

THE CREATIVE
TECHNOLOGY OF
INFINITY SPEAKERS.



The creative technology of Infinity speakers begins and ends with musical accuracy.

At Infinity our discipline is in the sciences. Physics. But our passion is music. Preferably live. At concerts and recitals, jazz sessions and folk music festivals.

The music-lover in each of us makes us impatient with so-called "high-fidelity" when it falls short of the sound of live music. (As it usually does.) Or when some speaker designers have the effrontery to try to "improve" upon the way music is played —by boosting the low frequencies and brightening the highs and introducing other electronic modifications. This is *distortion*.

Our scientific and engineering side —as well as our personal taste —

tells us that technological "improvement" in high fidelity must mean *greater musical accuracy*. That advanced technology can point to theoretical solutions. And that we can convert theories into measurable, audible reality.

When you buy components, your primary goal is not the lowest price, the handsomest cabinetry, or even the grandest specifications, but the greatest enjoyment of *music*.

And Infinity resolves to remain not a speaker company, nor a components company, but a music company.

That is what it's all about.

One of the three largest speaker manufacturers in America.

In the years since Infinity Systems began (in a two-car garage). Infinity speakers and other products have earned the respect and praise of hard-core audiophiles, hi-fi critics, and music-lovers throughout the world.

Our fame has spread the way we would have wished —by word of mouth. The widest dispersion in stereo is the sound of friends telling friends about Infinity.

In the first ten years since the introduction of our initial product, Infinity has grown most impressively. And along the way it has made significant contributions to audio technology—in electronic components and tone arms as well as speakers.

Superior stereo imaging —an Infinity trademark.

When you first hear music through a pair of Infinity speakers in a quality stereo system, you'll realize that you are hearing something for the first time outside of a live performance.

Every instrument and every voice is reproduced not only with its own characteristic timbre, but also in its own *position*. Not only left to right, but also *front to back*.

This natural stereo imaging recreates accurately the musicians'

relationship to the recording microphones—some close up, and others farther away.

You may never know how much depth was captured in your favorite stereo recordings until you hear them through Infinity speakers.

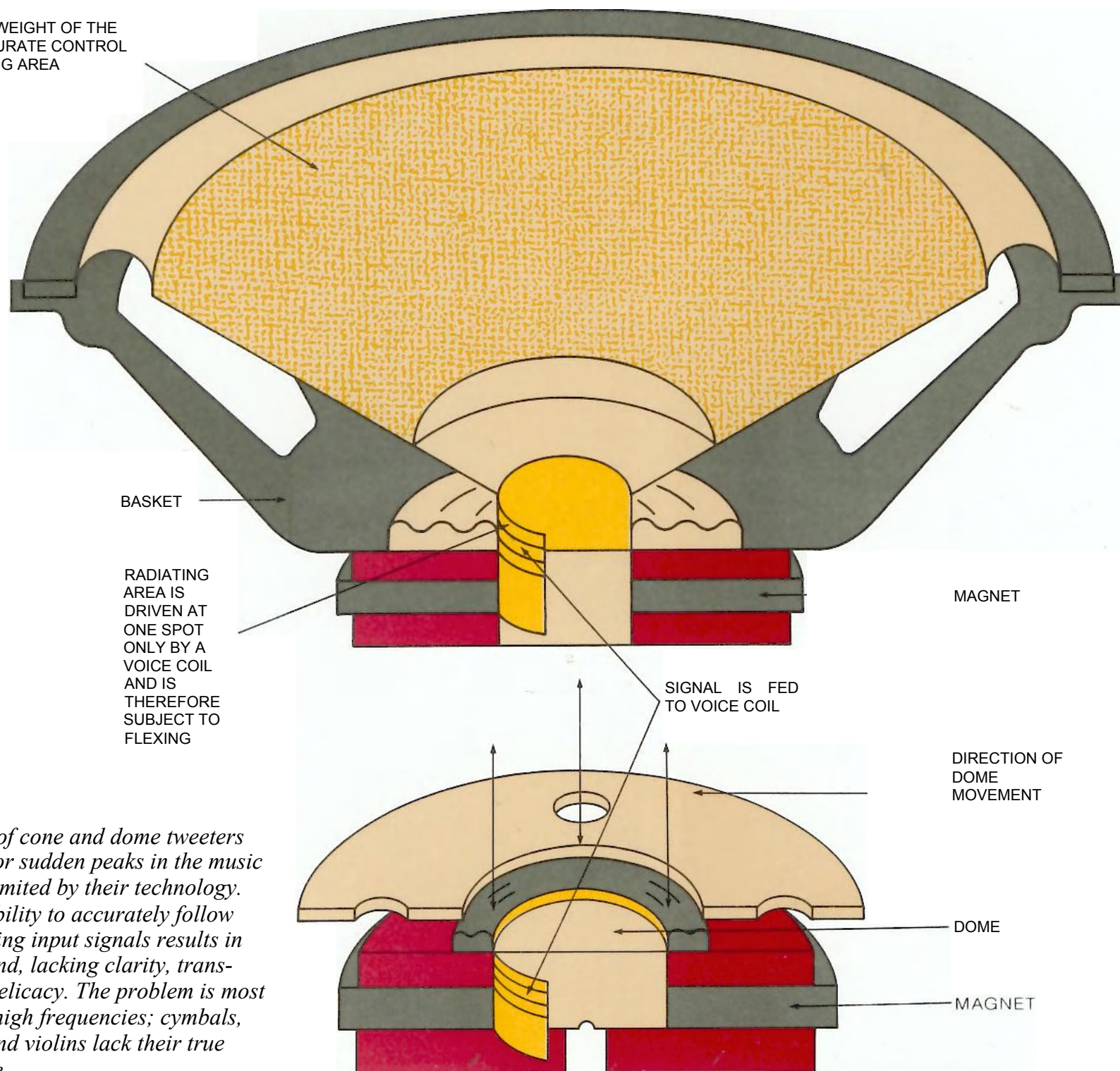
We've extended the art.

Infinity engineers and physicists combine scientific objectivity with subjective musical judgement. We use anechoic chambers and real-time analyzers for frequency response measurements; pulse and polar

response measurements, and measurements of driver and system distortions of all types. We also lean heavily upon our well-trained artistic judgements. We measure *and* we listen; either without the other will not attain the musical accuracy we seek.

As a result. Infinity loudspeaker systems will never give you bass boost, midrange "presence" or treble "sparkle" that is not in the original performance. Our systems do not bounce the majority of their sound off room walls to "enhance" stereo

The trouble with cone and dome tweeters.



The response of cone and dome tweeters to transients, or sudden peaks in the music is inherently limited by their technology. This limited ability to accurately follow rapidly changing input signals results in a "veiled" sound, lacking clarity, transparency and delicacy. The problem is most noticeable at high frequencies; cymbals, bells, guitar and violins lack their true life-like timbre.

imaging or to obtain the effect of a gigantic listening room — invariably at the expense of musical accuracy. Instead, every Infinity system interacts naturally and in harmony with room acoustics, just as live music would.

Existing high frequency drivers were limited by their own designs.

We had to develop our own technology to solve these inherent problems.

We began by examining existing audio technology and design theory, with the objective of retaining the most desirable attributes while avoiding the shortcomings. Next, we added our own creative engineering —not merely for the sake of change or "better" specifications, but to improve the accuracy of musical reproduction.

