

Smith then analyzes the case wherein the horn throat is an annular ring at the air chamber as shown in Figure 8. Again the mode shapes inside the air chamber are found to be complex functions of Bessel functions. It is further found that the first null can be suppressed by properly choosing the radius of the horn throat annulus. To suppress the j th node it is necessary to choose r_1 such that $k_j r_1$ is a root of J_0 . The parameter k_j has already been chosen such that $k_j a$ is a root of J_1 .

The radius of each of m annuli is chosen to suppress each of the first m modes that exist in the air chamber by finding the first m roots to the J_0 function. Table 1 lists the first five roots of the J_0 and J_1 functions.

Table 1
Roots of the Functions $J_0(m)$ & $J_1(m)$

m	$J_0(m)$	$J_1(m)$	k_j
1	2.41	3.83	$3.83/a$
2	5.52	7.02	$7.02/a$
3	8.65	10.17	$10.17/a$
4	11.79	13.32	$13.3/a$
5	14.93	16.47	$16.47/a$

The procedure, then, is to choose a number m corresponding to the number of concentric rings desired. If this number is five then the m th root of J_1 is 16.470. The radius of each of the rings is obtained by dividing each of the first five roots of J_0 by this fifth root of J_1 and multiplying by the radius of the air chamber. Note: If the air chamber is not flat, i.e. spherical, then the radius of the chamber is the distance from the center to the outside edge measured along the curve defining the chamber, i.e. arc length.

For the five ring case under consideration

$$a_1 = \frac{2.405a}{16.47} = 0.146a$$

$$a_2 = \frac{5.520a}{16.47} = 0.335a$$

$$a_3 = 0.525a$$

$$a_4 = 0.716a$$

$$a_5 = 0.907a$$

Up to this point the ratio of horn throat area to the diaphragm area has been arbitrary. Indeed, if additional concentric annuli are added their total area is still the choice of the designer. However, the area allotted to each additional annulus now becomes defined by the solution to the problem. To determine the width of each of these annular slots we must solve m^{-1} simultaneous equations and one simple equation to find the areas of each of the slots. Smith's equation 25 defines the simultaneous equations and for the case of the five rings they are written as: