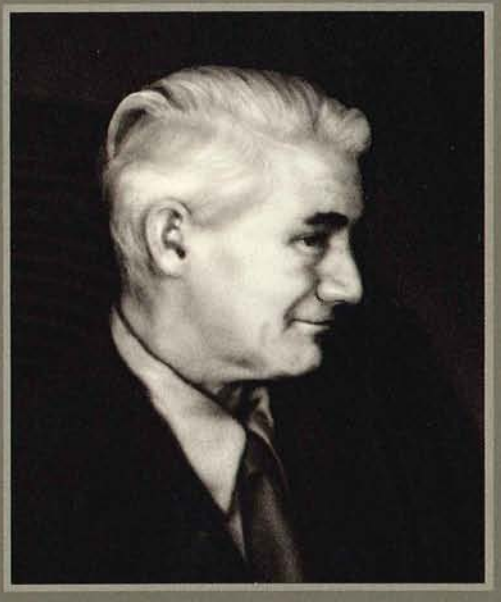
INSIGHT: JBL



AN INTRODUCTION TO JAMES B. LANSING:
THE MAN, THE COMPANY, THE PRODUCT

INTRODUCTION

Insight is intended to familiarize the reader with the fundamentals of loudspeaker design and production.

We have included a brief historical narrative that describes James B. Lansing's pioneering efforts and the reasons for JBL's preeminent status as a manufacturer today.

After you've read it, we hope you'll be in a better position to judge for yourself the differences between good and bad loudspeakers, and more importantly, between good and great loudspeakers.

THE BEGINNING

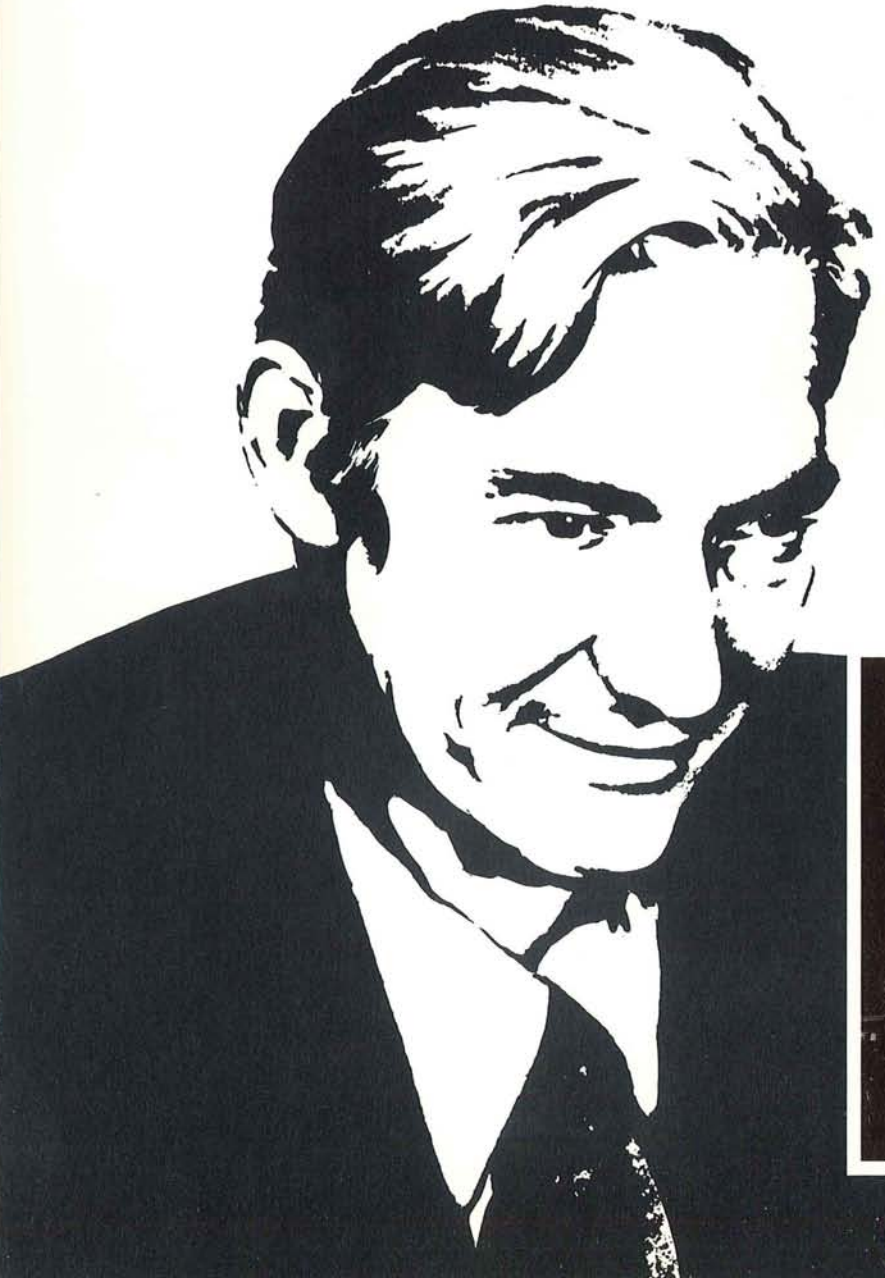
Some 40 years ago, on a night in Fall 1934 when James Bullough Lansing put the finishing touches to his first professional loudspeaker system, JBL high fidelity sound as we now know it was born.

That system was an audio perfectionist's dream. It contained a 15-inch low frequency unit mounted in a large bass reflex enclosure and a powerful horn-loaded compression driver for treble frequencies, each matched to the other by a state-of-the-art dividing network. It had been designed and hand built by Jim Lansing for the most demanding applications of the period – motion picture sound studios and theaters.

The motion picture industry had just entered the era of "talkies." Loudspeakers in use at that time were reasonably wide range but lacked the crisp, transparent sound, the clear definition and the substantially increased efficiency provided by Jim Lansing's first studio system.

It was an immediate success in the industry and became the first of a distinguished line of loudspeakers – the speakers that have established a standard known today as the "JBL Sound."

Times and technologies have changed. Today the ultimate challenge to a loudspeaker system has moved from the motion picture studio to the recording studio, where 2-inch magnetic tape used in conjunction with 30 inches per second



recorders far surpasses the quality of sound possible on film.

Today's recording studios use mixing consoles so sophisticated that it is possible to modify an original recorded sound beyond recognition, to add minute amounts of reverberation over a narrow range of frequencies, to amplify a signal to extraordinary levels without distortion – and to combine all these elements into infinitely complex wave forms. And in those studios the monitor loudspeakers must recreate these signals – sometimes whisper-soft, sometimes at levels approaching the threshold of pain – with verbatim accuracy.

Yet, despite all the spectacular advances in recording technology, an arresting parallel exists between today and 1934.

If you were in the control room of a major recording studio such as Electra or MGM right now, standing before the mixing console with its vast array of meters, indicator lights, slide switches, pushbuttons and pan pots, you'd find suspended from the wall or ceiling – and aimed directly at you – big bass reflex enclosures containing 15-inch low frequency drivers and powerful horn-loaded compression drivers, all perfectly matched by state-of-the-art dividing networks.

JBL Studio Monitors. Remarkably similar in concept to that first studio speaker Jim Lansing designed and hand built those 40 years ago.

The present monitors have, of course, far wider range, handle much more power, and offer vastly superior fidelity. But the essential design philosophy and manufacturing methods that make the original such an outstanding product are still very much in evidence. James B. Lansing's commitment to quality and efficiency is still there, and his dedication to craftsmanship continues unchanged. And most important, the "JBL Sound" is still there. In many ways better than ever.

HISTORY: JBL; MAN & COMPANY

As recently as the beginning of the 20th century the most dedicated music lover could spend an entire lifetime without hearing more than a fraction of the world's finest music. Today, at the flick of a switch, we can hear the gamelan of Bali, the Vienna Philharmonic, rock groups, jazz groups or the songs of Wales, in the comfortable surroundings of our own homes. And with equipment that achieves an uncanny likeness to the original performances.

As is so often the case with achievements of such profound significance, the total commitment of a few pioneers was what made it possible. James Bullough Lansing was such a pioneer.

There is precious little information about Jim Lansing's early years. We know that he was born into a large family in the Midwest. We know that he left home at age 14 to pursue a variety of undocumented activities, which led him eventually to Los Angeles. It was here, in his middle 20's, that he became deeply involved with a challenge that was to consume his time and energies for the balance of his life.

