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# AUDIO

## SPECIAL PREVIEW ISSUE

Specifications of Over  
750 Hi-Fi Instruments and Components  
to help you Select and Buy Wisely

ANNUAL ISSUE

AUGUST 1966



26 Record Reviews  
Classical-Jazz-Popular

How to Measure Your  
FM Stereo Tuner's  
Performance

Questions and Answers  
About Tape Recording

Build an SCR  
SPEAKER PROTECTOR

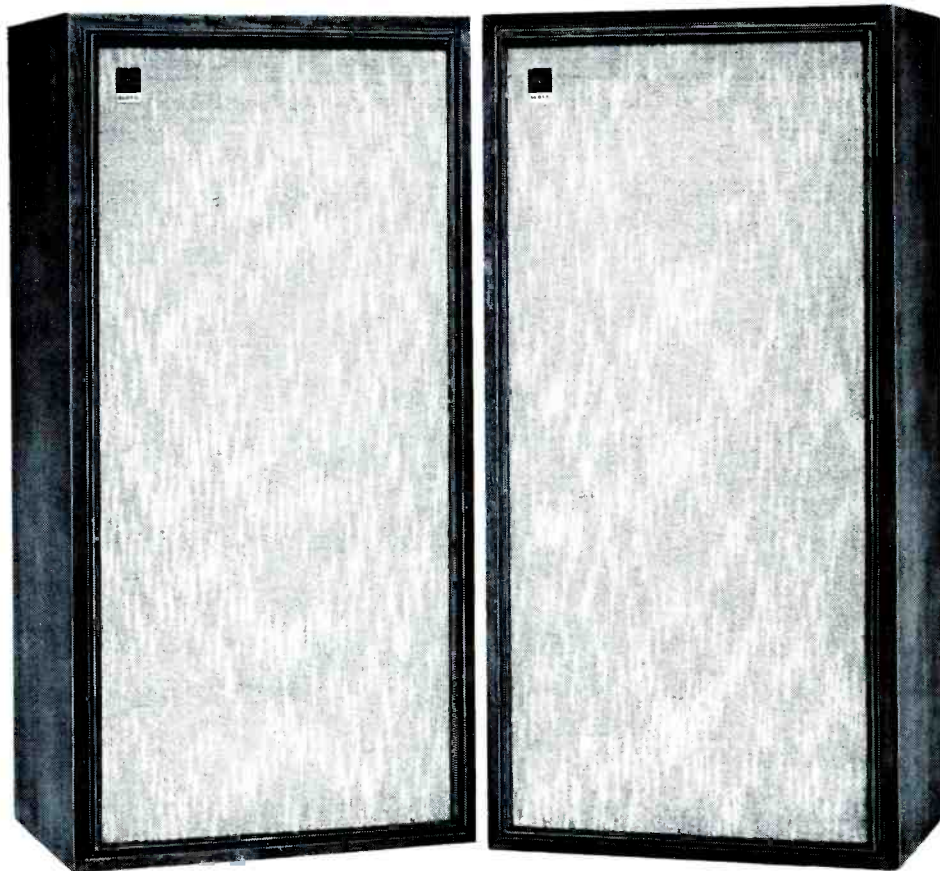
Classical Review:  
A New Performance  
of Handel's 'Messiah'

More About  
FM Stereo Antennas

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# Only the new Scott S-8 is designed for solid-state components!



## Only the new Scott S-8 is designed with Controlled Impedance!

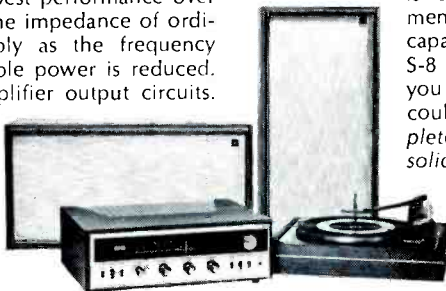
Scott engineers have developed a new kind of speaker system, specially designed for finest performance from solid-state components. Of all speakers now on the market, regardless of price, only the S-8 is completely compatible with new solid-state equipment. Here is why:

Solid state amplifiers and receivers give best performance over a fairly narrow range of load impedance. The impedance of ordinary speakers, however, varies considerably as the frequency changes. With increased impedance, available power is reduced. Lowered impedance may overload the amplifier output circuits.

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For further information and specifications on the new Scott S-8 speaker system, write:  
H. H. Scott, Inc., Dept. 35-08, 111 Powdermill Road, Maynard, Mass. Export: Scott International, Maynard, Mass.

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# AUDIO

August, 1966 Vol. 50, No. 8

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Number 36 in a series of discussions by Electro-Voice engineers



## NARROW-MINDED SOUND

**PAUL K. FRANKLIN**  
Chief Field Engineer

It often seems to sound installers that all P.A. systems fall into two categories: the speakers must be too close to the audience, or the speakers must be too far from the audience. While there has been considerable design activity recently devoted to wide-angle speakers to solve the "close-in" applications, there has been seemingly little attention paid to improving high-efficiency, narrow-angle speakers for concentrated long range coverage.

The traditional approach to this problem has been to utilize very large re-entrant trumpets with high-power drivers and massive amplifier power to attain long reach. This method has not been without its drawbacks. Large horns are quite expensive and awkward to install. But performance drawbacks are even more significant.

High frequency losses are severe in large re-entrant horns, thus reducing intelligibility and increasing power requirements. These losses occur at the bends of the re-entrant horn, as highs—much shorter in wave length than the cross-section of the horn—are reflected back toward the throat. And distortion generated at high sound levels in large re-entrant horns may reach 13% or more, again reducing intelligibility. This distortion is the result of attempting to pass a wide-range signal of high intensity through a long horn. Throat pressures can reach such high values, particularly at high frequencies, that non-linear air compression results.

An alternative approach to concentrated coverage is now available with the development of a compound concentrating projector (E-V Model AC100). This unit utilizes concentric horns coupled to opposite sides of a single driver diaphragm. Frequencies below 1000 Hz. are directed from the rear of the driver through a re-entrant horn section, similar to the well-known Electro-Voice CDPC®, except that the final horn section is round for efficiency and maximum concentration. Frequencies above 1000 Hz. are taken from the front of the driver to a round horn with only two 90° bends. High directivity is achieved since this horn is large compared with the wavelengths involved.

The benefits of this horn design are threefold. First, the system is quite efficient, particularly above 1000 Hz. Overall gains of up to 3 db are common, compared to large re-entrant horns, thus cutting amplifier power requirements by 50% in many cases. Second, the improvement in speech clarity resulting from lower distortion (less than 1.0%) improves intelligibility and may also permit lower sound levels without loss of understanding or reach. This lower distortion is largely due to the shorter horn length for high frequencies. Third, the unit itself is not significantly larger than a re-entrant horn of normal dimensions, thus simplifying installation.

The compound concentrating projector design, coupled with modern convertible drivers, often offers a distinct saving in overall system cost, while also achieving an improvement in performance where narrow-angle coverage and long reach are desired.

For technical data on any E-V product, write:  
**ELECTRO-VOICE, INC., Dept. 863A**  
602 Cecil St., Buchanan, Michigan 49107

**Electro-Voice**  
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**AUDIO**, Editorial and Publishing Offices, 134 North 13th St., Philadelphia, Pa. 19107

Postmaster: Send Form 3579 to the above address.



# COMING

## Articles:

Integrated Complex Tone Generator for Electronic Music, by Robert C. Ehle.

An introduction to some of the "hardware" used in the composition and creation of this form of music.

King-Size  $\frac{1}{4}$ -Horsepower Audio Amplifier by Robert M. Voss.

This might well be "the last of the vacuum-tube amplifiers" to appear in these pages, but this monster is a real solid "putter outer."

Simulated "Live vs. Recorded" loudspeaker Test, by Edgar M. Villchur.

The printed version of a lecture paper given by the author at an AES meeting.

## Profiles:

Heathkit IO-14 5-in. Professional DC Oscilloscope

Marantz SLT-12 Turntable

JBL SA-600 Solid State Integrated Amplifier

In the September Issue

On the newsstands, at your favorite audio dealer's, or in your own mailbox.

# AUDIO CLINIC

Joseph Giovanelli



Send questions to:

Joseph Giovanelli  
2819 Newkirk Ave.  
Brooklyn, N. Y.

Include stamped, self-addressed envelope.

### Connecting Multiple Speaker System to Amplifiers

*Q. I wish to connect a pair of 16-ohm speakers and a pair of 8-ohm speakers to my amplifier.*

*How will I do this and obtain the proper impedance match?*

*Because of the higher efficiency of the 16-ohm speakers, I may need to use a pad to obtain the proper sound level from each of these speakers. How would I connect such a pad?*

*If I put a pad on both sets of speakers, how would I make this connection? S/Sgt James C. Horne, Syracuse, New York.*

A. In this particular instance, the 16-ohm speaker will be connected to the 8-ohm tap on your power amplifier. The 8-ohm speaker will be connected to the 4-ohm tap.

Use a T pad rather than an L pad. When you order the T pad, be sure that it has the same impedance as the speaker to which it is to be connected and is capable of handling the power which will be fed into it. Because instructions are included with such pads, no further instructions will be given here regarding the installation of the pad.

If you plan to use the T pad for no other reason except to match the efficiencies of the speakers, you will need to use the T pad only on the more efficient speaker.

Of course, if pads are used on each speaker, you will have a means of varying the volume produced by each speaker at the speaker location, rather than having to make such changes at the control center.

