

# LETTERS TO THE EDITOR

*The Editor does not necessarily endorse the opinions expressed by his correspondents*

## *Electrostatic Loudspeakers*

IN the article on "Distortion in Electrostatic Loudspeakers" (February issue) it is claimed that distortion-free operation is obtained only if the two sides of the diaphragm are insulated from each other and fed through independent resistances. This state of affairs is shown in Fig. (4) of the article with the statement that the charges on each side of the diaphragm will remain constant and that the voltages  $V_1$  and  $V_2$  will adjust themselves to satisfy this condition.

Now any potential difference between  $V_1$  and  $V_2$  will give rise to charges on the insides of the conducting surfaces. Since the two inside charges are opposite in sign, there will be a redistribution of charges resulting in unequal charges on the outside surfaces. It can be shown that if the capacitance through the diaphragm is large compared to the capacitance of  $C_1$  and  $C_2$  then the conditions will approach those of a single conducting diaphragm fed through a high resistance, Fig. (3).

The force on the diaphragm *due to the signal* is completely independent of the position of the diaphragm both for the case of constant total charge and for a theoretical case of constant independent charges.

The author points out that if, with constant total charge, the diaphragm is moved mechanically then a force appears on the diaphragm. He states this force is linear with displacement, but is not due to the signal and is therefore a distortion. The force is indeed linear with displacement and acts away from the central position. This is a negative stiffness. It causes no distortion, but it does of course require the introduction of positive stiffness in order to avoid diaphragm collapse to one or other of the fixed plates.

In spite of the above, a diaphragm conducting along its surface will introduce distortion, but for a different reason. Since the diaphragm requires supporting, there will effectively be forces acting at these supports in the opposite direction to the electrical forces. The

diaphragm will not be a truly flat piston and the charge per unit area will not remain constant. The time constant of each small unit area (small compared to support spacing) must be made large for distortionless operation.

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