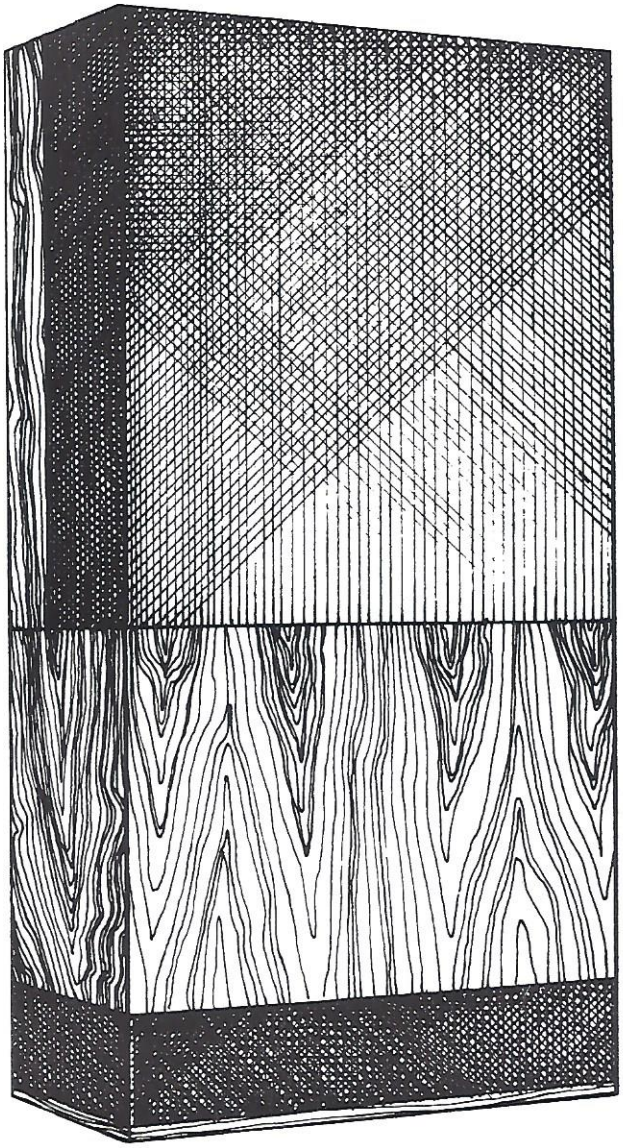


Type A loudspeaker system technical background

Snell Acoustics

Snell Acoustics Type A

the objective

An ideal loudspeaker would produce sound energy that is an exact analog of the applied electrical input. As a practical objective, a loudspeaker should accurately reproduce the sound of the program material within the listening environment without adding any sonic character of its own.

Snell Acoustics was founded to design and manufacture loudspeakers that meet this objective. Our research and development began in 1973 and resulted in the production of the Type A loudspeaker in mid-1976. During the fall of 1978 an improved version was introduced, incorporating a new tweeter, provisions for bi-amplification, and other refinements. We believe that the Type A more closely satisfies this objective than any other loudspeaker, regardless of size, type, or price.

the design

We originally began our investigation into loudspeaker design because we found that existing loudspeakers did not meet our criterion of accurate sound reproduction. Our objective was to determine which engineering criteria are audibly significant and to apply those criteria to the design of a no-compromise loudspeaker.

Frequency Response*

The principal conclusion to emerge from our research was that the *frequency response* of a loudspeaker is its most important, and most misunderstood, audible characteristic.

The frequency response of a loudspeaker is far more complex than that of an electronic component. A power amplifier, for example, for a given input signal produces a single output signal that can easily be measured at the amplifier's output terminals. By contrast, a loudspeaker produces acoustic pressure waves into three-dimensional space, and its frequency response may vary with the location of its measurement within that space. Our research showed that to achieve accurate sound reproduction, a speaker must have a uniformly flat frequency response over the entire audible range throughout the listening environment. This became the primary design criterion for the Snell Type A loudspeaker.

Loudspeaker frequency response can be examined by considering two types of response that are of particular psychoacoustic importance. The first is the frequency response of the *early arrival time sound.* This sound comes directly to the listener from the speaker and includes the first reflections off nearby surfaces such as the floor, walls, and even the cabinet. *We extract transient and localization information from this sound. Uniform response is essential for the accuracy of this information.*

The second type of response is the frequency response of the *sound power* radiated by the speaker (known as the power response). The sound power is the total of all the sound radiated by the speaker in all directions at any instant, and is what fills a room with reverberant sound. *The tonal "color" of a speaker is largely determined by the sound power, which must be uniform for accurate reproduction.*

*More correctly known as amplitude/frequency response.