### Difficult FM reception

*Q. I live in a difficult FM reception area and am not permitted to use an external antenna. My building is made largely of concrete and steel. The living room faces away from the Empire State Building—the source of most of the FM stations in New York City. We have, however, a master TV antenna connection in our apartment which is a 72-ohm system.*

*The FM-Stereo tuner I have ordered has a 300-ohm input connection. If I connect the tuner to the TV antenna, will I get good stereo reception and separation?*

*Would I be better off putting a dipole antenna under the carpeting? Arthur Aster, Glendale, New York.*

A. Judging from my mail, the problem of adequate FM reception is one which comes up more than perhaps any other topic with which I must deal. While it is not always possible to solve all such problems, I hope that through the personal answers I give to questions such as yours, and through the few which I can print in this column, that I can reduce some of these problems to their minimum levels.

Master TV antennas are often designed to reject all signals but those of television channels. Therefore, the antenna may well not allow FM signals to be passed along to the individual antenna outlets. Further, such antenna installations are often so poor as to exclude even the television signals. For this reason I am uncertain as to whether or not you will obtain any success with the master system. You should try it, however, to be sure. You must use a transformer to match the 72-ohm impedance to the 300-ohm impedance required by your FM tuner. Such transformers are manufactured expressly for this purpose.

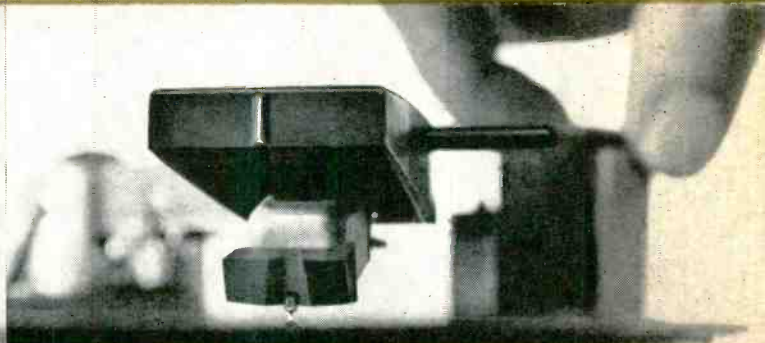
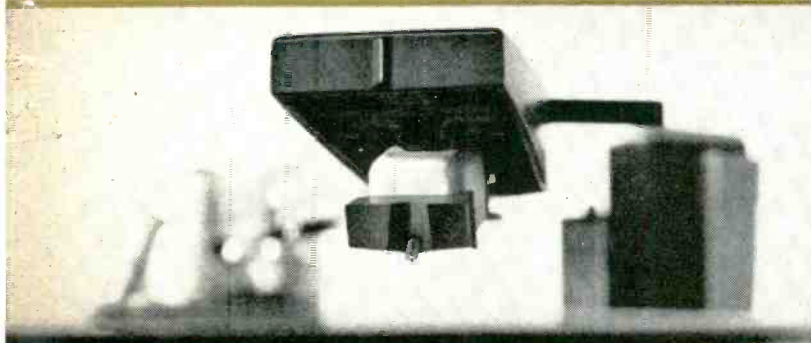
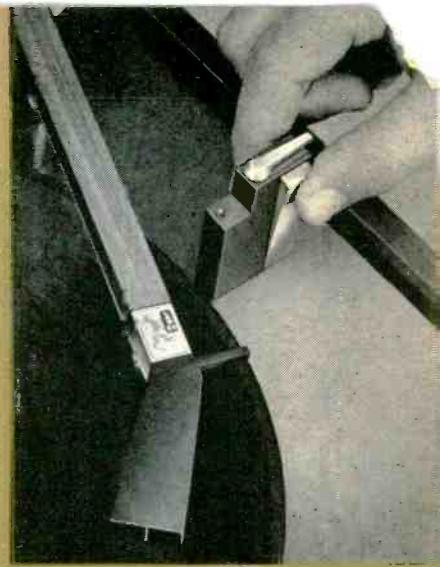
The dipole antenna might or might not work. It would be nice if you could manage to place it near a window—behind drapes or some such similar arrangement which will enable you to conceal the transmission line. I understand that you may lack signal strength because of the direction your apartment faces. This is a problem which probably has no real solution. Remember, though, that the signal strength of stations in your area is quite strong and it may well be that you can stand a considerable amount of signal loss and still obtain good reception. Of course, when you face in a direction other than that from which signals originate, multi-path reflections are likely to take place and there is no cure for that trouble in your case. You may obtain reasonably good monophonic reception but may not be able to obtain good stereo.

If you are receiving good sound quality but with considerable noise background, this condition can be corrected to a considerable degree through the use of a booster. You may be able to make improvements in signal by placing the dipole in another room in the house whose location is more advantageous. You then must run the transmission line back to the tuner in the best way possible. You may be able to locate twin lead in a color which blends into the woodwork to some extent so that this line running over doorways or wherever is not conspicuous. Keep this line

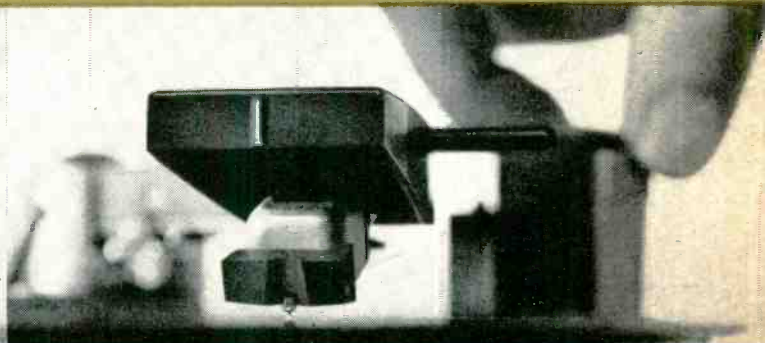
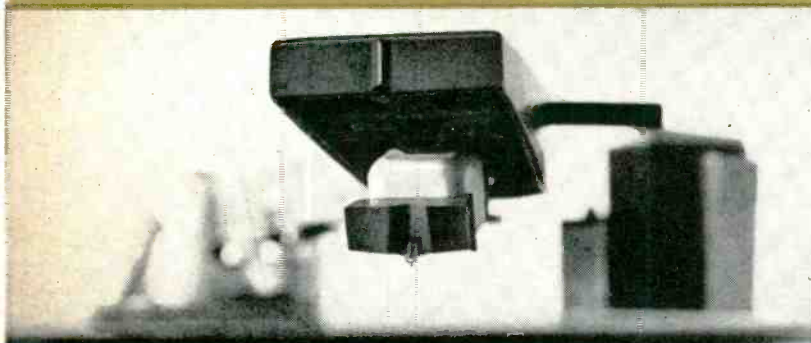




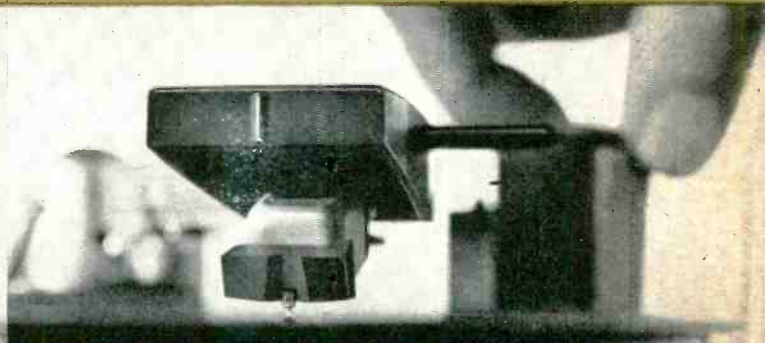
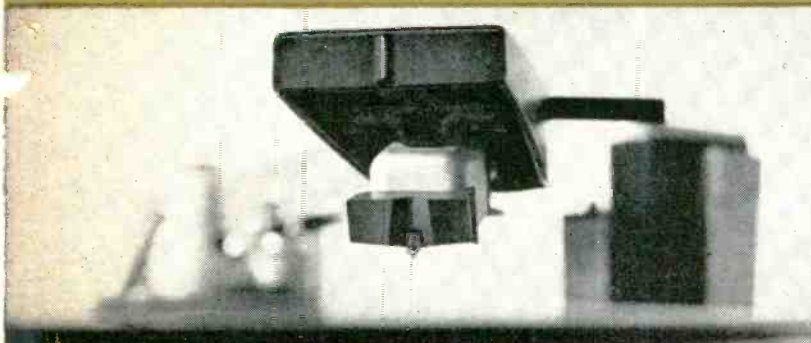
At the touch of your finger...  
**the cueing control**  
**built into the**  
**Garrard LAB 80**  
**gently and precisely**  
**raises and lowers**  
**the tone arm...**



**1. To play a single record, you simply move the arm into position over the first groove . . . . . then, touch the cueing control . . . the arm gently lowers onto the record.**



**2. To interrupt the music, touch the Manual tab -the arm gently rises . . . . . then, touch the cueing control . . . the music will resume at the very same groove.**



**3. To cue to any band or to repeat a passage , place the tone arm over the desired groove . . . . . then, touch the cueing control . . . the arm gently lowers to the exact groove.**

Garrard incorporated this unique cueing control into the Lab 80 for your convenience...to add to your listening pleasure...and for the safety of your sensitive stereo records and vulnerable stereo stylus. The Lab 80 cueing control is simple to operate, easily accessible from any angle, and com-

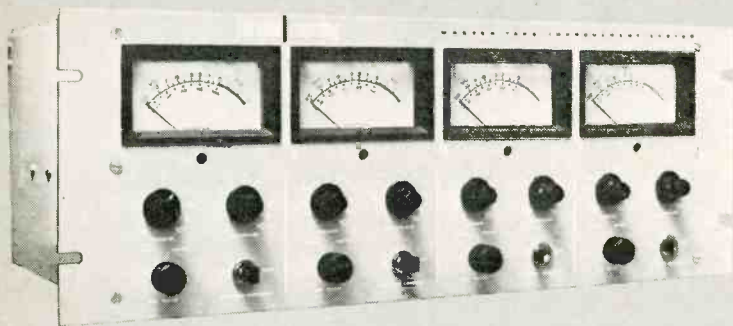
pletely foolproof. It works beautifully whether you're playing a single record or a stack of eight.

For complimentary copy of our 32-page Comparator Guide describing all the advanced features of the Lab 80, write to Garrard, Dept. GK-16, Westbury, New York 11590.

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RECORDING EQUIPMENT CORPORATION  
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away from metallic objects because they will change the characteristics of the line and you will experience some loss of signal or suffer increased multipath effects.

I suggest you read the series on FM antennas which commenced in our July issue.

### Record Playback Distortion

*Q. I have a tonearm with a new, stereo, 0.7-mil stylus—equipped cartridge.*

*When I play monophonic and occasionally a stereo record. I sometimes get distortion from the speakers on loud notes. When I do get the distortion, the noise that the needle makes in the record grooves is very noticeable.*

*On the advice of a friend I increased the stylus force, but I still get both the distortion and the noise from the grooves. I have very little tracking error. I thought that perhaps I should use a monophonic stylus for mono discs and a stereo stylus for stereo records. I certainly would appreciate any help you can give me. Kenneth A. Bush, Rutherford, New Jersey.*

**A.** To answer a question of this nature, all one can do is list the possible reasons for your problem. Each requires investigation.

If the compliance of your cartridge is low, the record must exert considerable force in order to move the stylus. There will be sound produced during this process—sound other than that heard in the loudspeaker. This is direct radiation of sound emanating from the point of contact between the moving stylus and the moving disc. This direct sound produced by the moving stylus contacting the groove walls represents a loss in the efficiency of the system. When sound is radiated in this manner to the extent that it is plainly audible, groove-wall deformation is possible. The material of which records are made is somewhat elastic. Therefore, much of this deformation is of a non-permanent nature. However, it will become permanent over many plays of the record, thereby hastening the ultimate destruction of the disc. More force is required to move the stylus at high levels of groove modulation than is the case at lower levels.

A 0.7-mil stylus should be able to play both stereo and monophonic records. If the radius of the stylus is reduced below this value, some difficulty will be encountered on some older monophonic recordings which were cut with different cutting styli than are used at present. The playback stylus will "bottom" in the grooves, and the result will be an increase in surface noise and distortion.

Of course, it is possible that your tonearm is mounted incorrectly, leading to tracking error. This error would result in the modulation on the groove wall moving the stylus in a direction for which stylus motion was not intended by the designers of the cartridge. The degree of tracking error will influence the degree to which the stylus is subjected to this type of force. I realize that you indicated that you do have good tracking efficiency, but it is well to check this once again just for the sake of completeness of investigation.

*(Continued on page 93)*





The microphone  
with backbone...

MODEL 674

now has a  
staunch new  
companion!

MODEL 676

**E-V** In just a few short months the Electro-Voice Model 676 has gained quite a reputation as a problem solver—no matter what the odds. Now the 676 has a teammate. The Model 674 has the same unique backbone that rejects unwanted sound... an exclusive with Continuously Variable-D (CV-D)<sup>TM</sup> microphones from Electro-Voice. And the improvement in performance is dramatic.

Troubled with feedback or interfering noise pickup? Most cardioid microphones cancel best at only one frequency—but CV-D\* insures a useful cardioid pattern over the entire response range. And its small size means the pickup is symmetrical on any axis.

Bothered by rumble, reverberation, or loss of presence? A recessed switch lets you attenuate bass (by 5 or 10 db at 100 Hz) to stop problems at their source. And there's no unwanted bass

boost when performers work ultra-close. CV-D eliminates this "proximity effect" so common to other cardioids.

Wind and shock noise are almost completely shut out by the CV-D design. Efficient screening protects against damaging dust and magnetic particles, and guards against annoying "pops".

As for overall sound quality, only expensive professional models compare with the 676 and 674. The exclusive Acoustalloy<sup>®</sup> diaphragm gets the credit. It's indestructible—yet low in mass to give you smooth, peak-free, wide-range response with high output.

The Model 676 slips easily into its 1" stand clamp for quick, positive mounting. The fine balance and shorter length of the 676, and absence of an on-off switch makes it ideal for hand-held or suspended applications.

The Model 674 offers identical performance but is provided with a stand-

ard mounting stud and on-off switch. Either high- or balanced low-impedance output can be selected at the cable of both microphones.

Choose the 676 or 674 in satin chrome or non-reflecting gray finish for just \$100.00. Gold finish can be ordered for \$10.00 more (list prices less normal trade discounts). There is no better way to stand up to your toughest sound pickup problems. Proof is waiting at your nearby E-V sound specialist's. Or write for free catalog of Electro-Voice microphones today.

An important footnote: There is no time limit to our warranty! If an E-V microphone should fail, just send it to us. If there's even a hint that our workmanship or materials weren't up to par, the repair is no charge—even decades from now! Fair enough?

\*Patent No. 3,115,207

ELECTRO-VOICE, INC., Dept. 862A, 602 Cecil Street, Buchanan, Michigan 49107

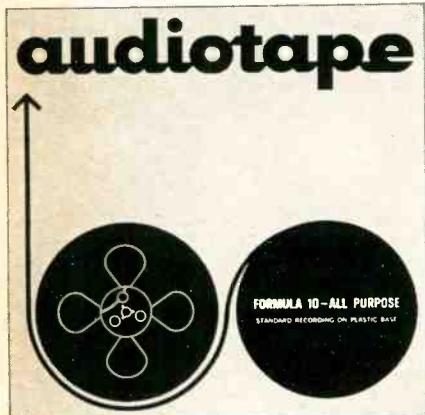
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SETTING NEW STANDARDS IN SOUND



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# 10



What they're buying is the all-purpose tape with the built-in safety factors.

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## LETTERS

### Electronic Music

SIR:

I was glad to see an article on electronic music in *AUDIO*, and I feel that Mr. Lawrence writes entertainingly on all subjects with which he deals. On the other hand, there are many aspects of electronic music (EM) which should be amplified considerably in all fairness to the serious composers practicing in this medium.

While it is true that EM exhibits all of the eccentricities which characterize modern music as a whole, and it is also true that EM can eliminate music's "middlemen," the fact is that more composers are turning to EM each year and also that many important music schools are providing EM laboratories.

The basic reasons for the growing appeal of EM to creative people are these: 1. Electronic recording allows the creator of a work to re-experience it and to polish it to his satisfaction; 2. EM gives the composer complete control over the work from conception to public; 3. EM allows the artist the experience of hearing a finished product which is entirely his own work. 4. EM gives the composer the same freedom which painters and sculptors enjoy. Is it possible that EM might even become a hobby for musically inclined experimenters?

Having taught EM at North Texas State U. and being an electronic composer myself, I can attest to an increase in its popularity as well as a definite lack of loneliness in electronic composers. There is a strong sense of satisfaction in the completion of a composition. EM lends itself admirably to the means of distribution which electronics has made possible. While concert performances are fast becoming museums for the music of earlier periods. EM can be employed for TV and movies with considerable savings over conventional music. Such applications are becoming frequent, and they provide fertile ground for cultivation by commercially minded composers. The only danger is that the mass production of music by electronic techniques may tend to swamp all existing outlets for music of any sort. The idiom is new, but it has already claimed a lion's share of the world of music. In 16 years it has completely revised the process of creating with sound.

ROBERT C. EHLE,  
314 Atkins Ave.,  
Lancaster, Pa. 17603

*(We have an article from this correspondent which will appear in the near future. Ed.)*

### "Recording Studios"

SIR:

As a long-time subscriber to your magazine, I would first like to thank you and your staff for the information, ideas, guidance, editorial and critical comment, and also the many hours of pleasure you have provided over the years. I look forward each month to receiving my copy. My only complaint is that you don't publish more frequently and expand your coverage of the audio world.

One area upon which you have occasionally commented and sometimes criticized, but never thoroughly covered or even featured is that of the "recording studio" and the "recording engineer." Many of the letters from readers printed in the *LETTERS* column have contained questions regarding one or the other, like: what is it . . . why certain things are done . . . studio layout . . . capabilities . . . design philosophy . . . engineering practices, and so on. I believe an article or a series on these subjects would be of interest to your readers, and one which might help them understand the reasons for much of what they hear, and perhaps help them to appreciate some of the problems involved at the other end of the product to which they listen.

Criteria Recording Company, one of the country's leading independent studios, is soon to begin construction of a new studio which will adjoin the present facility. On completion, in some four or five months, we believe this plant will be one of the finest sounding and one of the most versatile in the country. It will be one of the first fully solid-state transformerless installations in existence.

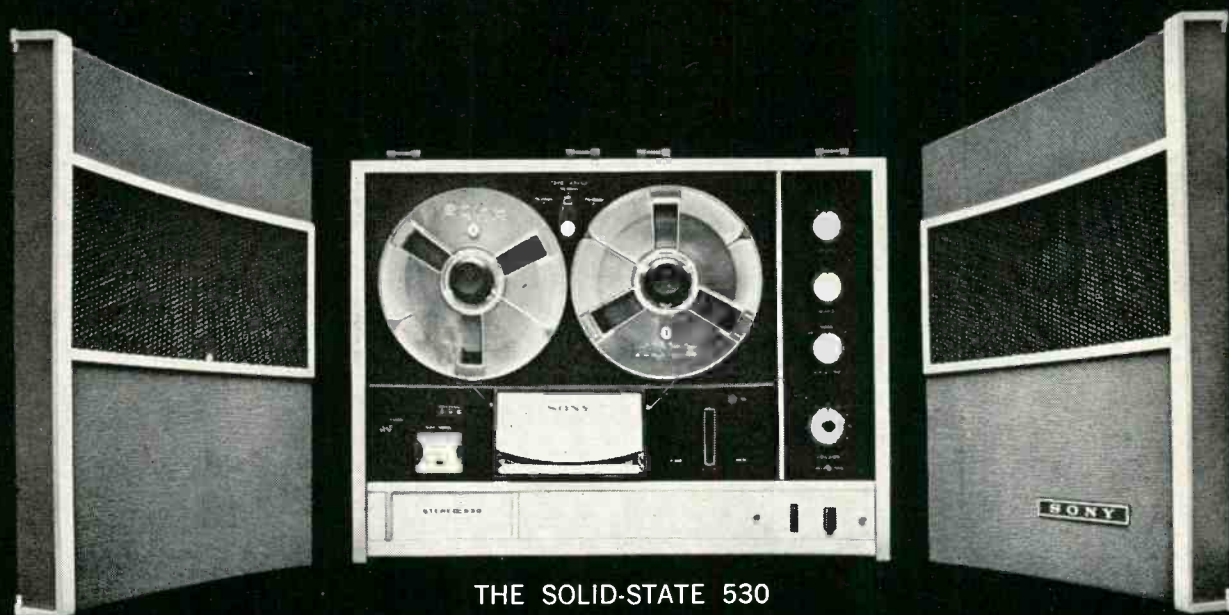
I propose one or more articles covering the planning, philosophy, design, goals, construction, layout, installation, checkout, tuning, and news of this studio. Would such a series be of interest to *AUDIO*?

STANLEY E. GOLDSTEIN,  
Criteria Recording Co. Inc.,  
1755 Northeast 149th St.,  
Miami, Florida, 33161.

*(It certainly would, and we shall be looking for it in the next few months. Ed.)*



# Surround Yourself with SONY Sound!



THE SOLID-STATE 530

## ...with XL-4 Quadracial Sound

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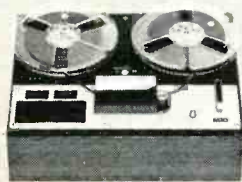
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## LIGHT LISTENING

Chester Santon

**Gilbert and Sullivan Spectacular.**  
London Tape LCL 75010

The record companies most active in the field of Gilbert and Sullivan operettas, London and Angel, are aware of the fact that most Savoyards prefer complete recorded versions of these productions. Tape fans with a weakness for G. and S. have been well taken care of in the past, provided they were willing to go along with the status quo and purchase each operetta in the form available to them in the tape catalog. In the Ampex catalog, the London G. and S. releases are well represented (Angel handles its own processing and distribution of tape) but the orientation has been toward the serious collector with plenty of money to explore the full range of wit and melody in the shows of England's most famous theatrical team. Seven G. and S. operettas are available on Ampex tapes in D'Oyly Carte performances recorded by London Records. Of these, only three (*Mikado*, *Pinafore*, and *Pirates of Penzance*) are being sold in highlight reels along with the complete performances. Anyone wishing to sample a true cross section of the G. and S. repertory on tapes by the D'Oyly Carte has been out of luck until now. Luckily, this new release, titled "Gilbert and Sullivan Spectacular", performs two functions, both of them welcome. It offers D'Oyly Carte performances of the highpoints of four G. and S. operettas and reveals a new (and better) side of the London Phase 4 stereo process. This process, in the past, has not been one of my major enthusiasms. In this reel, however, there is hardly any sign of the artificial effects I've objected to in earlier releases. As a matter of fact, the sound on this tape is a match for the main London series in disc form. This new release with Sir Malcolm Sargent leading the Royal Philharmonic Orchestra in support of the D'Oyly Carte troupe will be preferred by those who like maximum presence in the lyrics. The older disc albums, offering the services of Isidore Godfrey and the New Symphony Orchestra of London, seem quite distant in pickup in relation to this tape, placing the listener in mid-orchestra seats instead of a "control room" perch directly beneath the monitor speakers. The stage effect of the earlier series is more logical for the choruses (not a minor factor in the give and take of the lyrics) but this new tape is an ideal way to sample at close range the outstanding solos of four leading Gilbert and Sullivan shows.

\*12 Forest Ave., Hasting-on-Hudson,  
New York, N. Y. 10706

**Ali Akbar Khan: North Indian Master of the Sarod**

World Pacific Mono WP-1433

With the accompaniment of Sheela Mookerjee, tamboura, and Shankar Ghosh, tabla, Ali Akbar Khan offers a program of wide variety that never ceases to fascinate. One of India's most celebrated musicians, he is the son of the distinguished musical scholar Dr. Padma Bhusan Allauddin Khan and a performer of brilliance and emotional depth. As more folk music of other cultures becomes available to us on long-playing records, the quality of performances and recordings is also improving. At one time we had to be content with indifferent musicianship and sound. Happily that is not the case with this recording. These musicians perform with rare subtlety and a ravishing freedom of rhythm, and the excellent recording preserves all of the detail of their deft performances.

**Pomp and Circumstance**

Capitol SP 8620

The Hollywood Bowl Orchestra takes on a program of well known marches in this new release. Whatever its other merits, Capitol's latest recording process simply doesn't do justice to the bass end of a full orchestra in repertory such as this. The midrange is there and so is an adequate supply of treble but even straining of the ear reveals no useful bass to speak of. In the course of the average march, the bass drum usually has to compete with the rest of the band or orchestra. One march included in this record, however, is unique in its treatment of the bass drum. "The Rakoczy March" from "The Damnation of Faust" by Hector Berlioz has one passage where the other instruments gradually subside and the bass drum is left alone in the spotlight to lead the way to the final section of the march. Just about every recording of this march, and there are many, has some semblance of a bass drum to offer in this particular passage of the Rakoczy. Yet a control setting that can fill my room with bass drum at little more than average volume can find only the barest whisper of the drum in this record at the same setting. Most puzzling.

**Pop Goes the Zither**

Philips PHS 600-183

If you have deepseated opinions on the recorded sound of the zither, prepare to abandon most of them on hearing this record. Philips has uncovered a young Viennese musician named Karl Swoboda

who coaxes a zither into avenues I never figured the instrument could take. To most people, the "Third Man Theme" or Strauss' "Tales from the Vienna Woods" usually cover the gamut of the zither's claim to fame. In this release, Swoboda gives the instrument an entirely new personality with a refreshing dip into a wide variety of popular music. Instead of the usual accompaniment role, the zither stars prominently in Bossa Nova, ballads, waltzes, Broadway, film and folk tunes. Philips' brilliant close-to miking has had a lot to do with the scintillating end result.

**Norman Luboff: Songs of the Trail.**

RCA Victor LSP 3555

If a recording can be said to exude a healthy atmosphere, this one certainly does. The total impression takes in more than the natural out-of-doors heartiness of Western songs sung by a dozen male voices of the Norman Luboff Choir. Although the tunes themselves play an important role, I find equally impressive the Luboff treatment of the material and the unforced nature of RCA's sound as miked in their Hollywood studios. Perhaps the highest tribute that can be paid to recording engineer Dick Bogert's stereo setup is to mention that the ear is unaware of mechanical manipulation on his part. The natural cohesion of a good choir has been maintained across the expanse of the group's formation and the voices have all the male heft the songs require without blasting today's sensitive mikes. Luboff has steered an interesting course between the old and the new in his selection of Western tunes. Bob Nolan, composer of "Cool Water" and one of the original Sons of the Pioneers is represented by "Tumbleweed Trail" and "Happy Cowboy." Among the other recent compositions is a song that happens to be the most effective item in the album, "The Song of the Trail" written by the same Stan Jones responsible for "Ghost Riders in the Sky."

**Perry Como: Lightly Latin.**

RCA Victor LSP 3552

In the steady stream of new record releases, it's easy to lose sight of the fact that an occasional big name has been missing for a while. This is Perry Como's first album in almost a year and it indicates that an adequate diet of golf can keep any good singer in tip-top shape. This happens to be one of the better albums Como has made. This is all the more surprising because the program of songs is a bit of a departure for him. Much of the album is devoted to authentic Latin American music of the present with a few Latin-style tunes from other sources to round out the roster. The combination of good bossa nova and Como's relaxed assurance is an unbeatable one. He has some really excellent material to work with in some of the more attractive songs of Antonio Jobim, Luis Bonfá, Ary Barroso and Dorival Caymmi. Adding to the soft appeal of the tunes are the thoroughly professional arrangements of orchestra conductor, Nick Perito. Como has always been a stickler for lengthy rehearsal. He's had ample time to make this an outstanding release. Æ



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Precisely how this was accomplished should be of considerable interest to engineers, whom we shall fully inform about it in the appropriate technical journals in due course. For

now, suffice it to say that the difference is instantly apparent.

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## ABOUT MUSIC

Harold Lawrence

### On the Eve of Recording Handel's "Messiah"

**T**O ENGLISH AND AMERICAN audiences, *Messiah* is probably the most familiar and beloved of oratorios. Yet in certain ways it is virtually unknown to the general public. Ever since Handel's death in 1759 the work has been "updated," "improved," "enhanced," "refurbished," or otherwise altered to conform to the fashion of the day. What we usually hear at Christmas and Easter is a truncated version shorn of embellishments, appoggiaturas, double-dotting, cadenzas, and other Baroque performance practices, and presented by a full symphony orchestra and large chorus in an atmosphere of solemn reverence.

In the light of everything we have learned about Handel and Baroque music, the "standard" *Messiah* is as remote from the original as are the overblown orchestral transcriptions of Bach's Chorale Preludes. How did it get this way?

The tampering began soon after Handel died. Johann Adam Hiller prepared "an entirely new score, as far as may be what Handel himself would have written at the present day." He slashed and revised at will, substituted a crude solo for bassoon in place of the original violin part in "If God be for us," and made "many improvements in Handel's composition by the employment of wind instruments." Other composers reworked *Messiah* to make it more palatable to local audiences throughout the Continent. In 1789 Mozart himself re-orchestrated *Messiah*, and it was his version for years to come. Nothing Mozart wrote was in poor taste, but the end result of his filling-in of harmonies and winds was to soften the impact of the music and rob it of its freshness and Baroque flavor. Organ and harpsichord, for example, were "harmonized" into the orchestral fabric, thus depriving the choruses and recitatives of their characteristic accompanying colors.

What Hiller, Mozart and others did to alter the shape and harmonies of *Messiah*, nineteenth-century England did for its scale. At the Handel Commemoration of 1834, held in Westminster Abbey, *Messiah* was performed by an orchestra of 80 violins, 20 violas, 18 cellos, 18 double basses, 8 flutes, 2 piccolos, 12 oboes, 8 clarinets, 12 bassoons, 8 trumpets, 8 trombones, 2 ophicleides, two serpents, snare drum, two kettle-drums, and two tower drums. In those days, the Establishment believed in bigness. Things reached a gargantuan climax at the Crystal Palace Commemoration of 1859 where *Messiah* was given by a chorus of 2,765 singers and an orchestra

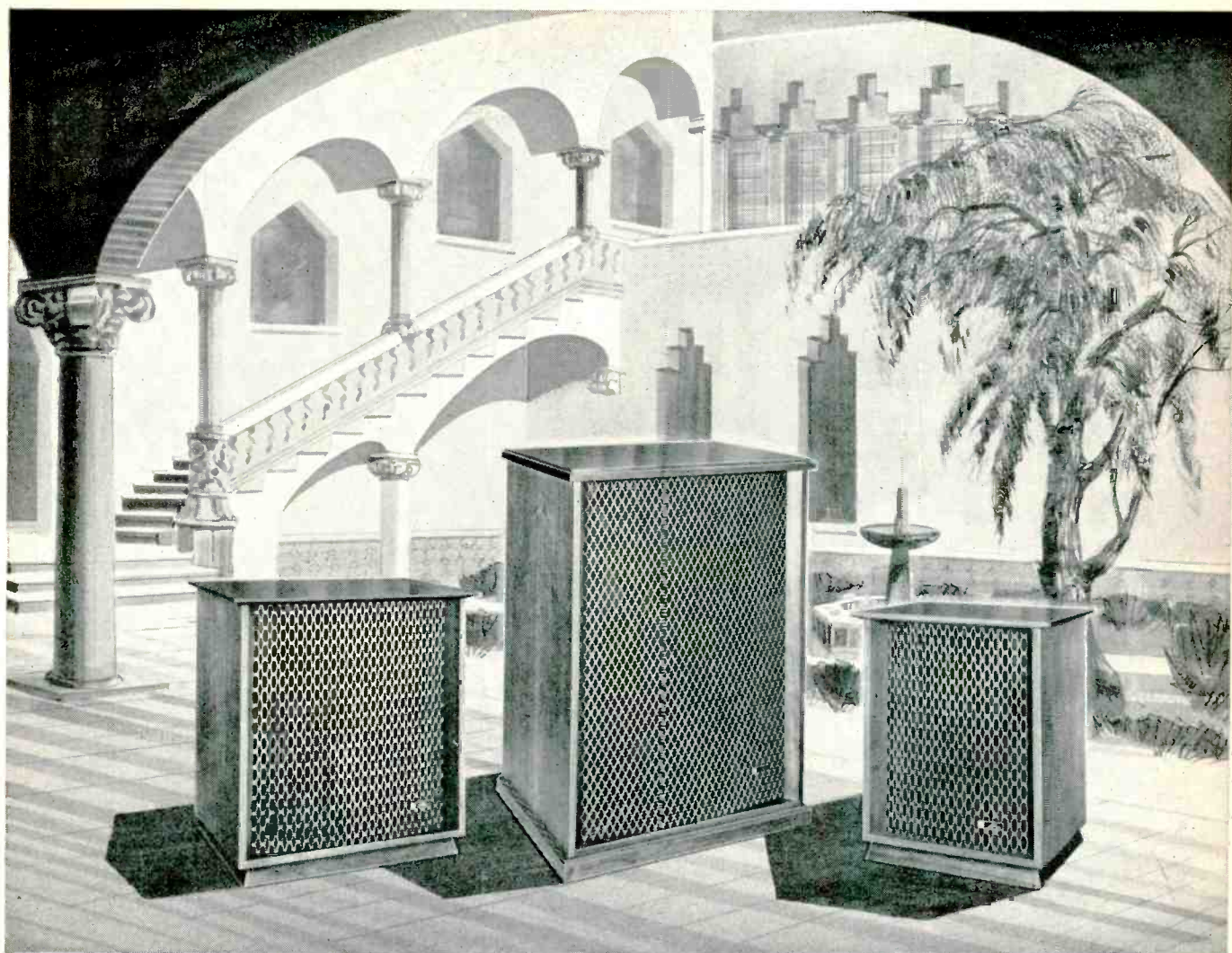
of four hundred, bolstered by a mammoth organ with four keyboards and 4,510 pipes. Twenty-eight thousand attended the final performance. In the midst of his Handelian inflation, German scholars under the supervision of Friedrich Chrysander were preparing a compilation of Handel's music, based on autograph manuscripts and original editions. In keeping with the Handel re-examination, the Englishman Ebenezer Prout produced a new edition of *Messiah* which dusted off some Victorian misconceptions; but his job was not a thorough one. Nevertheless, most performances we hear today are based on the Prout edition.

In 1896, a full score and complete set of parts of *Messiah* were rediscovered in the London Foundling Hospital, where Handel had given annual performances of this oratorio until his death. Why not then return to the original? If his were a score by Beethoven, there would be no problem. But the "original" score of *Messiah* is merely one of several versions composed by Handel. More important, *Messiah* must be seen through the eyes of a musician trained to interpret Baroque music. Performed literally, the oratorio would seem curiously incomplete, like a black-and-white version of a vivid color photograph. In the tradition of eighteenth-century Baroque composers, Handel did not bother to write in the necessary appoggiaturas, trills, mordents, double-dots, and other rhythmic and melodic alterations, because he knew his contemporaries would fill them in. The modern performer with no background in Baroque performance traditions, who confines himself strictly to the printed Urtext edition, is no more faithful to the original than the conductor who uses the Prout-out-of-Mozart version.

In recent years, scholars and conductors have prepared new performing editions of *Messiah*, bringing to their work a deep awareness of 18th-century musical practices. The Baroque *Messiah*, however, is still outnumbered by the "retouched" versions. The late Sir Thomas Beecham spoke out for revision when he said that "the whole business of reducing Handel's orchestra is a modern heresy and a very dangerous one, indeed, and should be extirpated root and branch . . . It is a physical and acoustical fallacy of the highest order . . . Suppose Handel were living today and saw our large halls and had full acquaintance with the resources of the modern orchestra, what would he have

(Continued on page 100)





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# AUDIO ETC.

Edward Tatnall Canby



## WHAT'S IN A NAME?

Everybody in the record business (classical, *et al.*) knows Schwann. As Schwann goes, in terms of record listings, so goes the nation. If you read it in Schwann, it *must* be true. At least in name.

But how much do names count—on LP? Does an LP by any other name sound as sweet? I'd say yes. So long as the label info sounds reasonably convincing.

Reproducing the basic info on record labels and seeing that the records themselves do in fact exist (whether the listed performers do or don't) is Schwann's big business. Actually, this sturdy little fat cat-alogue, which long ago beat down the competition by sheer monthly persistence, is an industrious reflection of the record business itself, or rather, what the record business says the record business is. Since the Schwann info comes direct from the manufacturers, who are as likely to wishful-think as the rest of us, Schwann has its problems. You hafta take their word for it, those record companies, one way or another. I'm sure Schwann does *not* play every record with score in hand, and attend every recording session to check on identities of the performers.

Yet in the long run, Schwann does tell almost all. All that any of us mostly get to know. At least, if Schwann says an LP is available, it'd better be—or else. You can't insert a false listing, in such a widely read publication, without a hot feed-back reaction from the readership. False listings, or even hopeful ones that are unrealistic, bring squawks from both customers and dealers. It's like putting nickels in a slot machine and not getting the candy bars. Or cash into a cigarette vendor that balks. (Just the other day in New York a man shot up a local bar when the machine swallowed his cash and then refused to disgorge the smokes.)

So in a big way Schwann's listings are self-correcting. Not that the staff doesn't break its back regularly (see below), working for statistical accuracy—that is, accuracy to the manufacturer's info. But they do get help. They are positively goaded by the record-conscious public. They ask for it, and they even thank you nicely when you goad them.

Therefore, you can understand, I tend to believe absolutely *everything* I see in Schwann. I always do. Even in the recent and notable Schwann Artist Issue of 1966 (June), which lists all LP records (as of May) under their performing artists, individual or corporate, instead of under the composers.

## Salzburg

I even believed Schwann, this time, when it was talking about *me*, like somebody in some other world. Imagine my surprise and pleasure when I read in The Artist Issue that my own New York singing group, the Canby Singers, had made a record in, of all places, Salzburg, Austria! Singing Buxtehude Cantatas under the direction of that venerable sage of the Salzburg Mozarteum (the Mozart museum), Bernard Paumgartner. You could have batted me with a feather. For I do love Salzburg and I adore old Dietrich Buxtehude's music. Herr Paumgartner, too, has been an excellent Salzburg conductor and it was wonderful to know that, in the LP fantasy-world, we Canby Singers had actually made a record under his distinguished direction.

Alas, it was merely a (rare) Schwann alphabetical error that got by uncorrected. I almost believed it, as I say. It seems the disc should have been listed under the *Cantata* Singers, not the Canby Singers. Right next door in the alphabet, and somebody made a slip of a card file. Too bad. I like Salzburg. I really do.

The error in Schwann will be corrected and the Canby Singers will be returned—on LP—to New York. But there remains an interesting little question. Just who *are* these Cantata Singers—of Salzburg?

No, no—not the Cantata Singers of *New York*. That's a real (i.e. "live") organization and it hasn't been traveling in Austria recently, either. These other Cantata Singers are, I suspect, quite fictional as to name. Oh yes—the singers exist, natch. They made the record under Paumgartner. But due to some contractual complication they couldn't use their real name. So—The Cantata Singers. I might further speculate that this *could* imply a reissue disc, an old one now updated and perhaps on a new label? Ah—wheels within wheels! That's the record business today. And it's Schwann's business too, for better or worse.

You see, I'm willing to bet that this Buxtehude disc by the theoretical Cantata Singers is a fine record. It ought to be. And I'll wager it's available, too, if Schwann says so. There they are—the *Salzburgischer Kantatensingkreis*, maybe?—as real as your hi-fi amplifier can make them, factually, audibly *existing*. And yet *who are they?* Perhaps we'll never now.

There's no use our being persnickety about who's who in this splendid big guessing game that is LP. Take it as an interesting phenomenon, a fantasy-world that's also true. All these *people*, real, honest-to-God people, singing and playing away be-

fore the mikes, and half the time you can't really be sure who or what or where they are, or even when! Crazy-like. Schwann's Artist Issue deals directly with this sort of zany world, and it's a wonder they don't make more factual mistakes than they do. The statistics connected with the new Artist Issue are startling.

For instance, since the last Artist Issue, in 1963, Schwann has *deleted* (at the manufacturers' request) just about half of the then-current LP listings. On the other hand, new LP listings have been arriving at the Schwann office. They tell us, on an average of *one per hour for an eight-hour work day seven days a week since 1963*.

Now admittedly that's an odd way to figure a *per diem* arrival rate, since we trust that Schwann works his cataloguers at most five days a week. Still—this does say very clearly (with a bit of rearranging) that it would take any listener like you and me approximately four hours of straight record playing *every single day*, never-ending, year in and out, just to keep abreast of the incoming new listings. That is, if we were to play each newly listed LP just once, all the way through, with no cheating. As, for instance, a conscientious record reviewer is supposed to do. There's your LP flood.

## Like New

Of course, in this odd fantasy world Schwann can't make any sort of distinction between brand-new recordings, never before released, and those hundreds and hundreds of "new" listings which are actually reissues, in any number of formats, or are reshaped from older LP's into new combinations. I strongly suspect that about half of the new listings are actually old ones revamped—for the good, in 99 per cent of the cases, as per my remarks in the July issue.

The manufacturers are not very helpful with info on this matter. Especially those who have bought up legitimate rights to material originally listed on some other label. Mostly they don't say a thing about it. Understandable. No point in giving bad publicity to a release that is perfectly good on its own and quite legitimate. Very few record companies dare try the Volkswagen approach—saying, yes, it is that same old recording, but we've greatly improved it technically and, maybe, lowered the price into the bargain. Much safer just to list it as a new release, which in a way, of course, it is. And so it goes, straight into the new listings. Like new. Often sounds that way.

A lot of "new" listings, too, are simply alternative packagings, from the same company. An excellent idea, even if it does make two or three LP's out of what is really just one. People like varying collections and pairings. Why not?

Schwann makes special note, for instance, of the recent huge spate of albums featuring the pianist Rudolph Serkin, from Columbia—a gargantuan pile that I haven't been able to face yet. Too big. Great Romantic Concertos, all the Piano Concertos of Beethoven, separately and together, music by Mozart, Brahms—the whole classic repertory of the old fashioned virtuoso concerto pianist, German-oriented. Good stuff! Serkin is a hot live wire in that field.





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But I ask (and Schwann doesn't say), how many of these are brand new recordings, just made, *not previously issued*, and how many are perfectly legitimate repackagings of performances already released on Columbia.

I could find out easily enough, I guess, but I'm not going to bother. Neither Schwann nor I think it's that vital. For me, and for you, the proof of the LP is in the playing, not the dating. If it's ten years old and sounds just like new, I'm happy. After all, the best tapes of ten years ago are a lot better than the worst of today.

## Domestic Imports

Another big bulge in the bulging Artist Issue comes from those proliferating imports, many of which do get into the regular Schwann listings (though Schwann has launched, hopefully, a special Import Supplement). If they are offered on a domestic label, like Turnabout or Music Guild or even RCA Victor, the imports are of course automatically "in". And, I gather, they are also "in," even under their own foreign labels, if they are nationally distributed hereabouts by an American company. The import biz is too big, now, and too complex, for Schwann to draw fine import distinctions. You can't very well shoulder aside Angel, Philips, London, Deutsche Grammophon, nor even Telefunken, L'Oiseau-Lyre, Argo, or Odeon, imports all of them in varying degrees. Collectively they swing a big weight in our li'l old U.S.A. And so, increasingly, they are listed right down the line alongside RCA Victor and Columbia. More imports—and more LP's than ever in the catalogue.

Well, I guess Schwann's biggest problem with the Artist Issue must have been inevitably resolved beforehand—that little matter of the semi-fictional ghost-names, of which there are, to put it mildly, simply hundreds. Here we have a listing of records by artists—and half the artists, if a name is a name, don't even exist. Phew! Some listing! But the ethical problem had only one possible and reasonable solution, as far as this catalogue was concerned. Don't call a spade a spade. (And how do you know it is a spade?) Call it whatever the manufacturer says it is. It's his worry, after all. Not Schwann's.

Just imagine it, even so. A whole catalogue populated with all sorts of corporate ghosts, mixed together with corporate realities (as of real-life "live" music, at least), and if you start trying to eliminate the pseudonyms and the double-aliases and the all-purpose, catch-all titles, you're in a rat's nest for fair. Because most of the fictitious titles are perfectly legal and many of them have a life of their own—on records. Many are very real, in this way, even though the actual personnel keeps changing. It's the name that exists, not the players.

After all, any orchestra, or chorus or opera company, has a regular turnover. When does a quick turnover amount to a new performing group? Who knows! But that's not all. Take a fine, legitimate, well-known, often-recorded name like the Columbia Symphony Orchestra. What could be more real, in the LP sense?

## Columbia's Symphonies

Now Schwann dutifully lists almost seventy releases by the Columbia's sidekick, the Cleveland Orchestra (mostly on Epic with a few Columbias and others) and you may be pretty sure that each of these involves the actual Cleveland Orchestra that was then playing before the public in Cleveland, Ohio, U.S.A. But Schwann also lists nearly eighty releases—mind you, many of them are multiple-record albums, up to 7 discs—as played by the Columbia Symphony Orchestra. And there the situation is a wee bit different.

Very few of us have heard the Columbia Symphony in the flesh because "it" doesn't play thataway. "It" just makes recordings.

I say "it" because the personnel of "the" Columbia Symphony is such a spaceless intangible that nobody but a Columbia man could hope to pin it down to an occasion. No offense intended—the Columbia Symphony, whichever one, is always a crack outfit, the very best. In New York, maybe. Or on the West Coast. Or wherever a Columbia Symphony is needed. They seem to spot Columbia Symphonies conveniently all over, or work them up new for special occasions, like Bruno Walter, or Igor Stravinsky.

Rumor even says that one of these numerous excellent Columbia Symphonies was physically resident in old Vienna, where it also plays (and just maybe makes records for other labels) under a different name. Could be. Could *you* tell the diff? And if so, would you care? It's in your living room, isn't it, and do you *hafta* know where the mikes were, where you're listening?

There is, by the way, an unfortunate term for orchestras got together on the spot, for an occasion: pick-up orchestras. More often than not, these pick-up groups are first-rate in the personnel and lack only the long rehearsal time and intimate association of the "real" orchestras that play regularly together in public. Some of the Columbia Symphony Orchestras, and others of the sort, have in fact played very regularly together (for taping) and so who can complain if the name skips blithely around from one of them to another? It all comes out of the same loudspeakers, doesn't it?

Then there are other and similarly indefinable orchestral outfits that go under personal names—with the suffix "& His Symphony Orchestra" added. That title has a distinguished history on records! And never more so than when it was Leopold Stokowski & His.

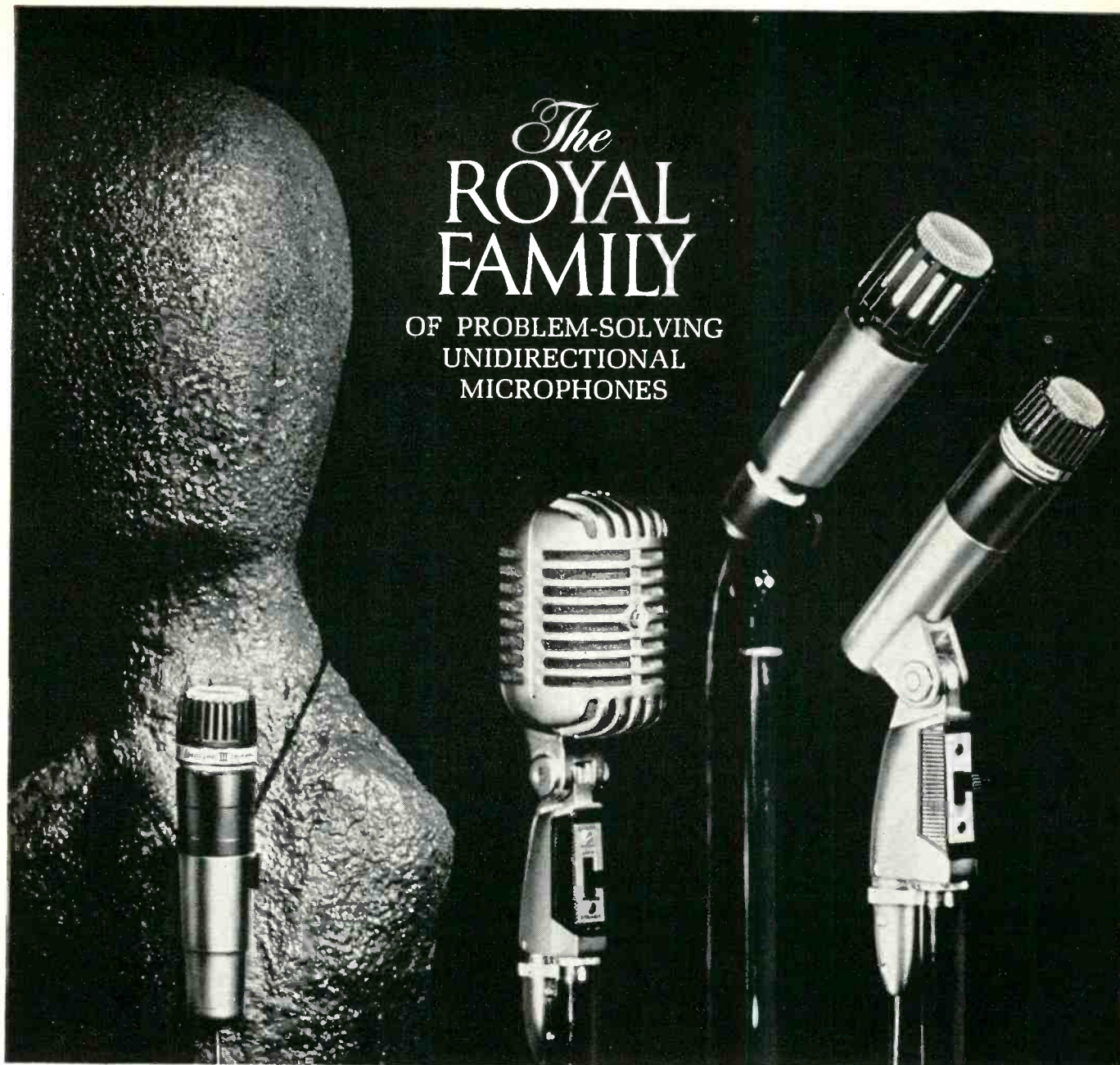
On a similar plane we find such hard-to-list artist groups (poor Schwann) as "*The* Symphony Orchestra." (*What* Symphony Orchestra??) A grammatical problem—do you list it under T, or under S? Even worse is the orchestra that is called "And," or even just "&." So-and-so, pianist, "&" Symphony Orchestra. Do you list it under Ampersand?

(Schwann is sweetly reasonable here. It lists just three items under the high-sounding title of "Symphony Orchestra" and puts almost seventy others, according to (Continued on page 100)



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# EDITOR'S REVIEW

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**M**ASTHEAD READERS—those who read the contents page regularly and are thus cognizant of any changes in editorial staff or other personnel—will already have noticed that *AUDIO* is no longer situated in the village of Mineola, a Long Island town some twenty miles east of the Big City, but in the future will emanate from Philadelphia, Pennsylvania. After almost fifteen years in Mineola, *AUDIO* is now “on the move”—and, we trust, not only physically.

*AUDIO* is “moving in with the family,” which is what it says on our notice of address change to advertisers, advertising agencies, and so on. The “family” refers to the other publications of North American Publishing Company, which *AUDIO* has just joined—*Printing Impressions*, *Data Processing*, *Graphic Arts Review*, *Business Forms Reporter*, and *Food Trade News*.

For the reassurance of the old timers who have been reading *AUDIO* for up to nineteen years, there is no change in the editorial staff—we’re all going along. We do feel that the addition of the creative staff of North American will be able to improve our appearance appreciably. We also feel that the operation of the subscription fulfillment service in our own office will result in more efficient operations in that area. And we are certain that our own advertising sales offices, located in five cities throughout this country and one in Japan, will give us a closer liaison with the people who make magazines possible—the manufacturers and advertisers.

One of the complaints we often hear at Hi-Fi Shows is that it is often difficult to find *AUDIO* on the newsstands—this too, we expect to change, so non-subscribers may find the magazine more readily. The expansion of our staff will make some of these things possible, whereas heretofore we often thought up the ideas, then were unable to put them into practice simply because of lack of enough hours in the month to execute them.

There are so many related fields that are on the fringe of audio—video recording, for example, which is only slightly different, in operation at least, from

audio recording. We know there is a great interest in electronic organs and in electronic music. With the editorial staff freed from the mundane business aspects of publishing, we look forward to a more thorough coverage of our existing hi-fi field, as well as a considerable expansion into the professional areas, and still have some time left over to explore the more esoteric subjects. In short, we feel that with the “back-up” of a large organization, we will be able to do many of the things which have been left undone in the past.

One of the plans our new “parent” has for us is the regular use of four-color covers (although the July cover was our own idea). This will drift us away from our long-standing custom of running pictures of readers’ installations, so when you think of a front cover of your ultra-super-duper rig, make sure that the picture is in color—we need at least a 2¼ x 2¼ transparency.

One more reassurance before we leave this subject—*AUDIO*’s editorial staff remains intact, and even “Sandy” Cahn, our erstwhile advertising director, now gets a new title—he’s now Marketing Director.

And note our new mailing address: 134 North 13th Street, Philadelphia, Pa. 19107. The telephone number for those who like to (or need to) call us, is (215) 564-0336.

## TWENTIETH ANNIVERSARY

Just a brief note of congratulations to Magnecord, which celebrated its twentieth anniversary on June 17, 1966. Magnecord, now a division of Midwestern Instruments, Inc., a subsidiary of The Telex Corporation, started in Chicago, and its first product was a wire recorder. We didn’t think there was hardly any company older than *AUDIO*, and we don’t reach our twentieth until next May. At any rate, we well remember the famous PT6 series of tape recorders, even though we never had any direct experience with the Magnecord wire machines. Congratulations again to Magnecord, and many more years of building fine recorders.



# Nine out of ten musicians prefer the natural sound of Pickering.

PHOTO BY FRANZ EDGON



Microgroove discs are recorded by magnetic processes. Naturally they sound better when reproduced with a Pickering Micro-Magnetic™; there's a natural compatibility. From the tiniest peep of a piccolo to the mightiest roar of an organ, Pickering produces sound as natural as the original performance. That's why musicians prefer Pickering. And so does everyone else who can hear the difference.

Pickering makes it easy to get natural sound in any stereo installation. There are four Pickering Micro-Magnetic pickups, each designed for a specific application. The V-15AC-2 is for conventional record changers, where high output and heavier tracking forces are required. The V-15AT-2 is for lighter tracking in the newer automatic turntables. The even more compliant V-15AM-1 is ideal for professional-type manual turntables. And the V-15AME-1 with elliptical stylus is the choice of the technical sophisticate who demands the best word in tracking ability.

No other pickup design is quite like the Pickering Micro-Magnetic. The cartridge weighs next to nothing (5 grams) in order to take full advantage of low-mass tone arm systems. Pickering's exclusive Floating Stylus and patented replaceable V-Guard stylus assembly protect both the record and the diamond.

But the ultimate test of a cartridge is the human ear. Find out for yourself. Listen carefully to a Pickering. You'll hear the difference.

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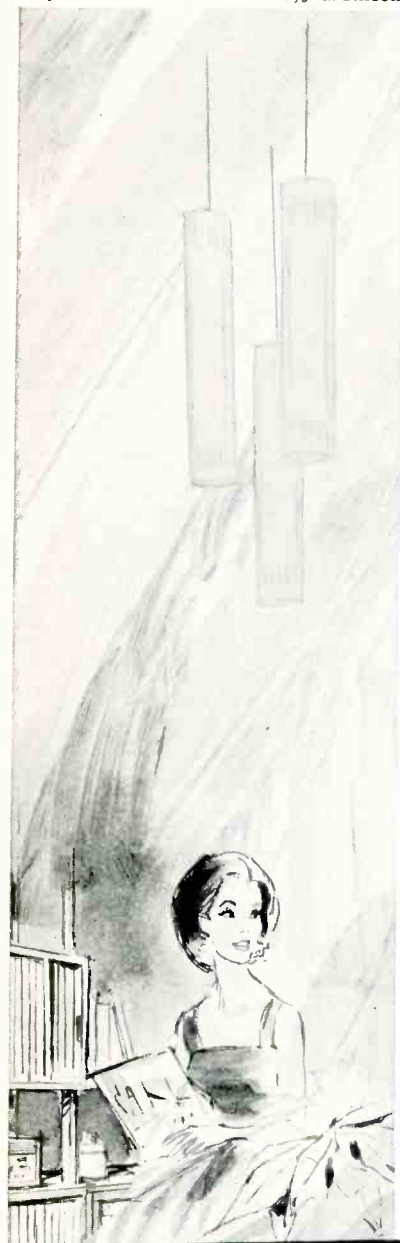
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Compare these new Sherwood S-8800 features and specs! **ALL-SILICON** reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, Front-panel mono/stereo switch and stereo headphone jack, Rocker-action switches for tape monitor, noise filter, main and remote speakers disconnect. Music power 140 watts (4 ohms) @ 0.6% harm distortion. IM distortion 0.1% @ 10 watts or less. Power bandwidth 12-35,000 cps. Phono sens. 1.8 mv. Hum and noise (phono) -70 db. FM sens. (IHF) 1.6  $\mu$ v for 30 db quieting. FM signal-to-noise: 70 db. Capture ratio: 2.2 db. Drift  $\pm$ .01%. 42 Silicon transistors plus 14 Silicon diodes and rectifiers. Size: 16 $\frac{1}{2}$  x 4 $\frac{1}{4}$  x 14 in. deep.

