires or mesh. The two electrodes form the plates of a capacitor. When an electric charge is put on a capacitor, a force is developed which tends to move the two electrodes together. In the simplified case being described, a steady DC polarizing voltage can be used to establish an initial condition in which the flexible film is drawn partially towards the open grid. If an AC signal is superimposed on the DC, the film will alternately move toward and away from the stationary electrode. The displacement of the air by the moving film produces the sound which we hear.

In order to obtain low distortion at large signal amplitudes, all good quality electrostatic speakers are of the push-pull type. The reasons for this, as well as the various construction techniques, are beyond the scope of this report.

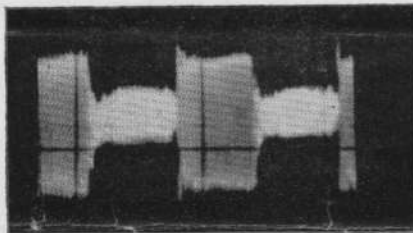
To obtain a sufficiently strong electrostatic field, the electrode spacing must be small. This precludes large excursions of the radiating membrane, and in fact the physical properties of the materials of which these membranes are constructed do not permit large excursions. For this reason, most electrostatic speakers are tweeters, confining their response to frequencies above 1,000 cps, since only very small amplitudes are required from a reasonably sized membrane at these frequencies.

The British-made Quad has extended its frequency range downward by employing a large radiating area. It is 34 in. x 28 in., and practically all of this area is involved in radiating sound. At

the higher frequencies, the radiation is from a narrow vertical strip in the centre of the speaker, to minimize directional effects.

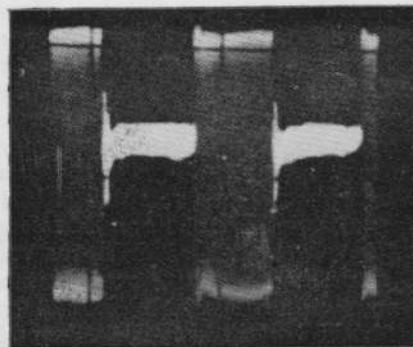
The electrode spacing is also greater than is customary in tweeters, and a much higher polarizing voltage is used. The result is a frequency response extending to below 50 cps with reasonably low distortion. The efficiency of the Quad is somewhat higher than that of some of the better American electrostatic tweeters, and the manufacturer recommends using a good quality 15-watt amplifier (such as the Quad amplifier). It is worth mentioning that this is one speaker which probably should not be used with a very high-powered amplifier, since the speaker has a definite upper voltage limitation making powers in excess of 30 watts inadvisable, even momentarily.

The surface of the Quad is slightly curved outward (towards the listener), for better projection in the listening area. It is mounted on three short legs. The high voltage power supply is built in, as is a matching transformer designed to be driven from the 16-ohm output of the amplifier.



ON OFF ON OFF

Tone burst at 2.85 kc.



ON OFF ON OFF

Tone burst at 5 kc.

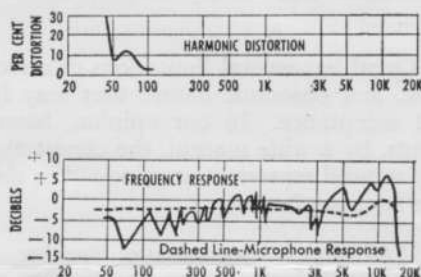
Unlike other types of speakers, the Quad should not be installed closer than two feet to a wall, or three feet to a corner. The bass performance is degraded by such improper positioning. As may be imagined, this large and uniquely designed speaker assumes considerable prominence when it is standing in the clear, undisguised as a piece of furniture or anything else but what it is — a radiator of sound. For this reason, those interested in décor more than fine sound may regard it as not readily adaptable to the usual living room. In stereo pairs this visual problem may be further accentuated.

The instruction booklet accompanying the Quad is quite specific in limiting its application to rooms of less than 5,000 cubic feet. Our experience suggests that it will perform to best advantage in rooms considerably smaller than that, and in fact will do a fine job in a room too small to accommodate any conventional speaker. Unlike cone radiators, the electrostatic speaker is literally a window opening on the concert hall, and one can listen to it in comfort at a two-foot distance as well as at twenty feet or more.

In using a Quad some modification of listening habits will probably be necessary for people accustomed to conventional speakers. This speaker should not, and cannot, be subjected to the room-shattering levels beloved by some audiophiles. To do so is to invite breakup and distortion well below the level where the windows rattle. The Quad should be listened to at *natural* levels. When it is heard somewhat above normal level, the effect is that of being transported towards the orchestra; softer levels move the listener to the rear of the auditorium. This effect is very real, and we have not experienced it to anything like this degree in conventional speaker systems.

The Quad sounds quite different from any other speaker we have heard. It is crisp and taut at all frequencies, including the middles and bass. There is not a trace of the boom or boxiness present to some degree in most conventional speakers. The separation of instruments in the orchestra, even in monophonic reproduction, is strikingly superior to anything we have previously heard. Any doubts as to its bass performance were dispelled when records having large bass drum sounds were played. A comparison against the best cone speakers we could muster showed that the cone speakers had much more apparent bass below 50 cps. A thump from the bass drum shook the room in a most satisfying manner. Switching to the Quad eliminated the strong, room-filled bass which we had come to equate with the best in high-fidelity sound. The drum sounded just like a large bass drum — no more, and no less. The absence of bass hangover and excitation of room resonances probably had a lot to do with this naturalness. Others who heard our Quad were equally impressed in its favor.

Having established by listening that this was a superior speaker we were curious to see what our measurements would show. Frequency response, taken out-of-doors, follows the contour of our microphone calibration rather closely. A line drawn through the centers of the many small peaks and dips in the response lies within 5 db of the microphone response from 60 to 15,000 cps. More important is the absence of any of the huge holes or peaks often found on lesser speakers. The low frequency radiation shows a slow, smooth decline starting at a few hundred cycles, but without the sudden change of slope characteristic of box speakers having a system resonance.



Bass frequency distortion is not outstandingly low between 50 and 80 cps, and rises sharply below 50 cps, which we consider to be the effective lower limit of the speaker's response. At moderate levels and with some increase in distortion, a useful output can be obtained at 45 cps. Obviously, this speaker will not reproduce the lower pedal notes of the pipe organ as well as some conventional systems may, but this is probably the only type of music with which it shows any limitation. On bass transients, such as those produced by drums or keyboard instruments, the loss of extremely low frequencies is more than compensated for by the lack of resonance and hangover.

The polar response (not plotted) is a smooth cardioid pattern, down about 10 db at 45 degrees off center axis. The Quad booklet shows a 70-degree effective angle in the horizontal plane, and our measurements confirm this. We measured it at 7 kc, but polar response of the Quad changes relatively little with frequency. This no doubt also contributes to its listening quality.

Tone burst patterns revealed one frequency at which ringing occurred (2.85 kc). At all other frequencies, however, the tone burst pictures were virtually ideal, resembling the 5-kc burst shown.

The Quad should be listened to carefully, and preferably in one's own home, before buying. Don't be surprised if the result is a feeling of dissatisfaction with your present speaker system.

H. H. LABS.