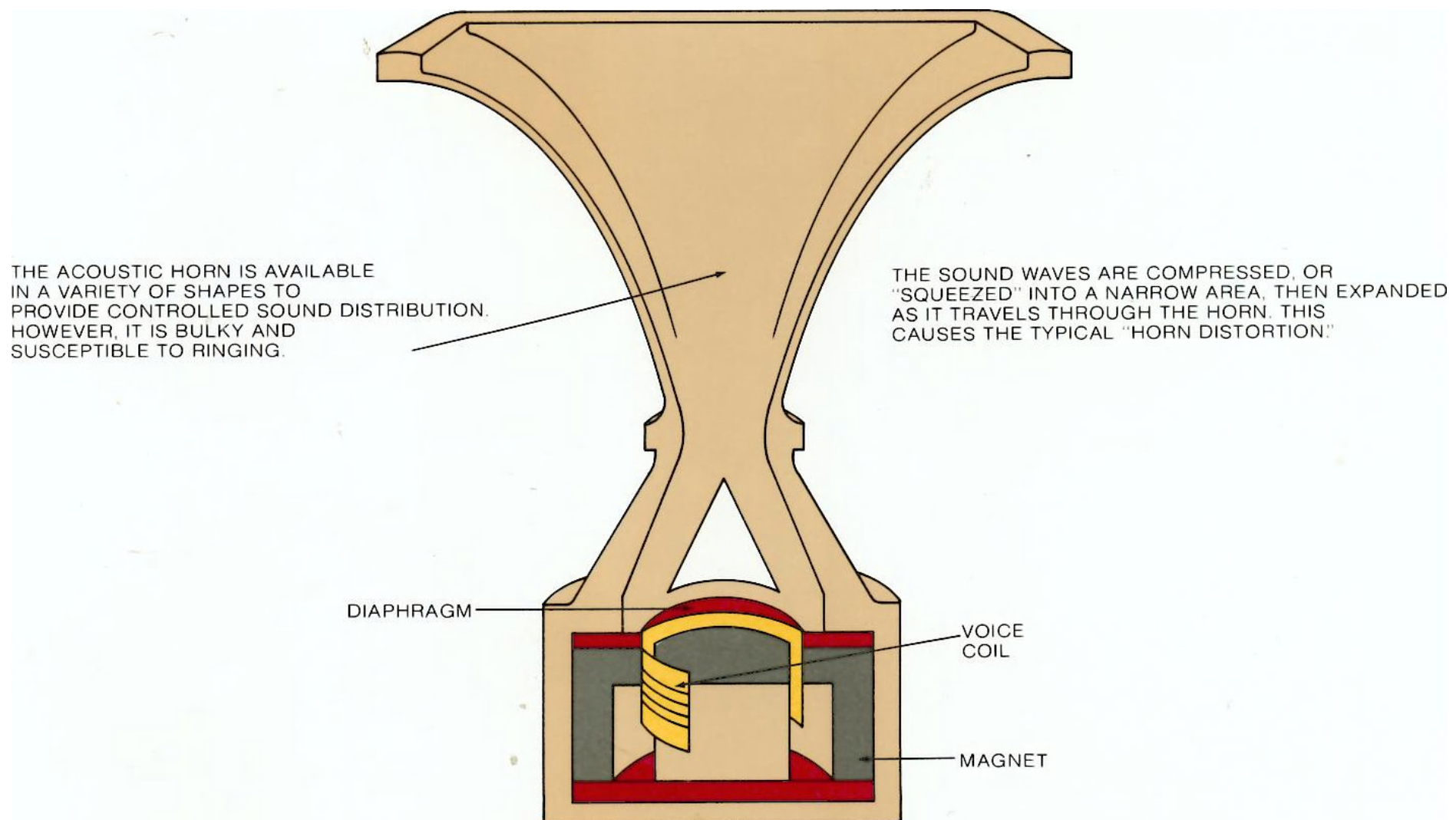
Like the musicians of an orchestra, band or combo, each component in the speaker system has to excel as a

soloist and as a member of the group. Each must contribute more than its share.

We resolved a number of seemingly mutually exclusive requirements for accurate mid and high frequency reproduction.

For example, wide sound dispersion requires that the radiating surface be small in relation to the wavelength of the sound being reproduced; yet

The limitations of horn/driver assemblies.



DRIVER/HORN COMBINATION IS LARGE. BULKY. AND INHERENTLY NOT ACCURATE ENOUGH

A second category, used for some time in theater-type or concert sound systems, is the compression driver with an acoustic horn. A compression driver, essentially constructed like a woofer, can be large and powerful. Its output, directed through a horn, can be spread over a wide area. How-

ever, its performance is limited by a metallic (generally aluminum) or phenolic (linen impregnated with phenolic plastic) diaphragm that is too massive to deliver the accuracy of other materials. Further, and most distressing to anyone who cares about musical accuracy, this configuration imbues

the music with a "honking" quality. While offering certain advantages for extremely large sound systems, compression driver/horn tweeters clearly are not the answer for high quality home music systems.

powerful output requires a large radiating area. In order to obtain distortion-free performance, the radiating surface must be strong enough to accelerate at many times the force of gravity; yet it must be lightweight for efficiency; plus it must radiate acoustic energy without physical deflections that would cause distortion.

Cone, dome and horn-loaded tweeters were reasonable compromises towards these objectives. But they each have their limitations:

Our EMIT™ and EMIM:™

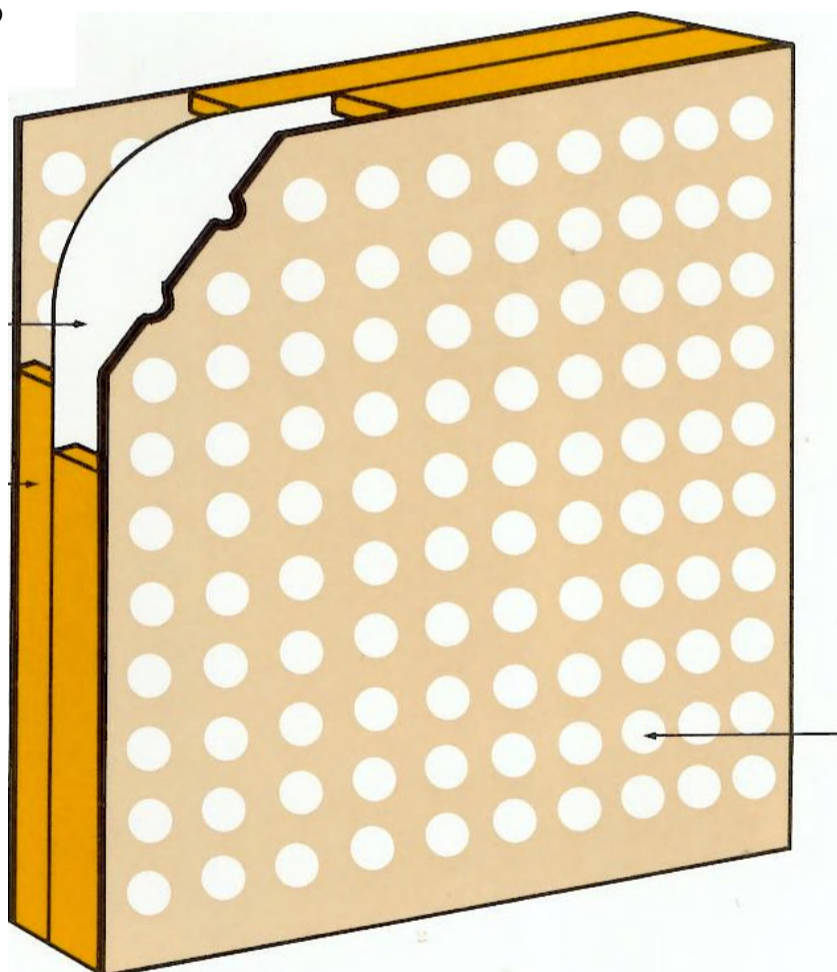
Electromagnetic Induction flat-driver technology. We went our own way.

After careful examination of the "traditional" mid and high frequency drivers, we developed a remarkable technology: electromagnetic induction, as found in the Infinity EMIT (Electromagnetic Induction Tweeter) and the EMIM (Electromagnetic Induction Midrange).

Along came the electrostatics...

DIAPHRAGM IS CHARGED TO A VERY HIGH VOLTAGE IS DRIVEN UNIFORMLY OVER ITS ENTIRE RADIATING AREA DIAPHRAGM CAN BE FLEXIBLE AND VERY LIGHT THEREFORE RESPONSIVE TO TRANSIENT (EXTREMELY SHORT) SIGNALS

FRAME



ELECTRIC SIGNAL FROM AMPLIFIER IS FED TO PERFORATED ELECTRODES RESULTS IN PUSH PULL ACTION OF DIAPHRAGM

WITH MOST ELECTROSTATICS SIGNAL PASSES THROUGH A TRANSFORMER WHICH INTRODUCES DISTORTION RESULT LOSS OF MUSICAL ACCURACY

The electrostatic responds beautifully to high frequency transients in music. The diaphragm, driven over its entire area can instantly follow input signals; therefore

great delicacy, nuance and clarity is possible. High frequencies have transparency and a life-like musicality.