The time was the 1920's, the age of that wireless wonder, radio. And for all of us who today are involved in the art and science of sound reproduction, it is fortunate that Jim Lansing became fascinated by one particular aspect of this new phenomenon, the component known as the "Loud Speaker." For it

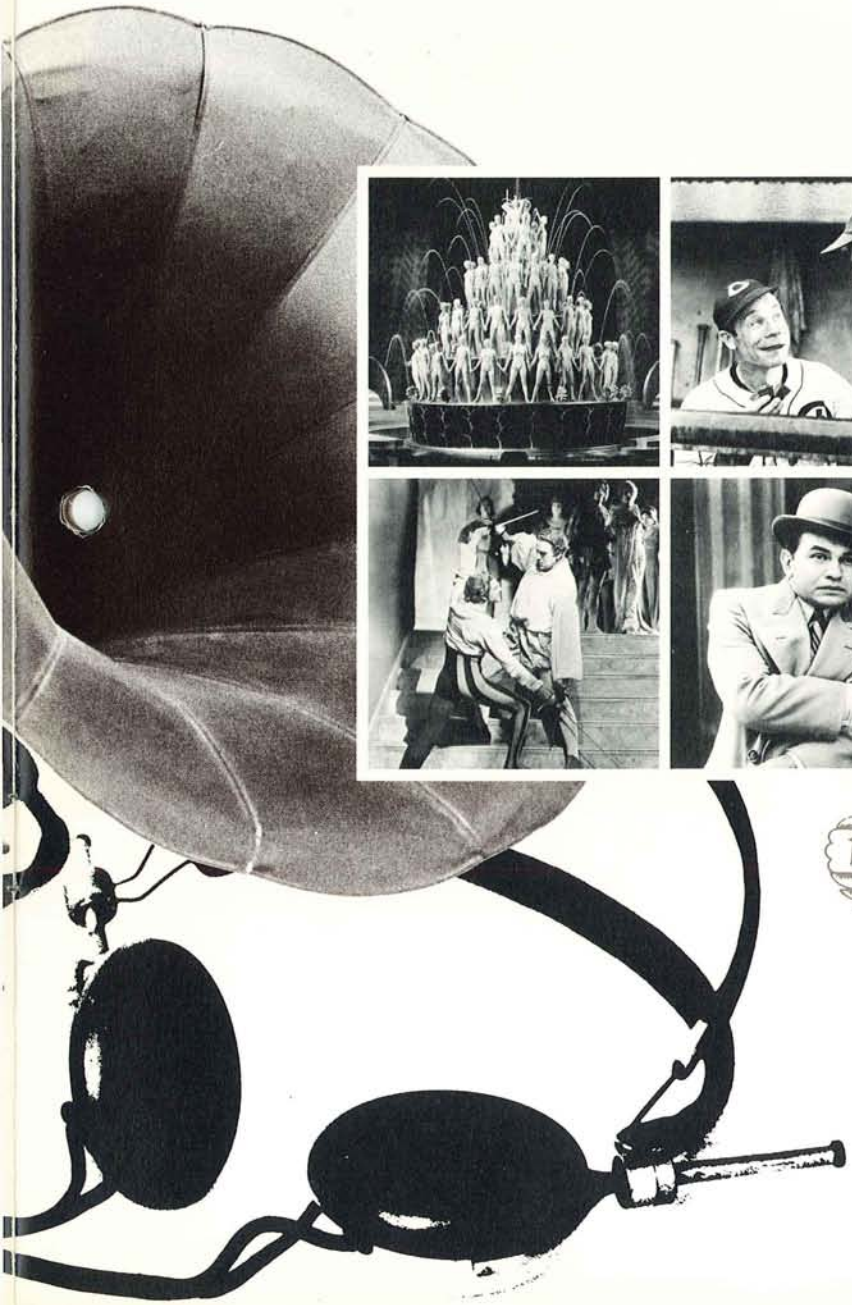
was this primitive electromechanical device that inspired him to a lifelong involvement in the design and manufacture of superior mechanisms for the reproduction of music.

Shortly after his initial encounter with loudspeakers, Jim Lansing joined in a partnership with businessman Ken Decker. Together, in a small shop on the outskirts of Los Angeles, they began the manufacture, under contract, of loudspeakers for the rapidly expanding radio and phonograph industry. This modest beginning was the forerunner of the Lansing Manufacturing Co., established in 1929.

During the '30's, Warner Brothers, one of the giants of the motion picture industry, introduced "talking pictures" with a process called Vitaphone. Talkies were an overnight success, thrilling millions of theatergoers who were hearing the voices of their film heroes and heroines for the very first time. Soon piano and organ accompaniments to the projections on the silver screen were fond memories.

Talkies created a tremendous demand for efficient, wide range loudspeakers that were capable of filling large theaters with sound. Since existing loudspeakers left much to be desired, the Western Electric Co. (which supplied the motion picture and recording industry with every possible type of sound reproduction equipment) assigned a team of several hundred engineers to explore all possible approaches to the problem. Although many of the team's designs and concepts looked promising theoretically, they failed in practice. Thereafter, Western Electric sought assistance from several individuals already involved in the manufacture of loudspeakers.

One was Jim Lansing. He provided valuable assistance to their engineers, producing such innovative designs as his extremely efficient compression drivers and edgewound ribbon voice coils. Improved versions of the designs he developed with Western Electric



Western Electric
MIRROPHONIC
SOUND SYSTEM

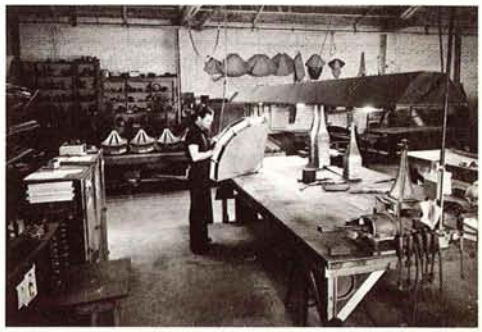
were incorporated into his first professional loudspeakers. These became so successful that he discontinued manufacturing the more conventional units for radios and phonographs and turned his efforts full-time to the design and construction of high quality loudspeaker systems, power amplifiers, dividing networks and DC power supplies intended specifically for use in the finest theaters and motion picture sound studios.

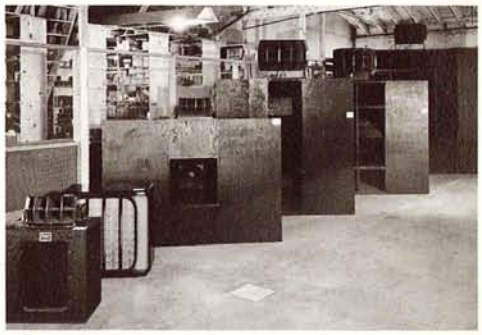
In 1938 Ken Decker was killed in an airplane crash. Two years later, Lansing, who was far more a creative engineer than a businessman, reluctantly sold the firm to a group of engineers formerly associated with Western Electric's Electrical Research Products Division. The new organization was called Altec Theater Service Corp. When Jim Lansing accepted their invitation to join as Vice President, a new company was created under the name Altec-Lansing, a company which continues to function today, but is independent of JBL.

Lansing served as Vice President until 1945, when he decided to leave in order to form his own enterprise. In 1946 he and William H. Thomas, former general manager of Marquardt Aircraft Co., established an association that resulted in James B. Lansing Sound, Inc.

Bill Thomas, fully realizing the vast potential of Lansing's ingenuity and ability, persuaded Marquardt to provide space and financial support to the new corporation. This gave JBL the boost it needed in its early days and gave Jim Lansing the freedom to lose himself in his work, experimenting, perfecting, frequently not leaving the factory for days at a time.

In 1947 he created the D130, undoubtedly the most outstanding extended range loudspeaker ever made. Even today it is considered extraordinary, reproducing an extremely wide range of frequencies by virtue of a 4-inch edgewound voice coil, pneumatically formed aluminum center dome, special curvilinear cone, massive Alnico V magnetic structure and unmatched efficiency.