Acoustical Interference

In achieving uniform frequency response of both early arrival sound and sound power, the most important design consideration is the elimination of *acoustical interference* effects. Acoustical interference may be described as an interaction of sound waves in which they become rarified or reinforced, depending on whether they "interfere" out of phase or in phase with each other.

There are three acoustical interference effects that determine the radiation pattern of a speaker and consequently the accuracy of its sound power response and early arrival time sound response:

1. Acoustical interference between drivers.
2. Interference of sound waves reflected and diffracted from nearby surfaces. (These surfaces include the floor and walls of the listening room and the loudspeaker cabinet itself.)
3. Directionality of the individual drivers (woofer, midrange, and tweeter).

Prior to the Type A, no loudspeaker design adequately minimized acoustical interference and its audible effect. To minimize interference effects in the Type A, all aspects of the loudspeaker system were considered: the drivers, the crossover, the enclosure, and the listening room. The resulting solutions were sometimes conventional and often innovative, but were always arrived at through meaningful test procedures and meticulous attention to detail. While one or more of these factors may have been considered in the design of other loudspeakers, the Type A is the first loudspeaker in which they are all optimized.

Interference Between Drivers

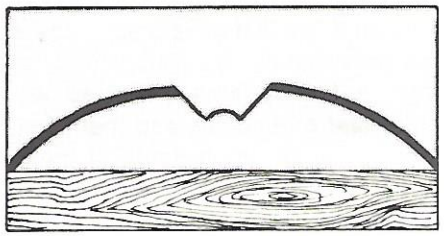
Interference between individual drivers is a complex matter that has not been adequately dealt with

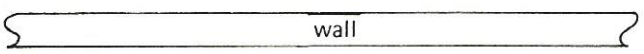
in other loudspeakers. The Type A, like many other loudspeakers, uses only one driver for each frequency range, thereby eliminating the most serious cause of interference, and the drivers are aligned vertically to prevent interference between them in the horizontal plane. In addition to these fairly conventional approaches, interference in the vertical plane has been reduced to negligible levels by proper placement of the drivers and by careful tailoring of the crossover network's amplitude and phase characteristics.

Interference From Nearby Surfaces

The interaction of the output of the drivers with nearby surfaces has been entirely neglected by most previous designs, yet the sound reflected by the floor and adjacent walls causes serious coloration in conventional speakers. This interference is particularly unfavorable when the distance from the driver to the reflecting surface is about one-quarter the length of the sound wave being reproduced. In conventional speakers, this effect occurs in the bass or low midrange (witness the effect on a speaker's coloration as its height above the floor is changed). A solution for this problem for low frequencies is to place the woofer *very close* to the floor and rear wall, *closer than* the critical quarter-wavelength distance. At higher frequencies, where the wavelengths are much shorter, the midrange and tweeter may be placed *far* enough from the floor and rear wall that the distance is *greater than* the critical quarter wavelength. This is the configuration of the drivers in the Type A. The listening room floor and walls are an integral part of its design.

Equally important is the shape and the size of the outside of the loudspeaker baffle. The diffraction caused by the acoustical discontinuities of conventional rectangular cabinets results in, among other effects, a severe deterioration in midrange dispersion. As shown in the diagram, the Type A midrange and tweeter are placed on a large, smooth, gently curved surface. This virtually eliminates diffraction, providing extremely uniform dispersion and exceptionally flat sound power response.





Top View

Directionality of Drivers

Directionality of drivers is a well-recognized problem. It is solved in the Type A, as in several other speakers, by using drivers whose dimensions are small compared with the wavelengths of sound they reproduce. In addition, the Type A utilizes very low crossover frequencies (275 Hz between 10-inch woofer and 4-inch midrange, and 2500 Hz between midrange and 1-inch tweeter).

By eliminating all forms of interference effects, the Type A is a speaker with a uniquely accurate frequency response throughout the audible spectrum for both early arrival sound and sound power.