Power-handling ability is limited, however, by voltage breakdown. And high

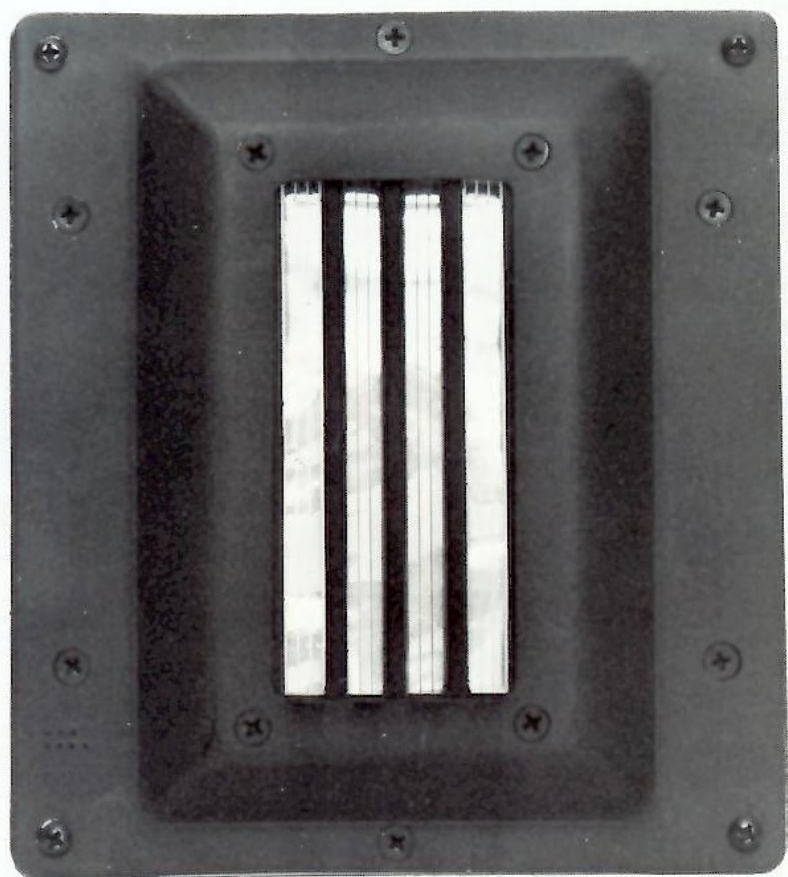
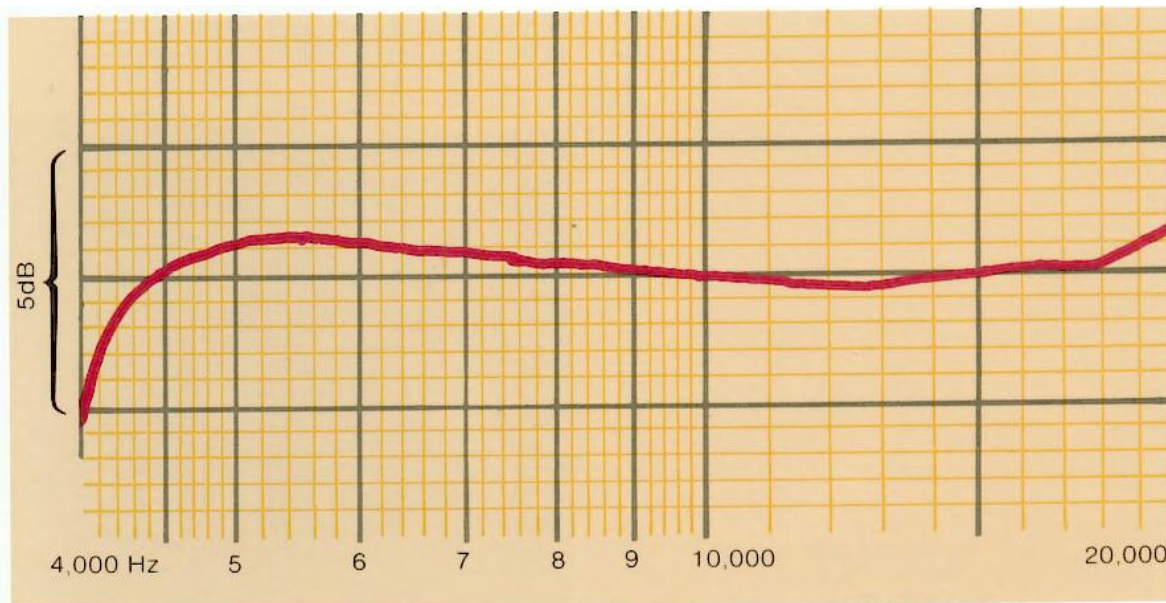
frequencies, in most electrostatics, are narrowly beamed. Also, many amplifiers do not give their best performance when driving electrostatic speakers.

Each utilizes a thin flat diaphragm that is both lightweight and strong enough to withstand the G-forces involved. An exceptionally light "voice coil" is etched to the surface of the diaphragm for even current flow and uniform distribution of the driving force.

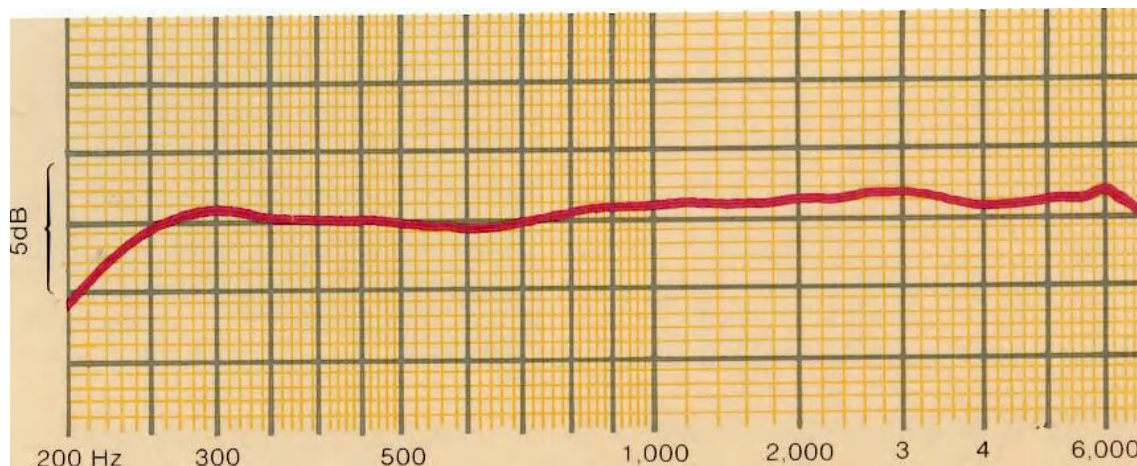
Small but extremely powerful rare-earth Samarium Cobalt magnets are located in front and behind the "voice coil" diaphragm, generating an intense magnetic field. The music signal, represented as an alternating current, interacts with the powerful magnetic field, causing the diaphragm to move in and out, in per-

fect sync with the input signal. The small physical dimensions of the samarium cobalt magnets permit the diaphragm to be located extremely close to the front of the driver, further aiding cooling of the voice coil and maximizing efficient coupling to the air.

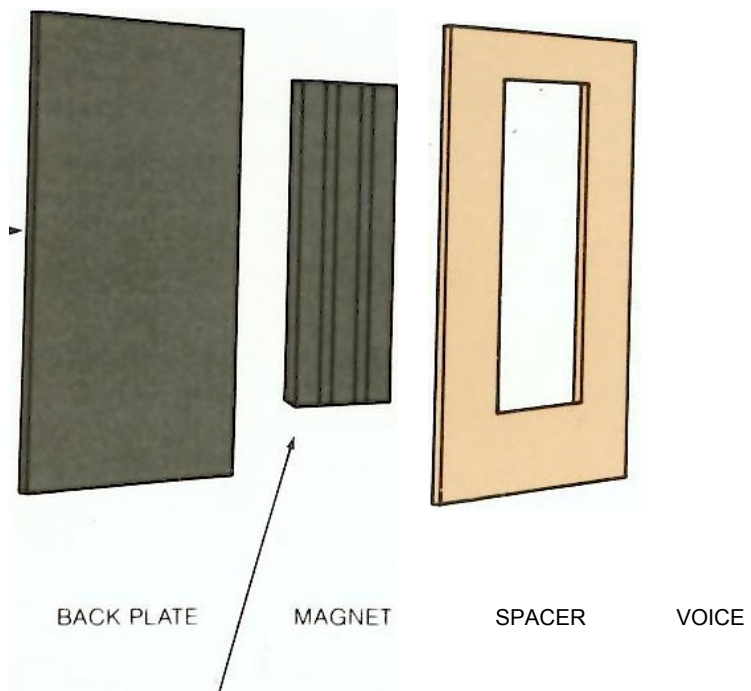
Solution: the remarkable Infinity EMIT and EMIM.



Frequency response of the Infinity EMIT (high frequency) and EMIM (midrange) electromagnetic induction drivers, measured near-field including microphone loss, including rolloff due to crossover.