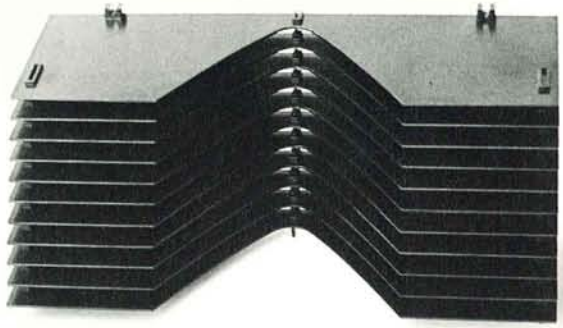


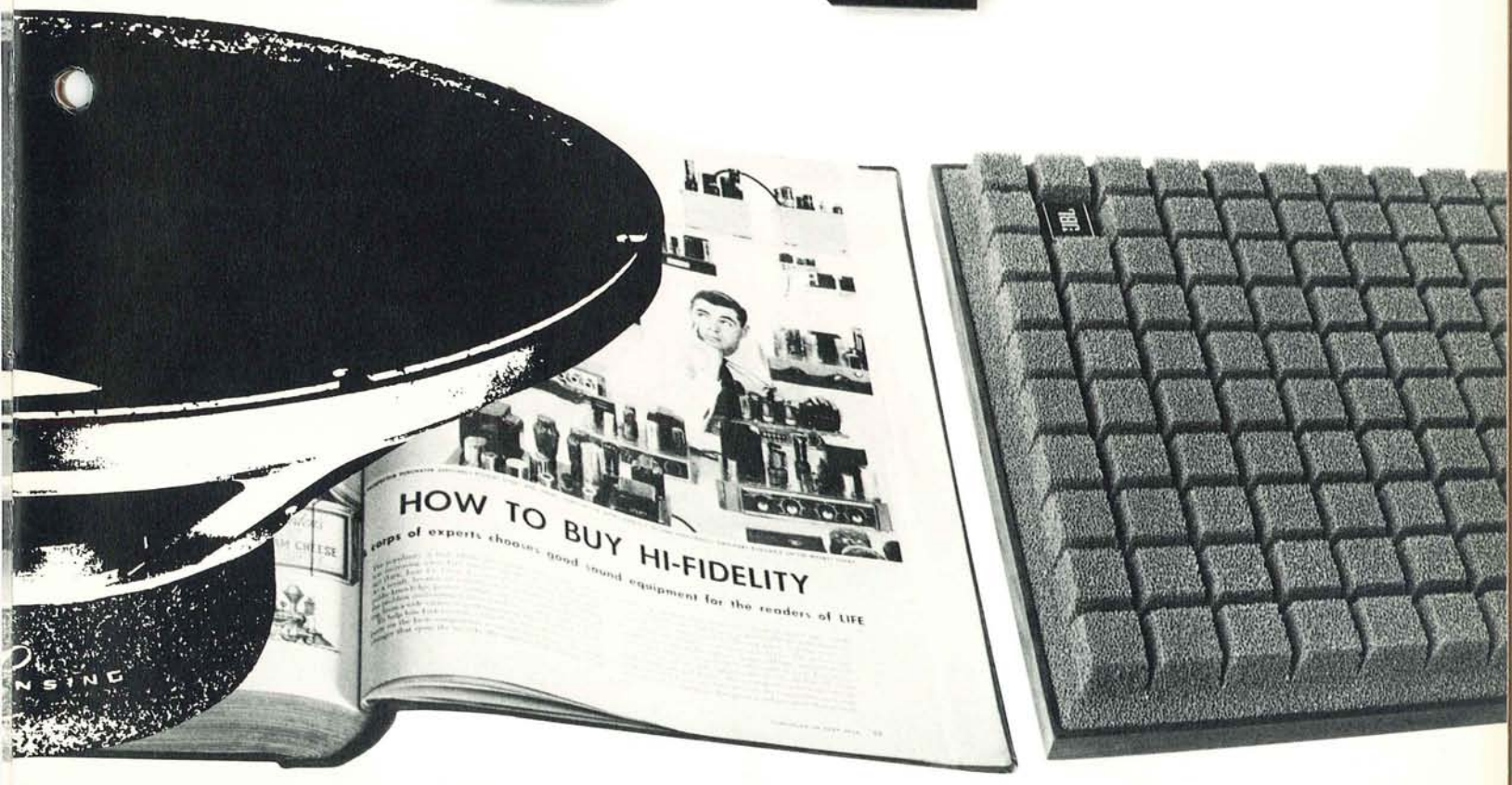


In 1949, at the very pinnacle of his career, James B. Lansing died. Bill Thomas succeeded him as president of JBL and slowly expanded the enterprise in response to the enlarging interest in high fidelity sound that was developing throughout the country. Then, in 1955, LIFE magazine published a survey of the hi-fi phenomenon and listed JBL's Hartsfield system as the "ultimate dream speaker." This established JBL at the forefront of the industry, where it has remained ever since.

The Hartsfield symbolized the great tradition of innovation that subsequently produced such outstanding systems as the Paragon, Olympus S8R, Lancer 99, Century L100, Studio Master L200, and, most recently, the L26 Decade. Since its inception James B. Lansing Sound, Inc. has been responsible for the development of many significant advances in loudspeaker technology and visual design such as the acoustic lens, the passive radiator, the edgewound ribbon voice coil, the ring radiator, and the use of acoustically transparent foam as grille material. As a result of JBL's enthusiastic professional acceptance in the audio industry and by discriminating listeners at home, the company has grown from fewer than 40 employees at its inception to more than 1000 in our present facilities.

But growth has never altered Jim Lansing's original guiding principle: to design and manufacture the world's finest loudspeaker systems—precision instruments that are products of pride and craftsmanship.



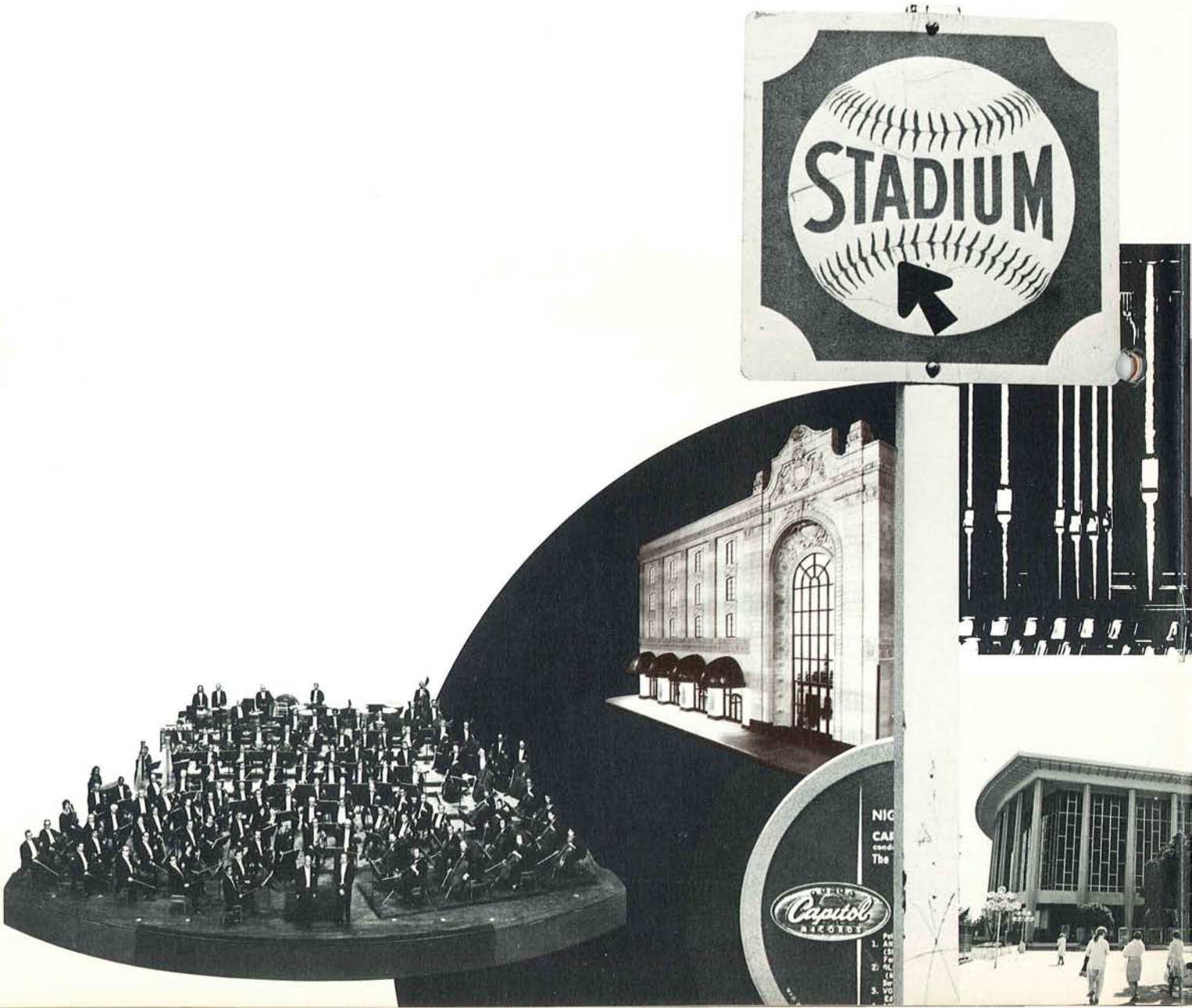


DESIGN: THEORY & PRACTICE

JBL is a leader in its field. It has attained this position by an unswerving commitment to quality, to creative engineering and research programs, to professional performance standards, and to the finest craftsmanship.