Other Criteria

Other audible performance criteria were also maximized in the design of the Type A:

1. Harmonic and modulation distortion are extremely low. The low woofer crossover frequency, for example, results in a notable lack of modulation of midrange frequencies.
2. Driver ringing caused by cone breakup and cabinet resonances has been eliminated as an audible consideration.
3. The frequency range of the loudspeaker, from the lowest notes to the highest audible harmonics, is in excess of virtually all commercially available program material.
4. The dynamic range is extremely wide. The Type A will reproduce 105 dB under typical listening conditions.

listening quality

The design of the Type A has resulted in superior audible performance. Because of its unique accuracy, a description of its sound quality is difficult and generally describes the program material and the audible effect of other components in the stereo system. However, it has been characterized as follows:

1. The sound quality is *neutral.*
2. The sound is *very open,* due in large part to the speaker's exceptional dispersion at all frequencies.

3. The accuracy of the early arrival time sound results in *excellent definition and natural reproduction of percussive attacks.*
4. The sound is *transparent,* largely because of the smooth, extended high-frequency response.
5. The sound is *spatially correct.* Stereo imaging is accurate because of the smooth response of the early arrival time sound and because all Type A's are acoustically identical.
6. *Depth perspective* is accurate, in part because the ratio of early arrival time sound to reverberant sound is the same for all frequencies.
7. The sound is *not fatiguing,* even at high volume, because of *extremely low coloration.*

Loudspeakers have often been accused of being the weakest link in the sound reproducing chain. We believe that the sound quality of the Type A refutes this claim. Its performance capability significantly exceeds the quality of most available program material and will reveal any inadequacies of the other components in your stereo system.

our standards

Snell Acoustics has a strong commitment to excellence. Our reputation hinges directly on the quality of our speakers. This quality is reflected in all aspects of the construction and performance.

Each speaker is not just compared with, but is actually matched to, a reference standard Type A. Two of the many quality control procedures are a *series* of tests and adjustments on each driver and the tailoring of crossover components to obtain the smoothest system response. The result is that all Type A's sound virtually identical.

The cabinets are solidly constructed from heavily braced, non-resonant materials. The veneers are carefully matched and then sanded to a mirror-like finish. They are hand rubbed with oil and given a durable coat of wax to bring out the beauty of the wood.

The design criteria for the Type A do not result in a small or inexpensive loudspeaker. However, the Type A was designed as a solution to the problems of loudspeaker performance on an *absolute* basis. Within this context we believe it embodies an excellent quality versus cost ratio.

specifications

Frequency response on axis and up to 25 degrees off axis*	36 Hz to 18 kHz ± 1½ dB
Impedance (minimum)	4 ohms
Power requirements (minimum)	80 watts continuous/channel
Driver complement	10-inch (24.5-cm) woofer 4-inch (10.2-cm) midrange 1-inch (2.54-cm) tweeter
Crossover frequencies	275 Hz and 2500 Hz
Fusing	
Woofer	AGC 3
Midrange	AGC 2½
Tweeter	AGC 2
Dimensions	
Upper section	25.5″ high x 23.75″ wide x 13.0″ deep (65.8 x 60.3 x 33.0 cm)
Lower section	21.0″ high x 23.75″ wide x 13.0″ deep (53.3 x 60.3 x 33.0 cm)
Weight	
Upper section	43 pounds (19.5 kg)
Lower section	54 pounds (24.5 kg)

**This rating applies to the inner side. The speakers are mirror image pairs, having slightly better dispersion toward the inner side.*

bi-amplification

The Type A loudspeaker may be bi-amplified with the addition of a Snell Acoustics Electronic Crossover and another stereo amplifier. This option enhances the dynamic range and overall "immediacy" of the system without the midrange colorations and distortion found in many other electronic crossovers. The Snell Acoustics Electronic Crossover was designed specifically for the Type A and is manufactured by Snell Acoustics according to the same quality standards used in speaker production.

The Electronic Crossover includes controls necessary for the level adjustments of amplifiers of differing gains. Negative feedback and the resulting transient distortions are completely avoided. In addition, the Snell Acoustics Electronic Crossover allows for straight-wire coupling of amplifier and woofer, maximizing damping and bass impact.

The advantages of the Type A Loudspeaker over conventional designs are quite apparent in standard single-amplifier use. Bi-amplification of the speaker with the Snell Acoustics Electronic Crossover and appropriate amplification is an additional step in the advancement of the state-of-the-art in home sound reproduction.

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specifications

Configuration	stereo two-way, 6 db per octave
Low pass f_3 (– 3db frequency)	300 Hz
High pass f_3	385 Hz
Level adjustment (either section or channel)	20 db
Power requirements	3 watts, 110-120 VAC