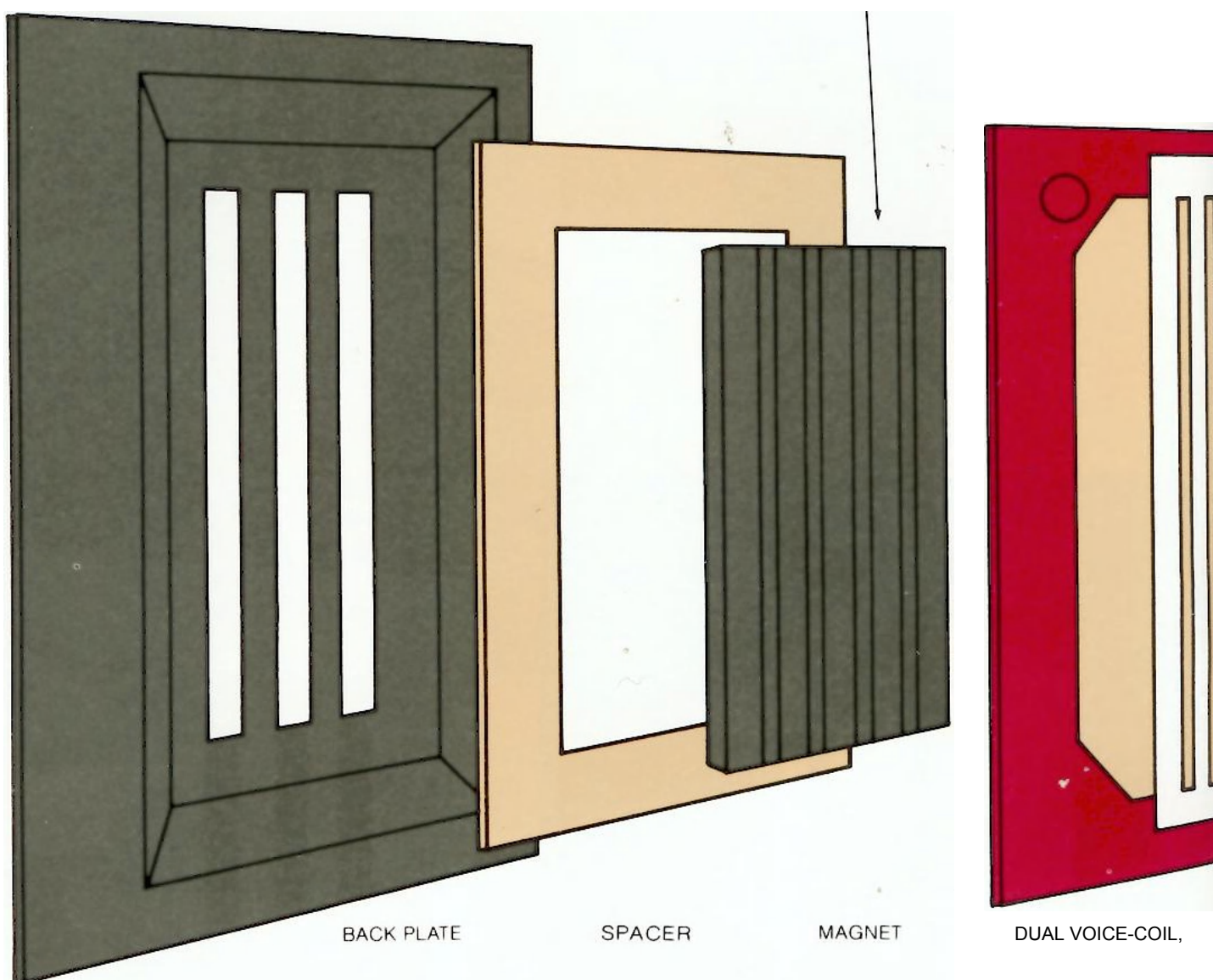


(EMIT)
SOLID BACK PLATE REFLECTS THE REAR SOUNDWAVE BACK THROUGH THE DIAPHRAGM FOR ADDITIONAL HIGH FREQUENCY OUTPUT



DIAPHRAGM IS DRIVEN BY MAGNETS OF POWERFUL RARE EARTH SAMARIUM COBALT (MOST POWERFUL MAGNETIC SUBSTANCE KNOWN)

(EMIM)
OPEN BACK PLATE DISTRIBUTES THE REAR SOUNDWAVES FROM THE DIAPHRAGM THIS REAR OUTPUT INTERACTS NATURALLY WITH THE ROOM SURFACES FOR OPEN SPACIOUS MIDRANGE



These are the component parts of Infinity's Electromagnetic Induction Tweeter (EMIT) and our Electrostatic Induction Midrange (EMIM). Each is the magnetic analogue of the electrostatic; each achieves its drive

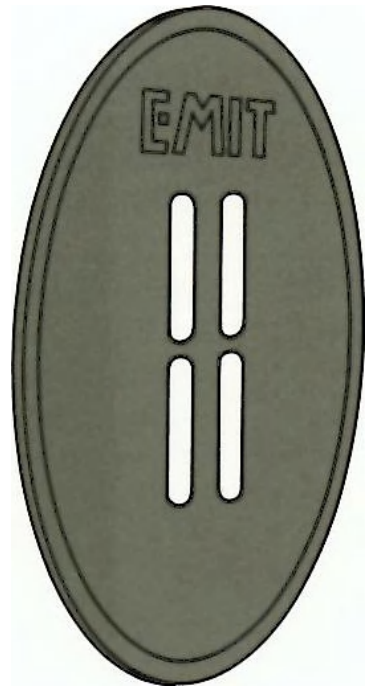
from powerful magnets rather than from high voltage.

EMIT and EMIM deliver sheer transparency; clarity; filligree-detailing of mid and high frequencies, even at high sound-pressure levels. Without the distortion and limited

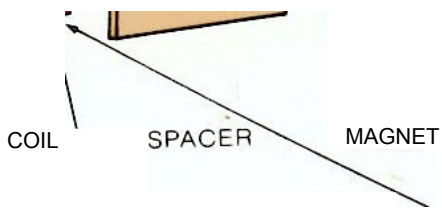
transient response of cones and domes. Without the voltage breakdown and narrow beaming of electrostatics.

The "distributed voice-coil" readily dissipates heat to the air. What's more, your

an inside view.



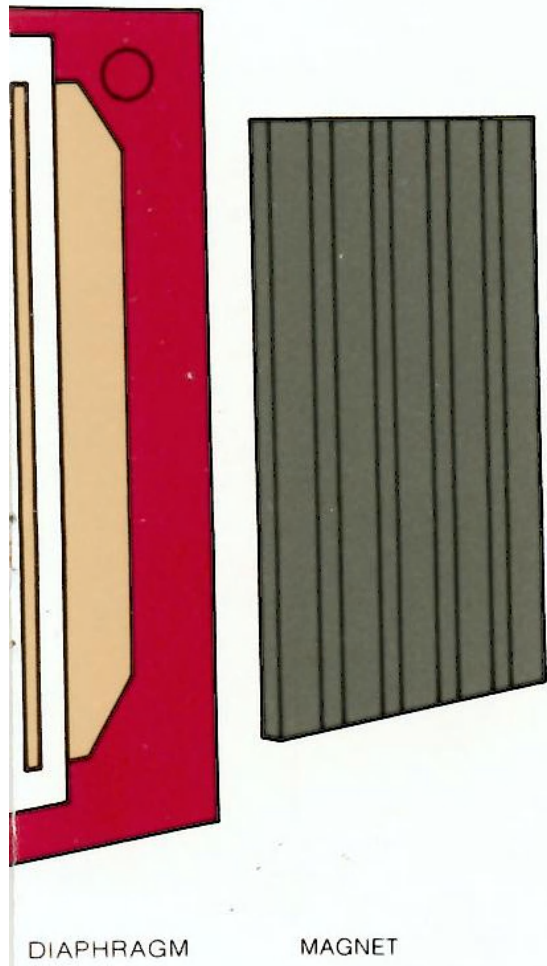
EMIT PRIMARY RADIATING SOURCE ONLY
Vfe-INCH WIDE RESULTING IN NEARLY
PERFECT HORIZONTAL DISPERSION OF HIGH
FREQUENCIES AS HIGH AS THE EAR CAN
HEAR AND BEYOND



LIKE THE ELECTROSTATIC DIAPHRAGM HAS
PUSH PULL ACTION AND CAN INSTANTLY
FOLLOW INPUT SIGNALS RESULTING IN
SUPERB MUSICAL ACCURACY DELICACY
AND TRANSPARENCY

VOICE COIL IS A PRECISE PATTERN ETCHED
DIRECTLY ONTO A PLASTIC DIAPHRAGM
BECAUSE DIAPHRAGM IS DRIVEN OVER ITS
ENTIRE AREA IT DOES NOT NEED TO BE
STIFF SO IT CAN EXTREMELY LIGHT

EMIM VOICE-COIL IS PRINTED ON BOTH
SIDES OF THE DIAPHRAGM FOR HIGH
EFFICIENCY.



EMIM PRIMARY RADIATING SOURCE
PRECISELY 1%-INCH FOR UNIFORM
WIDE SOUND DISPERSION THROUGH
ITS OPERATING RANGE

amplifier "sees" EMIT and EMIM as virtual-ly pure resistance—just the kind of impedance it handles best. Result: EMIT and EMIM respond beautifully to a little power or a lot of power. They lose none of their accuracy or detailing of inner voices,

whether reproducing powerhouse impact or pianissimo subtlety.

Sound characteristics: smooth, warm, delicate, transparent, with every nuance

captured; yet capable of tremendous sound pressure levels without loss of these same qualities.

In short, Infinity's EMIT and EMIM define the state of the art.

The narrow width of the radiating surface provides wide horizontal sound distribution into the listening room, and still has the total radiating area for high power. Both the EMIT and EMIM are constructed to allow utilization of the energy radiated by the back side of the diaphragm, further contributing to acoustic efficiency.