Of all loudspeaker manufacturers, JBL maintains by far the most active and creative product development program. Our engineers are constantly investigating new audio concepts and original ideas in loudspeaker design, electronics, materials and are encouraged to explore related areas of technology that may lead to rewarding directions. In some cases our engineers have spent years on products which ultimately didn't measure up to our basic criterion: that a new product must contribute to the advancement of the art and must perform demonstrably better than anything else in its class before it is produced by JBL.

JBL has an enviable reputation with audio engineers and professional musicians. Our speakers are generally preferred by audio contractors and acoustical consultants for installations requiring the highest in efficiency, sound pressure levels and realism. The Mormon Tabernacle in Salt Lake City, Los Angeles Music Center, Dodger Stadium, Yankee Stadium, Heinz Hall in Pittsburgh and the Phoenix Coliseum are just a few of the locations where JBL loudspeakers are used in extremely

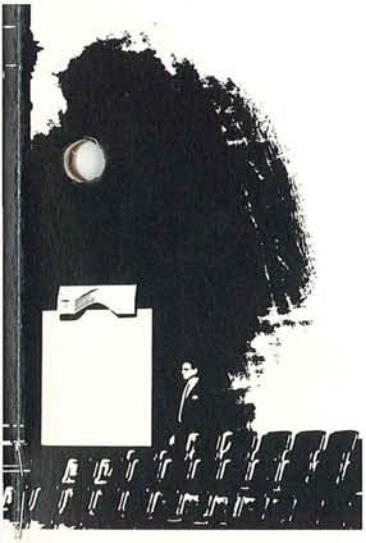


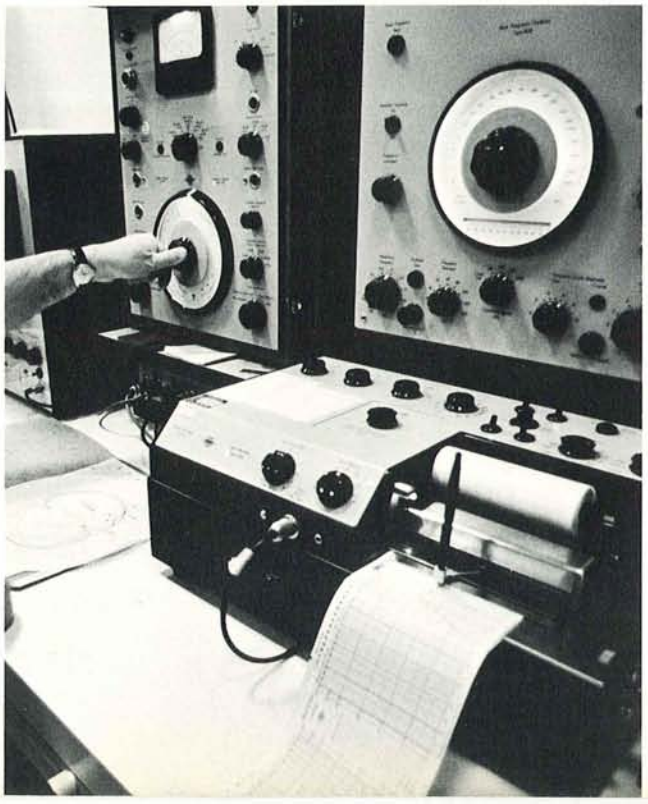
demanding professional applications. Additionally, JBL studio monitors are the preferred working tools of recording engineers at studios such as Angel, Capitol, Deutsch Grammophon, Electra, EMI, London/Decca, MGM, RCA, Reprise, Motown and Warner Bros.

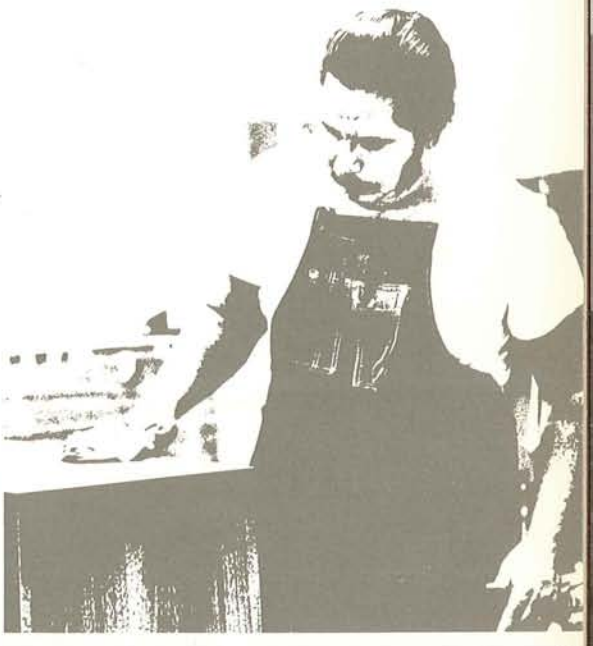
JBL stands for unequalled craftsmanship. We manufacture every loudspeaker in our own factory, whereas most loudspeaker manufacturers purchase components from mass producers of high production assemblies used typically in table radios and TV sets. In our own facilities JBL furniture is painstakingly handcrafted. We design and build our own frequency dividing networks to insure the precise interaction of associated components. We design and build our own test equipment and tools to further support our rigorous quality controls.

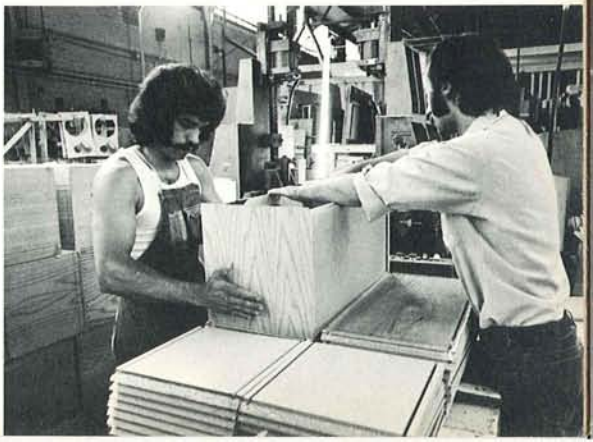
In sum, we don't buy networks, cabinets or loudspeakers from other manufacturers because our design philosophy requires us to design, engineer, manufacture and inspect every single part of every system ourselves. It is only by precisely machining and hand assembling each component, using special production techniques and tooling designed by our engineers and built in our factory that we can maintain the traditional quality and consistent product integrity signified by the initials "JBL."

We at JBL learned years ago that certain processes, certain design parameters and materials used in concert with unique machining and assembly methods, can yield sound superior to that indicated by laboratory tests. In practice this means that we begin our design process by assessing the highest industry standards and then refine both engineering and manufacturing techniques until precisely the desired results are reached. At JBL optimum frequency response curves aren't the goals—they're simply the base on which we build in our constant attempt to reach the goal of perfect sound reproduction.