EMIT, our exclusive Electromagnetic Induction Tweeter, is widely considered the most advanced high

frequency reproducer in the world of audio. From our *bVi*-foot tall Quantum Reference Standard to our 11-inch small InfiniTesimal, every speaker in the Reference Standard series owes its high end clarity and smoothness to single or multiple EMIT tweeters.

EMIM transducers, also utilizing our electromagnetic induction technology, are responsible for the exceptional midrange clarity.

openness and natural accuracy of Infinity speakers. In conjunction with EMIT tweeters, they contribute significantly to the spaciousness and exceptional stereo imaging of the Reference Standard 4.5 and 2.5 loudspeaker systems.

Though similar in concept, design and operation, EMIT and EMIM are each unique, delivering faithful, uncompromised performance through their respective portions of the sound spectrum.

Samarium Cobalt: the most powerful magnet available.



EMIT MAGNET



FERRITE MAGNET OF EQUAL STRENGTH

Rare-earth Samarium Cobalt magnets are the most powerful available. Their small size and high output enable the physical configuration to achieve wide sound dispersion of the EMIT and EMIM. Samarium Cobalt is approximately 5 to 6 times more powerful than an equal amount of ferrite.

Our polypropylene technology.

Prior to polypropylene, we tried a number of treated and untreated paper and exotic plastic cone compositions. Several exhibited specific improvements, but none were totally satisfactory.

Bextrene looked promising, it offered resistance to flexing, consistent performance and resistance to temperature and humidity. However, there were two severe drawbacks: bextrene was not very efficient, and it simply didn't sound good enough for us.

Ultimately, we utilized polypropylene, a material that revealed itself as having remarkable acoustic properties. In order to utilize the material, we had to develop new bonding agents and technology to affix the associated component parts (voice coil assembly and surround) to the polypropylene cone in a manner that would be compatible with the specific materials involved, and would remain dimensionally stable under the tremendous G-forces generated by the motor.

Objectively the polypropylene cone outperformed bextrene (and paper) in every respect. Subjectively—and most important—it *sounded* great!

The polypropylene speaker cone signals the end of cone-generated distortion.

There are a number of significant advantages to using polypropylene instead of paper or exotic plastic for speaker cones.

When a sudden signal, or transient, is applied to any cone driver, the cone responds unevenly, rippling and flexing. These aberrations continue after the signal stops or changes; the outgoing sound dulls the clarity of the incoming music.

Our polypropylene speaker cone.

A material's ability to recover quickly from these distorted modes is called its "Q." The lower the Q, the better. Paper has a Q of 90 to 100; polypropylene 7 to 9!

The polypropylene cone, used in certain of our low frequency and mid-range drivers, is very strong. It has a high ratio of tensile stress to linear strain. Our engineers would say it has

a high Young's modulus. You'll say it sounds cleaner, more accurate.

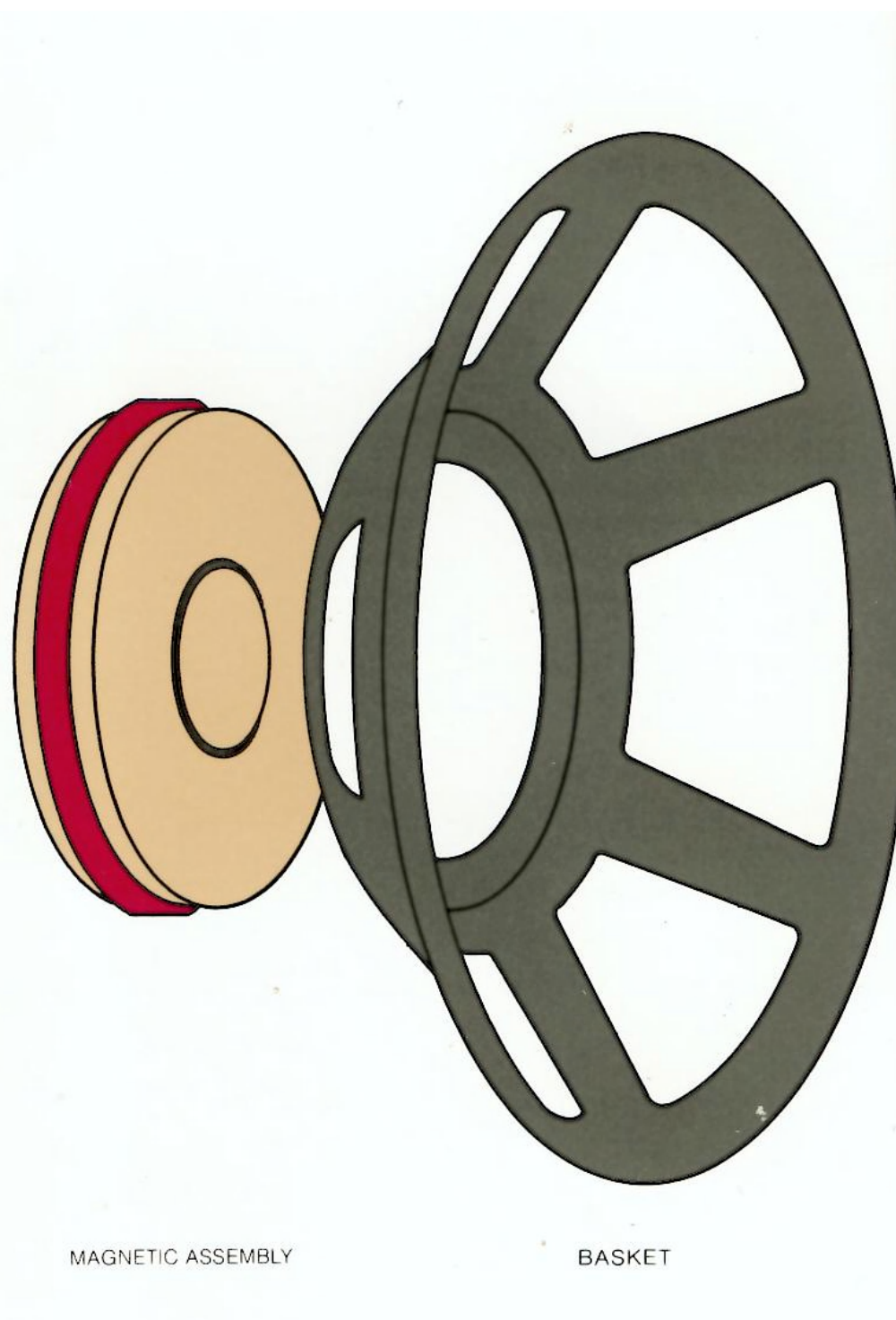
Polypropylene also forms a more effective sonic barrier against the escape of echoing backwaves from inside enclosure.

Furthermore, unlike paper, polypropylene doesn't tear, can stand

heat up to 135°C (275°F), and is not affected by humidity.

Infinity has refined the output of its already advanced dual-voice-coil woofer by equipping it with a polypropylene cone. This is why the output of our woofer exhibits such accurate midbass transients.

Infinity/Watkins



MAGNETIC ASSEMBLY

BASKET

The radically simple
Infinity/Watkins Woofer.

Efficiency vs bass response:
a solution to the dilemma.

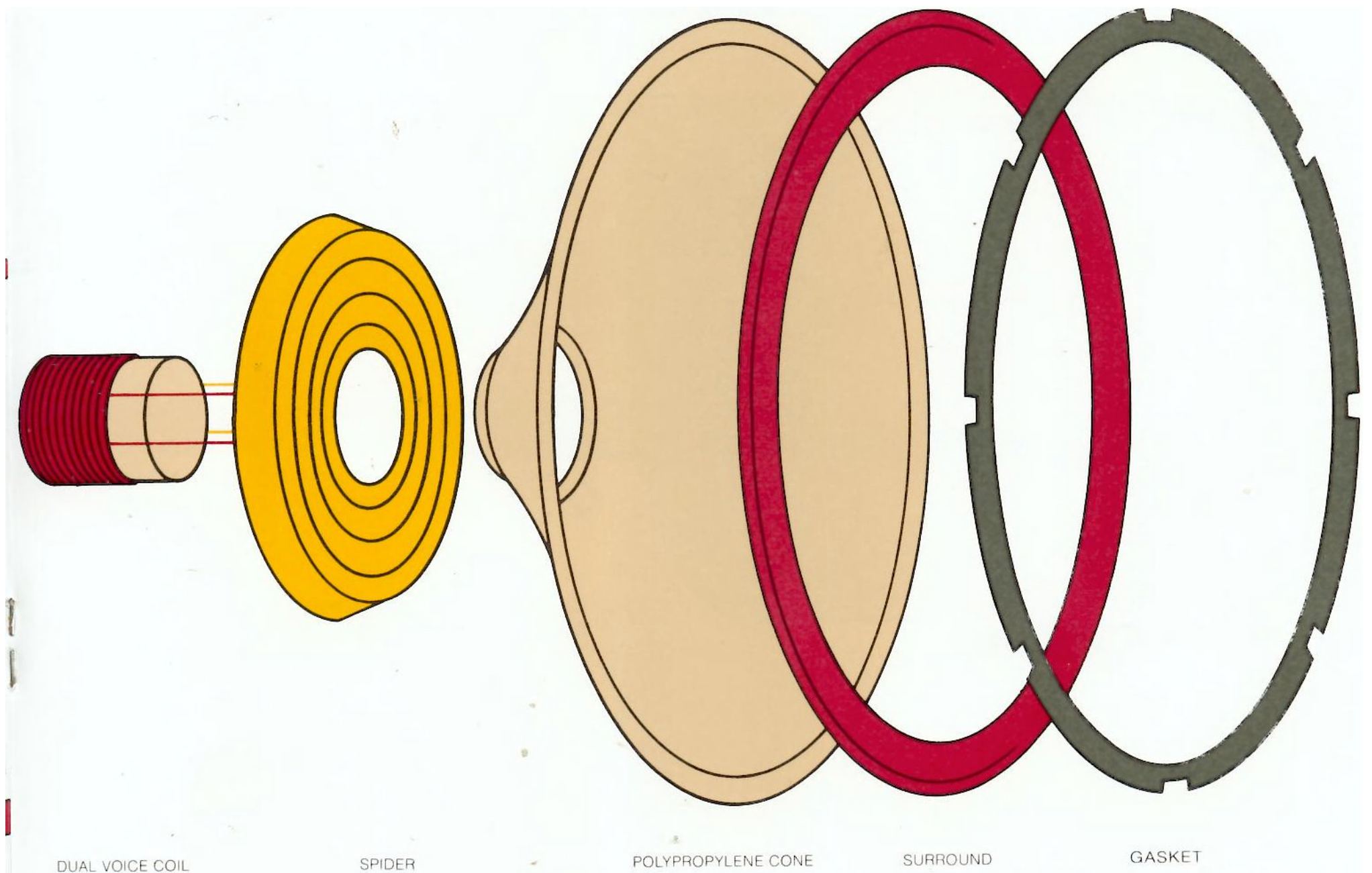
Newton's third law, familiar to all
beginning physics students, states that

" $F = MA$," or, "Force equals Mass
times Acceleration." In speaker terms,
this can be elaborated as follows: high
frequencies require very rapid vibra-
tions of the air, in which the air
molecules move extremely short dis-
tances. Low frequencies require slow
vibrations of the air, in which the

molecules move long distances.

Thus, the high-pitched whine of a
mosquito requires infinitesimal power
usage to vibrate the insect's filmy
wings at high speed for tiny distances.
However, the bass "thrum" of a great
steamship's propellers requires sev-
eral hundred horsepower to move the

Dual-Voice-Coil Woofer.



giant blades. Similarly, in the ancient, hand-pumped cathedral organs, the rippling runs of high notes through the narrow, short pipes of the upper keyboard required only an occasional swing of the choirboy's arm to replenish the chest of air. But the ponderous swells of Bach's pedal C's through 32-foot-tall pipes of huge diameter called for several of the boys to pump with holy zeal.

Similarly, in an acoustic suspension speaker, increased bass response (requiring more power to drive the woofer) has always been a corollary of decreased efficiency.

Traditionally in speaker design, if more efficiency is desired in a system of given cabinet volume, bass response must be sacrificed. Conversely, to obtain more bass, it has always been necessary to sacrifice efficiency.

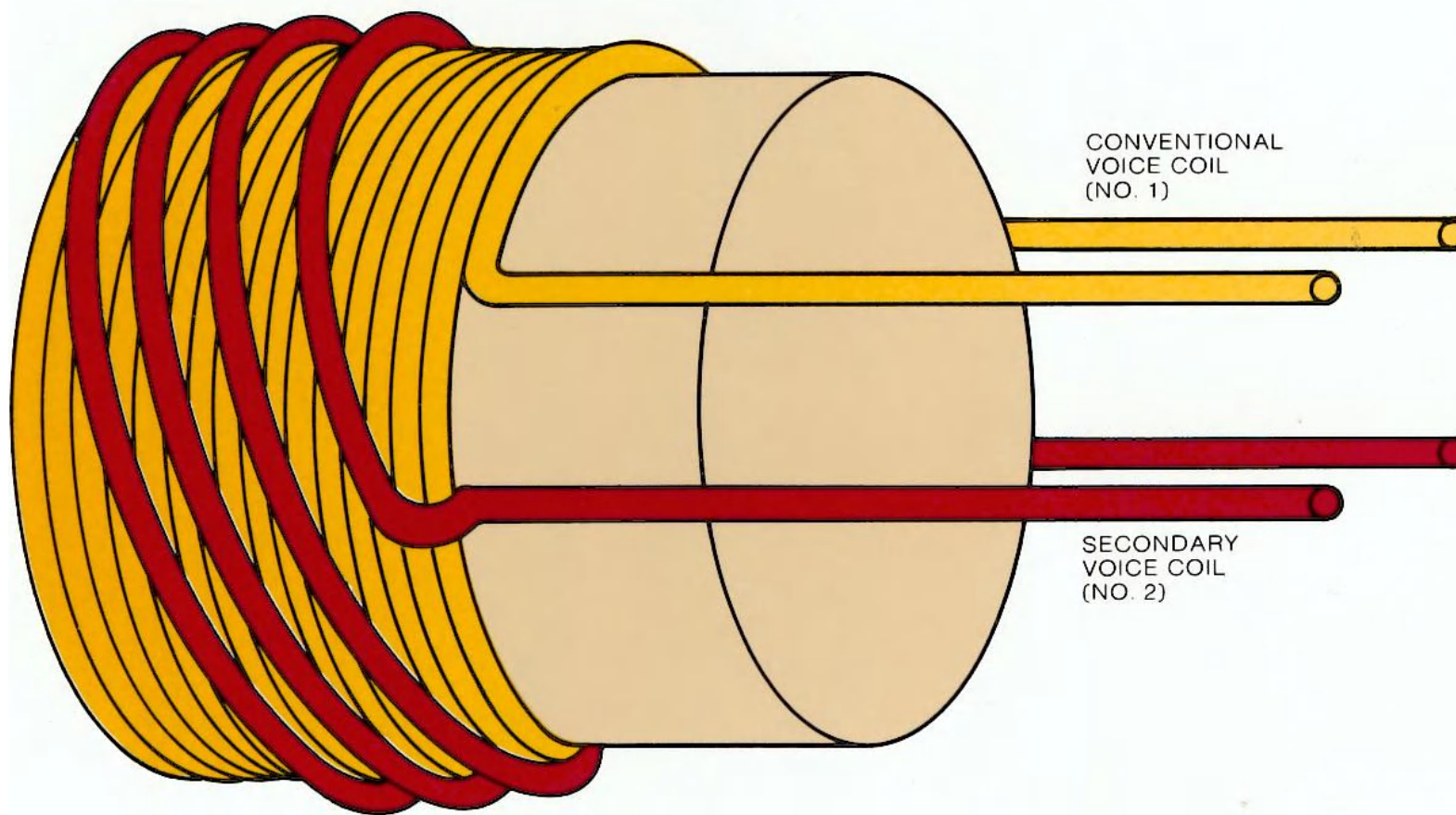
With the concept and realization of the Infinity/Watkins Dual-Drive Woofer, it becomes possible for the first time to obtain high sound-pressure levels of essentially flat frequency response *along with* high efficiency from the same speaker. Further, the device effectively eliminates the reproduction of the undesirable enclosure resonant peak with its distorting effect upon bass response.

Low bass response and "Hoffman's Iron Law."

For about twenty years, such advances as acoustic suspension woofers, transmission lines, bass reflex designs, and a variety of new materials and processes have steadily improved power-handling capabilities and midbass smoothness. Low bass frequency response, impulse response, and distortion have not significantly improved.

Infinity created the servo-controlled woofer for the state-of-the-art Servo-Statik IA. It has incredible bass performance, responding well under

Construction of the Infinity/Watkins Dual Voice Coil.



the 100 Hz level, but requires a servo amplifier to operate. This system is extraordinary expensive, and is, therefore, not the most desirable solution to the problem of powering low bass.

Altering the geometry of the enclosure in a conventional, closed-box system is not a workable solution either. "Hoffman's Iron Law" states that above 150 Hz the efficiency of a bass system, E , is equal to the system's resonant frequency (f_r) cubed and multiplied by the enclosure volume. Thus, $E = (f_r)^3 \times \text{enclosure volume}$.

The relationship implies that to raise efficiency (lessen power demand) and still maintain flat frequency response, it is necessary either to *raise the resonant frequency* or to *increase the volume of the enclosure*. Obviously, there are severe practical limits as to the size of enclosure that most persons are willing to tolerate, and so this route is not acceptable in home uses.