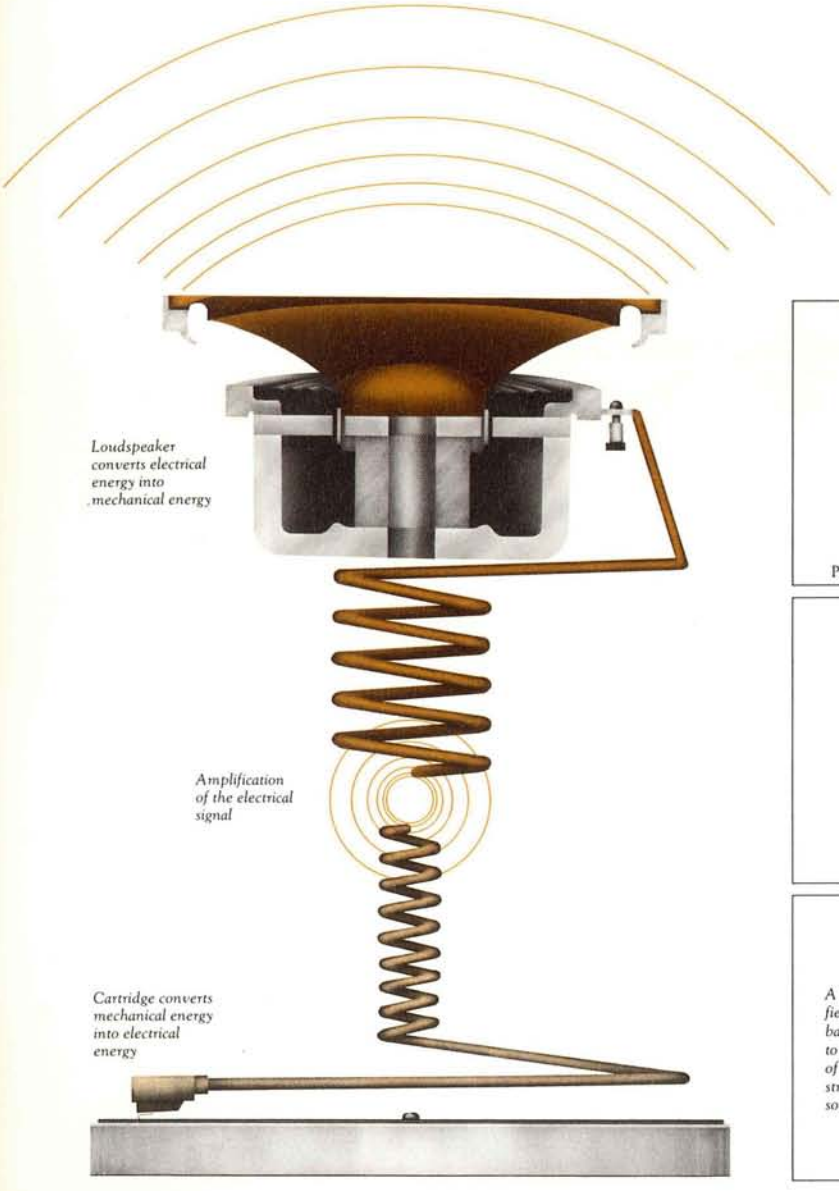


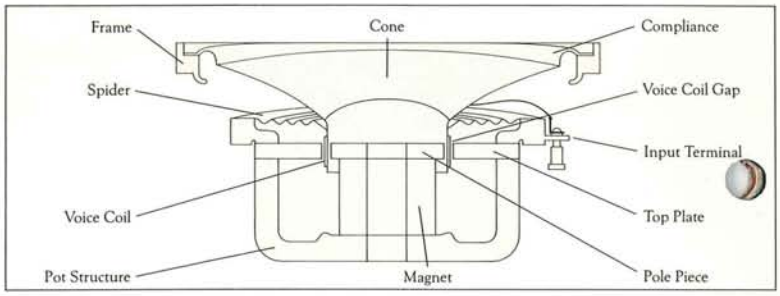
ANATOMY: INSIDE/OUT

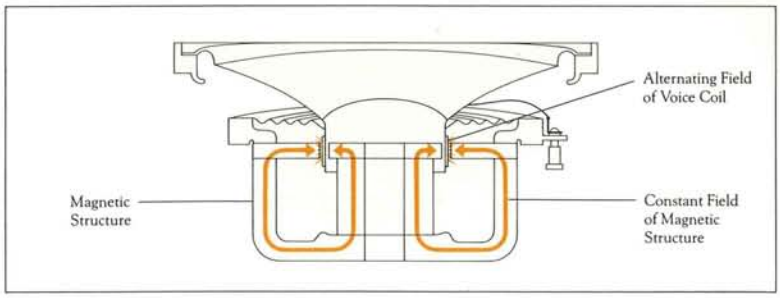
An amazing sequence takes place when the minute impressions on a vinyl disc are changed into sounds that recreate the physical sensation of a giant pipe organ or the delicate ring of an orchestral triangle. First, the mechanical energy generated by the stylus riding along the grooves on the surface of the phonograph record is converted into electrical energy by the phonograph cartridge. Then it is divided into two separate channels, strengthened by the amplifier and sent to the loudspeaker. Finally, in the loudspeaker it is converted back to mechanical energy and is perceived as sound by the listener—all in the merest fraction of a second.

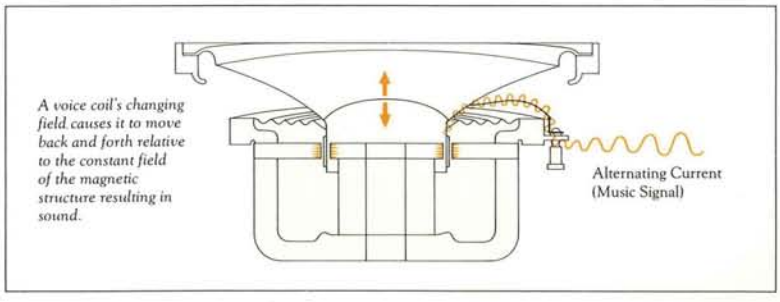
How the loudspeaker does it—the functions performed by each component in the system, why loudspeakers of approximately the same size and shape produce vastly different results, why high quality loudspeakers manufactured to critical tolerances cost more, are more efficient and deliver smoother, more accurate, better sound than less expensive, mass-produced units—these are the questions you'll find discussed in the following pages.

Magnetic Assembly The sound that emanates from a loudspeaker comes from the interaction between the varying electrical signals causing the voice coil to generate a magnetic force in the fixed field of the permanent









magnet. The fixed field is created by using a magnet housed in a structure that concentrates the maximum available magnetic energy in the voice coil gap where that interaction takes place. That structure is called the magnetic assembly.

Although there are many differences between the magnetic assemblies used in mass-produced loudspeakers and those of precision instruments, both structures utilize the same essential parts: pole piece, top plate, pot structure, and permanent magnet.

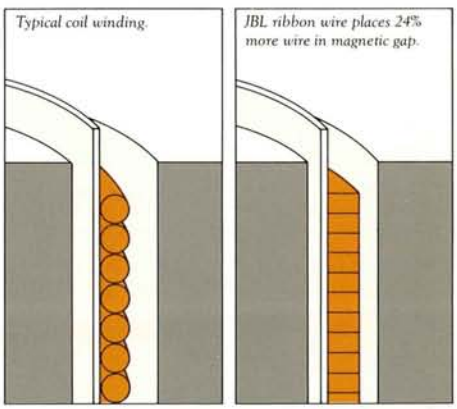
The JBL magnetic structure uses a massive, low reluctance iron pot that encloses the magnet and carries the magnetic force from the magnet on through the top plate across the gap to the pole piece and back to the magnet. The top plate and pole piece are precision machined, special magnetic iron plates designed to distribute the energy exactly throughout the voice coil gap.

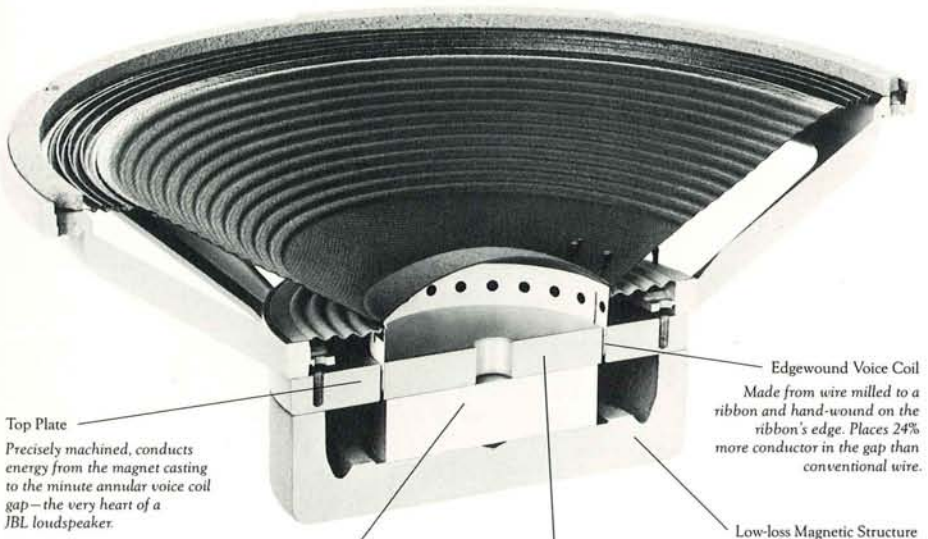
The physical size, shape and arrangement of these parts varies. A magnet may be long and thin or short and squat: it may be a slug, a ring or a "W." But whatever its shape, the sole purpose of the magnetic assembly is to provide a concentrated magnetic field in which the voice coil will operate.

Voice Coil The voice coil consists of tightly wound wires suspended in the voice coil gap, the interaction between the varying field induced in the coil by the signal and the fixed field of the permanent magnet produces alternate attraction and repulsion. This movement which is a mechanical analog of the electrical signal causes the radiating surface to create the phenomenon of sound.

The amount of energy depends not only on the strength of the magnetic field and the amplified signal, but also on the amount of voice coil wire. The amount of wire that can be placed in the gap is determined by two factors—the diameter of the gap and the design of the coil. High quality loudspeakers use the largest coils possible.

The amount of wire can also be increased by fabricating a coil that takes maximum advantage of the space provided. JBL flattens the wire into a thin ribbon then hand winds it on its narrow edge so there is virtually solid wire filling the entire gap. Most mass-produced speakers use voice coils made of round wire, primarily because they can be wound inexpensively by automated machinery. However, round wire, due to its very geometry, wastes valuable space by creating "valleys" between each turn. Additionally, the roundness reduces the number of turns that can be wound in a coil of a given depth.