The other approach, increasing the flux density of the magnetic field to brute-force response, does not work, either, as shown in Figure 1:

Figure 1 shows what is commonly referred to as The "See-Saw Effect." If the motor is too small for a given speaker enclosure volume, efficiency is low and there is a bump in the bass; conversely, if the motor is too large, efficiency is gained but bass response is reduced. (This also points up the fallacy of assuming that a larger magnet will necessarily improve bass response in a speaker.) As can be seen, desired efficiency and bass response are achieved only with a motor which properly balances the two opposing see-saw characteristics.

Figure 1 shows that the *efficiency* and *bass frequency response* are

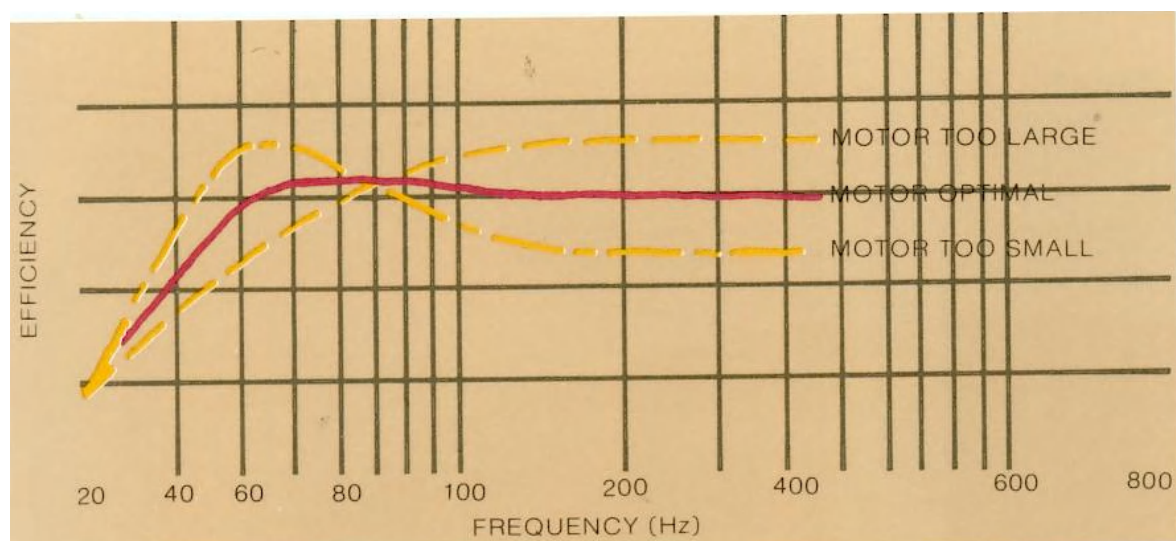


Figure 1. The "See-Saw Effect!" Efficiency vs. bass response in an enclosure of given size.

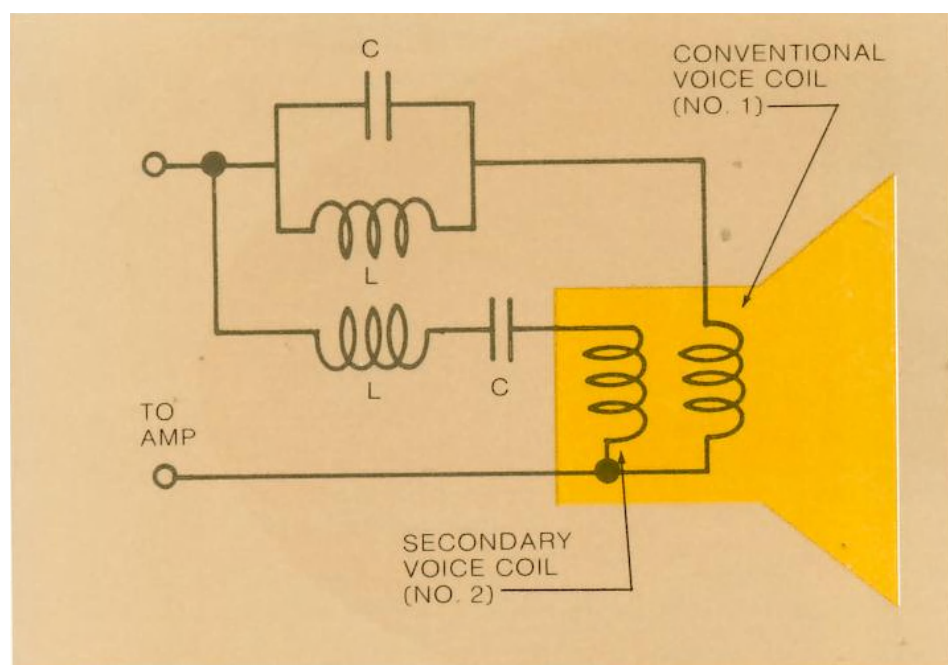


Figure 2. Principle of the Infinity/Watkins dual voice coil.

clearly predetermined for a given size box and the motor efficiency dictated by this parameter. In other words, if more efficiency is desired, bass response must be sacrificed. Conversely, to obtain more bass, it is necessary to sacrifice efficiency. This fact is well known and all high-efficiency systems (other than horns) have very limited bass response, while those speaker systems with extended bass response are of very low efficiency. This is one of those immutable laws of physics.

It will be seen by examining Figure 1 that for optimal bass response with *none* of the limitations imposed by "Hoffman's Iron Law," one needs a *varying* motor strength. For good efficiency above resonance a large

motor is needed, and for good bass efficiency a smaller motor is necessary. Must we repeal the laws of physics to accomplish this?

William Watkins faced this enigma in a brilliantly ingenious fashion. He realized that the motor strength was equal to the product of the magnetic field strength of the magnet and the *length* of coil contained within the magnetic field; that is:

Motor strength = $B \cdot l$, where
 B = magnetic field strength
 l = length of coil in the magnetic field.

He then began to look at the $B \cdot l$ product in a different way. He reasoned, suppose l could be, in effect,

varied with frequency in such a manner that a lower value of $B \cdot l$ in one frequency range would not affect a higher value of $B \cdot l$ in another range and vice-versa. Watkins, at this point, began to see clearly how to solve this enduring problem, and also how to embody it in a loudspeaker system.

The Infinity/Watkins Dual-Drive Woofer

Figure 2 shows the mechanization of the principle. A second voice coil is wound over the conventional voice coil, and is driven by a series LRC (inductance-resistance-capacitance) resonant circuit adjusted to resonate at the fundamental resonant frequency of the woofer in the enclosure.

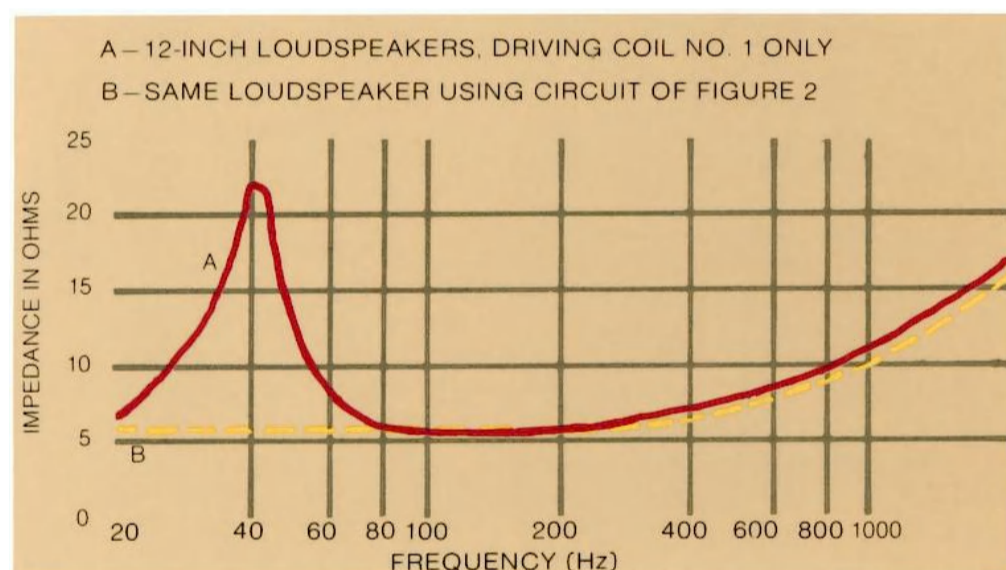


Figure 3. Effect of the Infinity/Watkins dual voice coil on impedance.