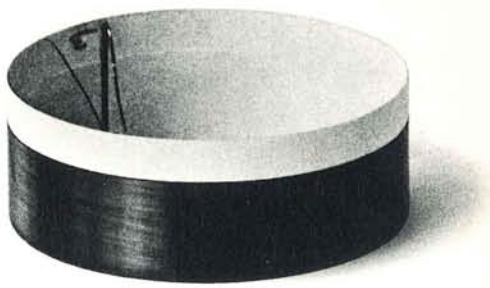
Top Plate
Precisely machined, conducts energy from the magnet casting to the minute annular voice coil gap—the very heart of a JBL loudspeaker.

Edgewound Voice Coil
Made from wire milled to a ribbon and hand-wound on the ribbon's edge. Places 24% more conductor in the gap than conventional wire.

Low-loss Magnetic Structure
Massive, low reluctance iron pot structure carries the magnetic force directly to the top plate.

Alnico V Magnet
Approximately 2½ times more powerful than a ceramic magnet of comparable weight.

Pole Piece
Conducts magnetic energy to the exact center of the voice coil gap. Precision machined of special magnetic iron.



Radiating Surface The radiating surface is the component that moves in response to the movement of the voice coil when it has been energized by the program signal. This movement pushes the air in front of it, causing varying pressure waves we know as sound. In low frequency units, the radiating surface typically consists of a large, relatively heavy cone. Mid and high frequency units use a smaller cone, dome, inverted dome, or in the case of compression drivers, a formed diaphragm. These radiating surfaces vary widely in shape, composition and weight, depending on the characteristics sought by the designer. A "paper" cone (usually a combination of selected fibers manufactured into an extremely stiff, felt-like material) for example, should be rigid enough to move the required volume of air without flexing (commonly called "break-up"), but not so heavy that it cannot respond quickly to rapid signals emanating from the amplifier.

In some cases, damping or "braking" material is applied to the surface of cones to optimize their mass and stiffness. Cones are also shaped in various ways to provide optimum performance within the frequency range for which they are designed.

The diaphragms employed for the high frequency compression drivers must be very precisely shaped and are usually made of a rigid, lightweight material such as aluminum or phenolic-impregnated cloth.

Rather than formulate a specific material and design for each type of radiating surface, many mass-produced loudspeakers use readily available "all purpose" cones or diaphragms. These may compromise the extremely critical relationship that exists between the mass of the dynamic assembly (voice coil, radiating surface, surround, spider) and the driving force available in the magnetic assembly, limiting performance at all sections of the frequency range.

Spider The spider is a flexible device that keeps the voice coil centered perfectly in the voice coil gap and which prevents cone wobble (side-to-side rather than the intended in-out movements), even when a speaker is being driven to its maximum capacity. Most often made of a resin-impregnated fabric, it is attached to the cone and to the portion of the frame closest to the voice coil. In precision machined loudspeakers the voice coil clears the inside of the top plate and pole piece by scant thousandths of an inch; therefore, critical location of the spider is absolutely necessary to prevent the coil from rubbing on the adjacent surfaces of the magnetic gap.

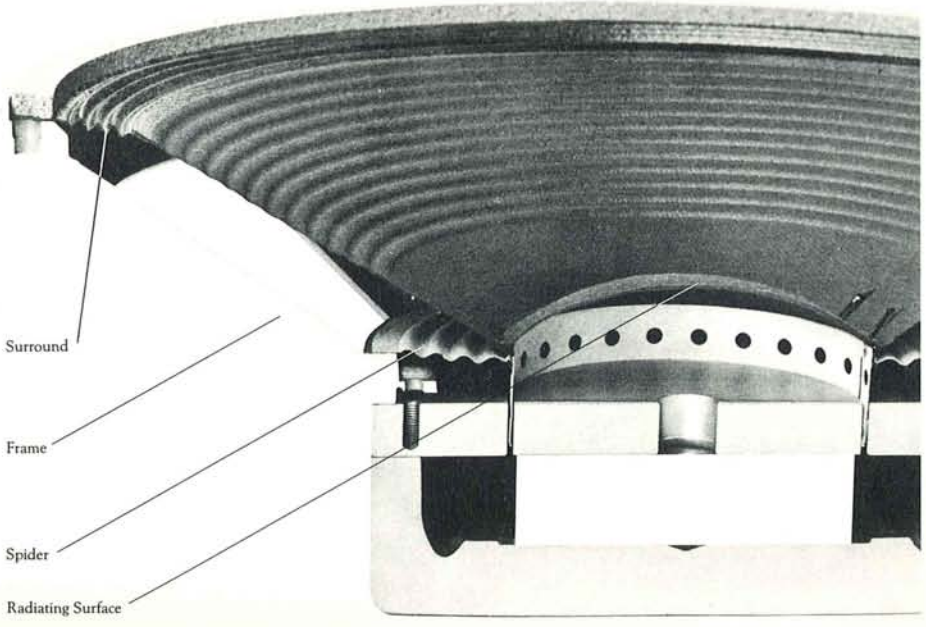
Surround The surround (also called the compliance, cone termination or suspension) is the outer edge of a cone that attaches the dynamic assembly to the perimeter of the loudspeaker frame. It, like the spider, keeps the cone precisely centered and permits excursion (in-out movements).

It also acts as an acoustical sponge, damping spurious resonances that travel through a cone's outer edge and which might otherwise be reflected back through the moving mass, adversely affecting impedance and smoothness of frequency response.

The shape and composition of the surround is determined by the performance requirements of the loudspeaker. It may be made of untreated corrugated paper (generally used on mass-produced loudspeakers, since the cone and surround can be molded simultaneously in one piece) or of treated paper, corrugated cambric or polyurethane foam for transducers designed to undergo long cone excursions. High frequency diaphragms also have surrounds, but they are usually molded extensions of the radiating surface.

Frame The loudspeaker frame must support and position the radiating surface and the magnetic assembly in an absolutely precise relation to each other. It should, therefore, be designed and built to withstand the stresses a loudspeaker may encounter under severe performance conditions: massive enough so it won't deform when bolted to a mounting panel, strong enough to support a heavy magnetic assembly when suspended inside an enclosure, and rigid enough to avoid vibrations or resonances that would diminish performance.

Frames are generally made of metal, although plastic is now being used on some high frequency units. Economy loudspeakers are stamped or pressed sheet metal frames; for many applications they are adequate. However, for speakers with large, heavy magnetic assemblies, an extremely solid frame is required to prevent warpage or deformation during shipping that might tilt the assembly, causing the voice coil to rub against the pole piece. For this reason, the frames of high-quality loudspeakers are typically die cast from an aluminum alloy to provide optimum rigidity with minimum weight.



MANUFACTURE: PUTTING IT ALL TOGETHER

Although design plays a crucial role in loudspeaker performance, without manufacturing techniques capable of achieving the rigorous tolerances, exact concentricities and perfect alignments called for in the specifications, the end result may be bad, acceptable or even good sound. It will never be *great* sound.