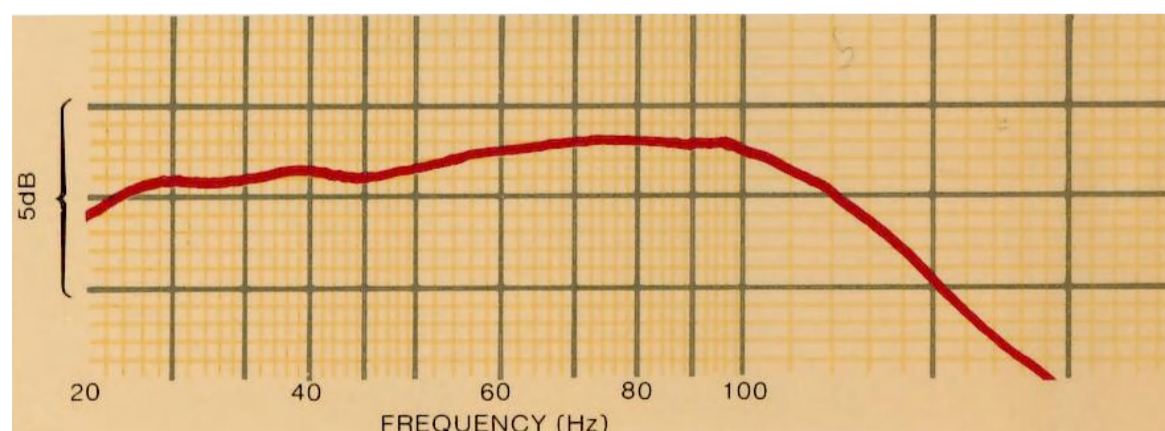


Figure 4. Frequency response of two Infinity/Watkins woofers in an enclosure of 4.5 cubic feet internal volume, measured near-field including microphone loss. Roll-off above 100 Hz due to crossover.

In addition, it can be shown that if the main voice coil can be disconnected at resonance, a further increase in acoustic output occurs. This can be accomplished with a parallel LRC resonant circuit in series with the main voice coil.

The conclusion, then, is simple. With proper design of inductor L and capacitor C, the LRC circuit presents almost zero impedance one octave either side of resonance, to effectively remove the secondary voice coil from the current. Furthermore, the parallel LRC circuit in series with the conventional voice coil effectively removes it from the circuit at resonance. Therefore, instead of the

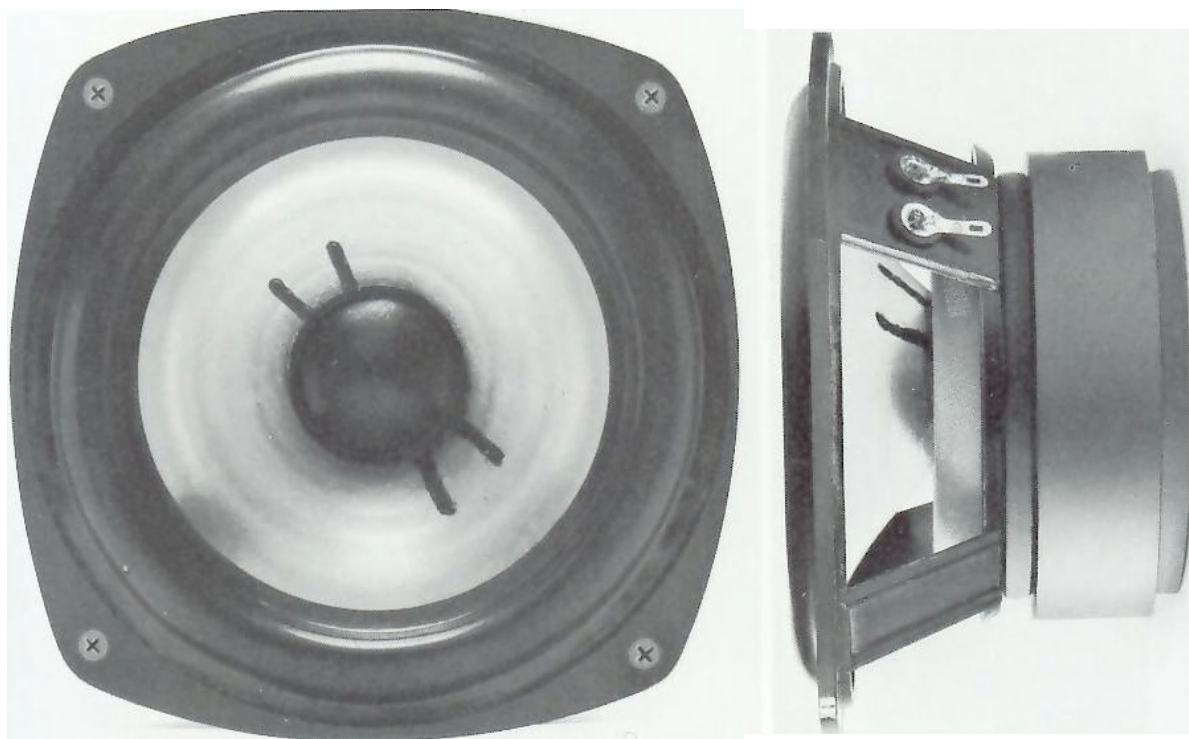
usual large increase in impedance at resonance, the impedance will remain virtually constant throughout the *entire* bass range.

At this point, it should be noted that Mr. Watkins did not violate the laws of physics. A second motor is merely added, which, because it is of different size, generates less back-EMF and presents lower impedance to the driving amplifier, allowing more *wattage intake* to the speaker in the area of resonance (essentially, the resonance is eliminated), thereby providing more bass response.

Watkins is simply using the wattage that was there all the time in a given power amplifier, but was never being used in the bass range because the

impedance barrier at resonance (see Figure 3) prevented it from being accepted.

What has been embodied in the Infinity-Watkins Woofer is a revolutionary, yet simple, solution to the problem of extracting bass frequencies from a box. The extraordinarily wide and linear frequency response (see Figure 4), the almost perfect impulse response, and the relatively high efficiency are truly a panacea. The listening experience takes on a new dimensional quality, a relaxed ease of almost over-powering low-frequency energy, like live music itself.



THE 5 INFINITY/WATKINS DUAL VOICE COIL WOOFER
ALSO HAS OUR POLYPROPYLENE CONE

The Infinity system approach to musical reality.

Meticulous care is given to designing each driver in the Infinity system — as well as the system as a whole. For example. Infinity crossover networks allow only the *correct* band of the music to reach the driver, and are also used to help preserve perfect phase linearity. The capacitors used on our EMIT tweeter are metalized mylar instead of non-polar electrolytics. (Non-polar electrolytics change their characteristics at high frequencies, thus degrading sound quality.)

Phase linearity is also preserved by the proper placement of the various drivers in the enclosure.

Infinity enclosures are carefully constructed of dense, compressed wood panels, integrally braced to resist vibration and flexing. Internal damping of the enclosure is critical. We found that traditional fiberglass or foam lining materials were not sufficient. Through experimentation, we learned that dacron of a specific, critical density and in just the right amounts, improved extreme and mid-bass clarity, optimizing performance of the woofer/enclosure systems in addition to absorbing internal reflections.

The result is that final enclosure and system design can only be resolved after countless measurements and listening tests.

Most Infinity enclosures are finished in high quality oak solids and veneer and each is furnished with a handsome, removable, acoustically transparent grille.

Infinity. For those who prefer the sound of music to the sound of speakers.

Our commitment to the ideal of absolute accuracy in musical reproduction separates Infinity from the popular trend toward manufactured distortion in speaker design.

In no Infinity speaker will you find the exaggerated “sizzling” highs, the exaggerated heavy “peaked” bass, the grossly exaggerated diffraction of groups of drivers spraying their sound off the walls —all forms of distortion that are highly advertised and frequently desired by many possibly unsophisticated speaker buyers.

Such speakers add *their own sound* to the sound of the music *whether that sound was recorded or not.*

We have always felt this to be a disservice to the musicians, to the producers of the session, and to you, the listener.

We believe that music deserves to be heard *exactly* as it was produced at the source. We resolve to add nothing.

The result is that Infinity speakers have virtually no characteristic sound of their own: their personality becomes the personality of the music

— whatever it may be. We strive to make our speakers virtually disappear; to let you find yourself listening instead to the performers.

That is why Infinity speakers are ideally suited for *all* kinds of music —whether classical, rock, folk, jazz, vocal, ethnic or electronic.

You can expect this from Infinity speakers at every price level:

- the best possible balance between cost, size and performance based on advanced technology.
- a respect for musicianship as well as engineering —which translates into unparalleled clarity of detail and overall musical balance.
- a never-ending series of musical revelations, even from your most familiar records: the delicate sheen and the robust body of a well-resined bow cutting through a cello sonata; the tight snap of a rock bass drum; the clean articulation of the drumstick and the liquid brilliance of a brace of Ziljian cymbals driving the brass section; inner details you never heard before from a favorite symphony; imaging so accurate you could actually tell where the musicians are sitting or if the soloist moves around the stage.

This is what Infinity products are all about. And this is why you'll live with them happily.

For a good long time.



Loud and Proud

HIFI GOTEBORG.se a



WANT TO RELAX TO BEAUTIFUL
MUSIC

WELCOME

WE HAVE GOOD HIFI AT YOUR
SERVICE

PLEASE WAIT HERE & A MEMBER
OF OUR TEAM WILL BE WITH
YOU SHORTLY.

Or press finger HERE