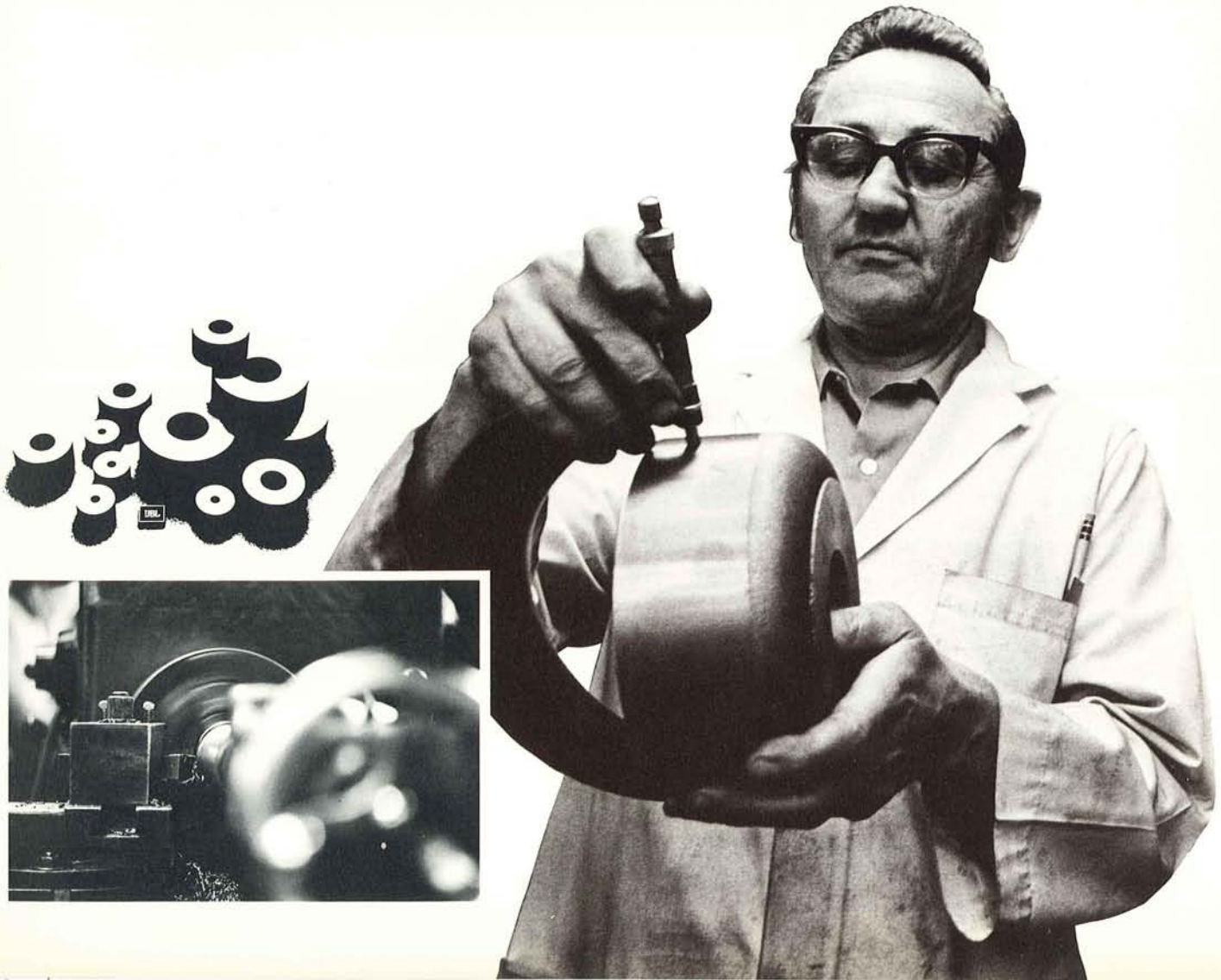
As we take you through a step-by-step look at the JBL manufacturing process you'll be able to see for yourself why JBL loudspeaker systems must cost more than the average and why, as a result, they produce superior sound.

At the heart of every loudspeaker is the magnet. In almost every application we use large Alnico V magnets (2-1/2 times stronger per pound than less expensive, conventionally used ceramic types). The surfaces of our magnets are finished to tolerances within 32 millionths of an inch to achieve the most efficient transfer of energy to adjacent parts.

The magnets are housed in massive iron assemblies which direct the energy to the voice coil gap. Precision machining of the assembly's parts (pot structure, top plate and pole piece) avoids the energy losses common to mass-produced loudspeakers. A JBL magnetic assembly yields an intense field to interact with the voice coil, providing unmatched efficiency, dynamic range and transient response.

JBL pot structures begin as rough castings and are machined to within two thousandths of an inch on parallel surfaces.

Machining the pole piece and top plate are extremely critical operations. By using special tooling, roundness is held to within five ten-thousandths of an inch.



The top plate and pole piece are concentrically mounted on the pot structure and magnet, forming the narrowest possible voice coil gap. Below you see top views of a JBL and a conventional magnet assembly. Note the larger gap diameter and much more precise concentricity of the JBL, which allows much more wire to be immersed in the gap, producing much greater efficiency and power-handling capability. JBL's voice coil gaps average .045 inch and concentricity is held to plus or minus a few thousandths of an inch compared to average industry gaps of .060 inch and tolerances of plus or minus one sixty-fourth of an inch.

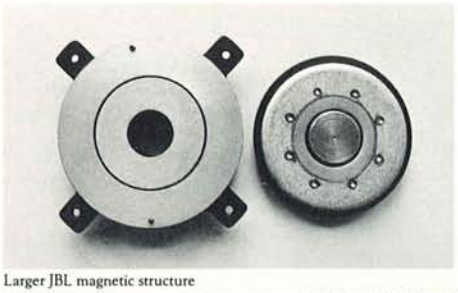
Note also that the mass-produced loudspeaker uses a backplate/pole piece combination with a high-loss open magnetic field. This design dissipates valuable magnetic strength, as shown by the screwdriver attracted to its magnetic structure. JBL's closed magnetic assembly has no stray magnetic fields that would hold the screwdriver. All the available magnetic energy is efficiently transferred to the one place it counts—the voice coil gap.

An extremely high-powered machine is needed to completely saturate magnetic assemblies with energy. Since none existed that would perform the job according to our specifications, we could have used available machines and still have achieved 90% of our performance goals at reduced costs. But it's that 10% difference that keeps JBL the leader in its field. So JBL engineers designed and built their own special magnetic charging machine.

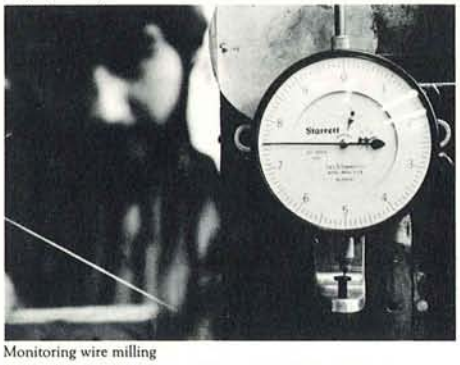
When the voice coil receives a signal from an amplifier it must move with verbatim accuracy. To do this, its magnetic field must be as strong as possible to interact instantly, accurately and perfectly with the constant field provided by the permanent magnet. Intense fields are achieved by using large diameter coils and by placing as much wire in the magnetic gap as possible. In most cases JBL forms wire to a thin ribbon, which is then wound by hand on its narrow edge. Compared to standard coils, this places at least 24% more wire in the gap.

To form the ribbon wire, JBL created a milling device that holds tolerances of one ten-thousandth of an inch.

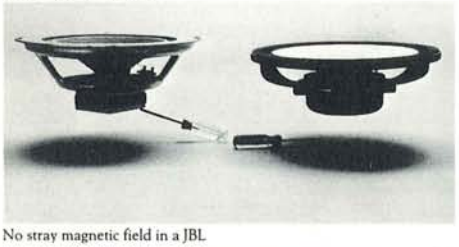
Special tooling developed by JBL insures diametric accuracy and perfect



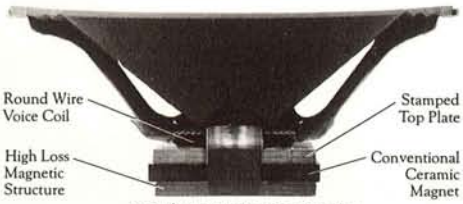
Larger JBL magnetic structure



Monitoring wire milling

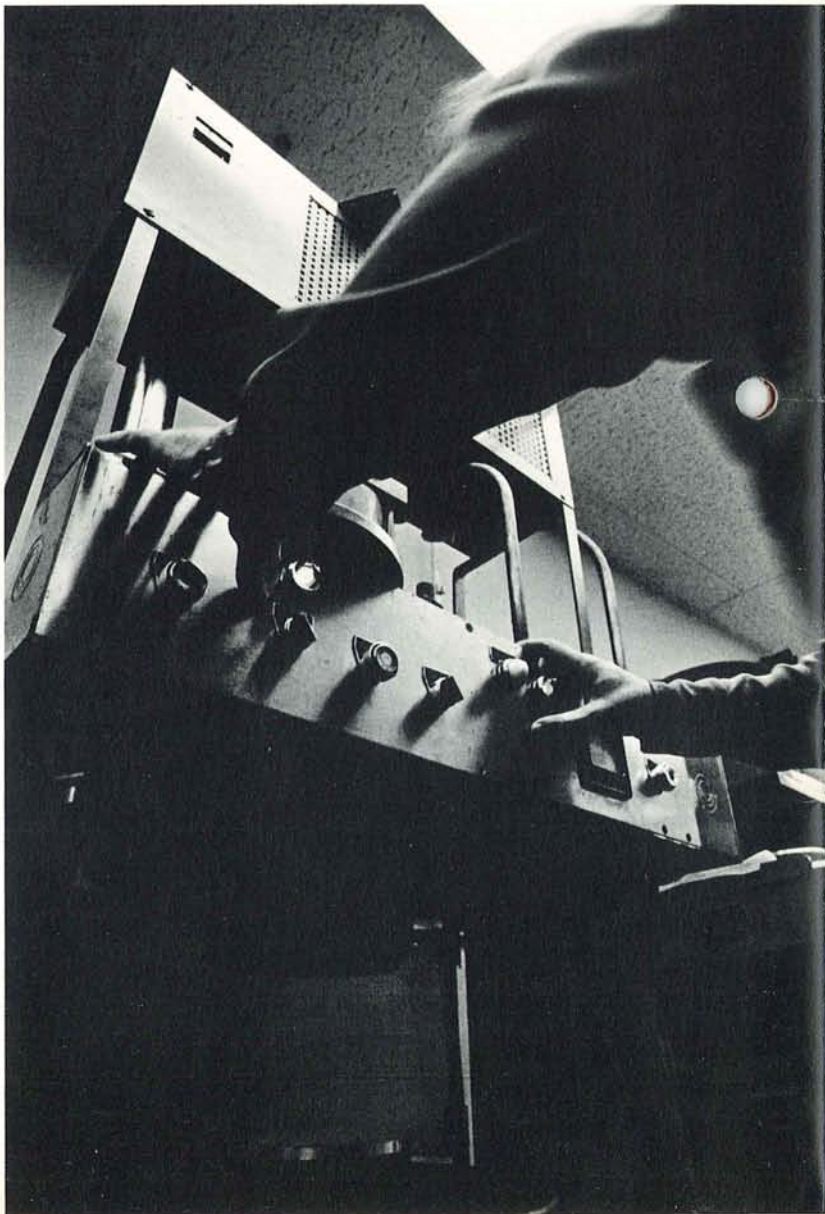


No stray magnetic field in a JBL



Typical mass produced loudspeaker loses vital magnetic strength in the form of stray fields surrounding its magnetic structure.

Magnet charger



roundness of every voice coil.

Insulation is applied to ribbon wire on this complex apparatus.

Because the voice coil and radiating surface are attached and work together as a single unit, a loudspeaker's cone must be an optimum combination of stiffness, density and weight to balance with the coil's magnetic strength. JBL cones are designed to provide the exact performance characteristics determined by our engineers. They are made in many sizes and shapes from a complex blend of paper and fiber and are of shallower design than conventional ones. These shallower cones are able to distribute the generated sound broadly whereas a deeper cone focuses the higher frequencies it produces.

Diaphragms of high frequency compression drivers and aluminum center domes are pneumatically formed on highly polished dies.

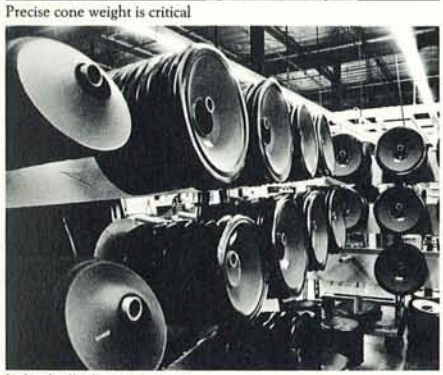
A loudspeaker's surround and spider suspend the voice coil/cone assembly from the frame and allow it to travel back and forth smoothly and linearly. Surrounds that are not engineered for specific applications may alter the movement of the cone and adversely affect sound quality. At JBL we form a number of our special-purpose surrounds on special machines designed and built by us. These machines mold the material into exact contours that allow the cone to undergo long linear excursions.

The next step in the manufacturing process is assembling the voice coil, cone and spider on fixtures that assure precise positioning. The parts are bonded together with special adhesives, then heat cured for optimum reliability.

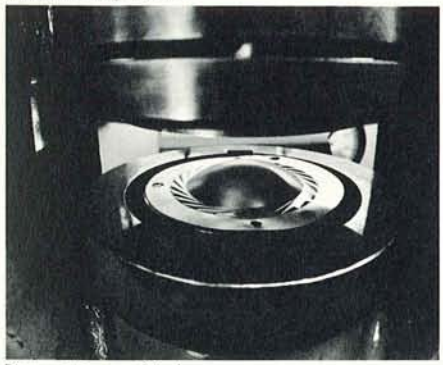
Next the voice coil, cone surround and spider are centered on the loudspeaker frame. Every JBL loudspeaker uses frames of die cast aluminum alloy that, unlike the stamped sheet metal frames of mass-produced units, cannot warp and cause misalignment of the voice coil in the magnetic gap.

After a final check of voice coil roundness and gap concentricity, the cones are installed in the frames, adhesives are applied to the mating surfaces and the speakers move into an electronically timed and temperature-controlled conveyorized oven for curing.

Precise cone weight is critical



Individually designed cones



Pneumatic forming of diaphragm

Surround molding

Precise coil and cone assembly

Temperature controlled oven curing

Cast frame

Stamped frame

After curing, each and every JBL loudspeaker is checked for possible voice coil misalignment by feeding it a high-powered low frequency signal. This signal causes the cone to undergo excursions that would rarely be encountered in actual use, even under the most intense listening conditions.

Frequency response curves are then run on our elaborate electronic testing installations. Those units that pass inspection receive an identification plate and serial number.

Those units that don't meet JBL's stringent standards are rejected and are sent back either to bring them up to the necessary performance levels or to be discarded.

At this stage in the manufacturing process the loudspeakers are ready to be moved into JBL's own cabinet shop. Here we build fine, uniquely styled, solidly constructed enclosures designed to last a lifetime. We use only the very best compressed woods and hardwood veneers, hand-rubbing them to rich, lustrous finishes.

Cabinet tolerances are typically held to one sixty-fourth of an inch.

All JBL enclosures feature hand-fitted joints.

All enclosures are electronically wood welded to force glue into the wood's pores, assuring rigid, airtight construction.

Every phase of assembly and finishing is done by hand. Each cabinet receives the personal attention fine furniture deserves.

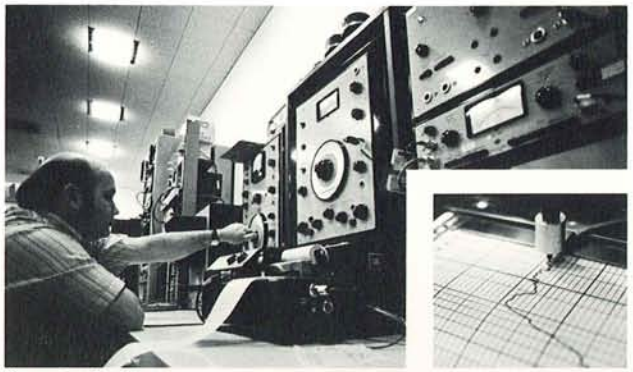
For oiled walnut finishes we use a special formula of oil and wax to create the luster characteristic of JBL cabinets and enclosures. Two coats are applied and after the wood grain is penetrated, each surface is painstakingly burnished to bring out grain structure and detail.

And now, finally, the finished product —a loudspeaker system by JBL.

We could easily get 90% of the performance at greatly reduced cost if we were willing to compromise: our powerful magnetic structures, our large edgewound voice coils, our critically machined components, and our attention to detail.

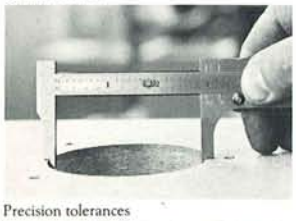
Things that set JBL apart from the average loudspeaker manufacturer. Listen to a JBL loudspeaker. Find out what the best of everything can do.

Individual testing



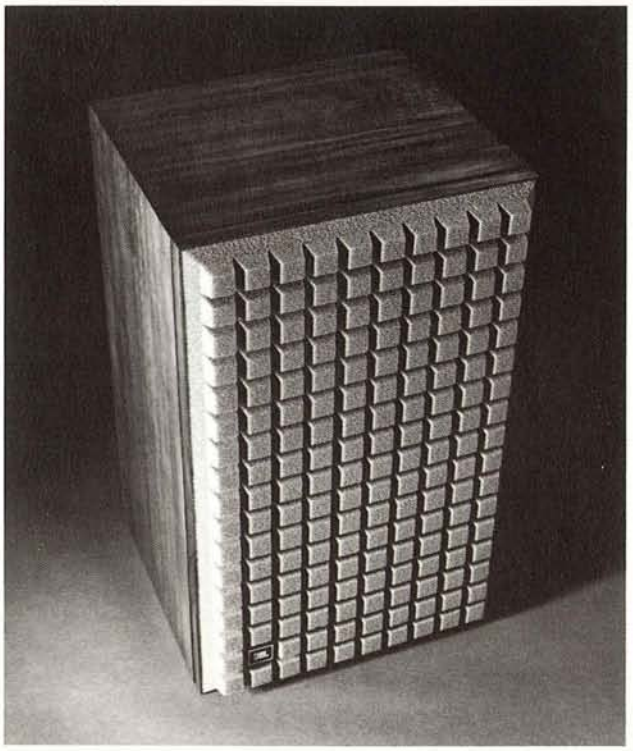
Electronic testing

Quality control



Precision tolerances

Hand fitted assembly



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