# Now, look at the *NEW* Sherwood specs!

Model	V-Vacuum Tube S-ALL-SILICON T-Germanium Transistor	Power (IHF) 2 channels 4 ohms Watts	FM Sensitivity Microvolts	Price	Dollars Per Watt
Sherwood S-8800	S	140	1.6	\$ 359.50	\$ 2.57
Altec 711A	S	100	2.2	378.00	3.78
Bogen RT8000	T	70	2.3	319.95	4.57
Dyna FM-3, PAS-3 & S-70	V	90	4.0	404.85	4.49
Fisher 700T	T	120	1.8	499.50	4.16
Fisher 440T	T	70	2.0	329.50	4.70
Harman-Kardon SR-900B	T	100	1.85	449.00	4.49
McIntosh 1500	V&T	85	2.5	499.00	5.87
Marantz 8B, 7T, & 10B	V&T	75*	2.0	1340.00	17.87
Scott 348	V&T	120	1.9	479.95	4.00
Scott 342	T	65	2.5	299.95	4.61

References "T" or "V&T" (above) may include some silicon transistors. Figures above are manufacturers' published specifications except (\*) which are published test findings.



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# Adjustable

RONALD L. IVES\*

## SCR Speaker Protector

Having trouble with blown out speakers? Here is a simple circuit which is claimed to protect them from high current surges. What effect the circuit might have on a high-power transistorized amplifier the author sayeth not.

**S**PEAKER DAMAGE from overdriving is not uncommon among those audio buffs who try to achieve realism by cranking up the gain until the listener feels that he is inside the bass drum. The last straw for more than one speaker system has been the first salvo of the Kremlin cannon in a certain recording of the "1812 Overture."

This is not exactly a new problem, and workable acoustic shock preventers have been used for some time in the telephone industry. Early models consisted of a neon lamp connected across a suitable part of the circuit. When the voltage exceeded the firing potential of the lamp, conduction took place, "absorbing" an appreciable part of the excess signal.

Clippers of various sorts, consisting of biased thermionic or solid-state diodes, have been widely applied. When the bias on these devices is adjustable, the clipping level is also adjustable.

More recently, zener diodes, connected "back to back" have been used with some success at low and medium powers. When used in conjunction with a Variac (usually a 400-Hz model), they provide very effective adjustable clipping, although not inexpensively.

Now, with the commercial availability of silicon controlled rectifiers at reasonable prices, it is possible to make a peak clipper for audio systems that combines low bulk, moderate cost, and high dependability.

### The Silicon Controlled Rectifier

The silicon controlled rectifier, normally abbreviated as SCR, is a solid-state device related to the rectifier which will not conduct until a short low-voltage pulse has been applied to the trigger element. Once triggered, it continues to conduct until the supply circuit has been interrupted. Its behavior is much like that of a thyatron, except that it

requires neither heater current nor a hold-off bias supply.

Because of its unique construction, the triggering pulse, in most instances, can be provided from the same source as the anode current, and the turn off pulse—an interruption of the anode supply—is automatically provided each cycle in an a.c. circuit.

These properties make it ideally suited for use as a speaker protector, or for related higher power peak clipping.

### Speaker Protector

Circuit of an experimental speaker protector using SCR's, is shown in Fig. 1. The speaker protector is floated directly across the speaker line, and imposes an infinitesimal load at line voltages below the critical value, which is adjustable.

Operation is as follows: As long as the voltages on the triggers are less than the firing voltages of the SCR's in use, the SCR's do not conduct, and the speaker system acts as if the protector were not there. As soon as the instantaneous voltage on the trigger of an SCR reaches the firing voltage (+4 volts relative to cathode in most instances), the SCR conducts, and remains in conduction as long as its anode is positive. At the end of the half cycle

under consideration, the anode of the conducting SCR goes negative, conduction stops, and the SCR will not conduct again until triggered by the next peak of voltage.

By using two SCR's in inverse parallel, and two potentiometers, the speakers are protected during both half cycles of any audio signal. As the clipping level is normally the same for both the positive and negative half cycles, a dual pot can be used here.

With the circuit and constants shown, clipping begins when the voltage across the line is approximately 4, with the pot arm set full CCW. This means that a sinusoidal signal of any value up to about 2.8 watts will pass unclipped: any signal of higher power will have both positive and negative peaks clipped. These wattage figures are not exact, as we have not considered the power factor of the system.

By advancing the pot arm CW, we can raise the clipping level from approximately 4 volts to any higher value desired.

### Performance and Limitations

With the circuit and constants shown, performance is excellent with ordinary

(Continued on page 93)

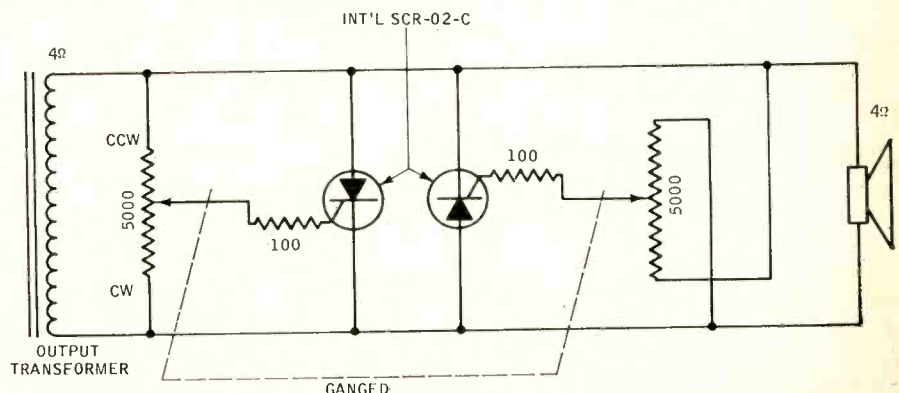


Fig. 1. Circuit of adjustable SCR speaker protector.

\*2075 Harvard Street, Palo Alto, Calif. 94306

# Radio Measurements Course

## Part 7.

NORMAN H. CROWHURST\*

Last month we covered preamplifiers. This month r.f. enters the spotlight with a discussion of AM and FM tuners. Most of the emphasis is on the latter.

**A** TUNER IS NOT STRICTLY an audio device, because it includes radio components. However, the main criterion in its over-all performance concerns the quality of audio that it delivers, for which reason measurement of all aspects of a tuner's performance really comes under the heading of audio.

All measurements on a tuner should be made with controls at normal, except where tests are being made on the function of specific controls.

Tuning needs checking. Three criteria may be used for determining correct tuning:

(1) the indication on a tuning meter, if provided;

(2) background sound—a tuner is usually in tune when background reaches a minimum;

(3) minimum distortion of the audio signal (in an FM tuner) or nearest-to-correct audio-frequency response (in an AM tuner).

In a good tuner, tuned for a given input carrier frequency, these three

criteria should occur at the same tuning point. If the tuning points differ, a note should be made of how much (by detuning the signal generator while keeping the tuner at a fixed setting, and measuring the change of carrier frequency between the three optimum tune points).

For other tests, the choice of tuning method needs to be stated. On an over-all performance check, maybe two or more sets of measurements should be made, because it would give an unfair evaluation of performance to measure noise when that is at a minimum, distortion at a different tuning point when that is at a minimum, and frequency response likewise.

Measurements should show, where there is measurable difference, what is the noise figure when tuned for minimum distortion, and also what is the distortion figure when tuned for minimum noise. All measurements should be made with an appropriate AM or FM signal generator and a suitable dummy antenna for the frequency

range being tested.

Reference level should be the output signal level when standard modulated input of 400 Hz is applied through the generator.

In any radio tuner, there are two forms of what would be called dynamic range in a simple audio system: the received channel has to be demodulated of the full dynamic range of the modulating audio successfully; the tuner also has to be capable of handling different magnitudes of received carrier, from weak to strong.

There is not usually much trouble with overload from too strong a radio carrier, except in areas that are really close to the transmitter. In these cases, if necessary, an attenuator can be applied between the antenna and input terminals. Many tuners come with a local/distance switch, that inserts or removes such attenuation, to change the range of signal levels the tuner will cover.

### Sensitivity

The minimum level receivable is usually determined as that at which the dynamic range of the received signal, with added background noise due to reception, is 30 dB. A much lower dynamic range can be accepted for communications purposes (usually is) but this is the audio requirement set down by the Institute of High Fidelity standard for high-fidelity reception.

Another complication in radio reception comes in at the antenna with the signal: interference. In FM operation the effect of interference may be divided into two headings: other channels using the same frequency as the wanted channel and those using different frequencies; in AM operation, a channel using the same frequency as the wanted channel produces a predictable and unchangeable degree of interference, but the other-frequency forms of interference are measured similarly to the FM situation.

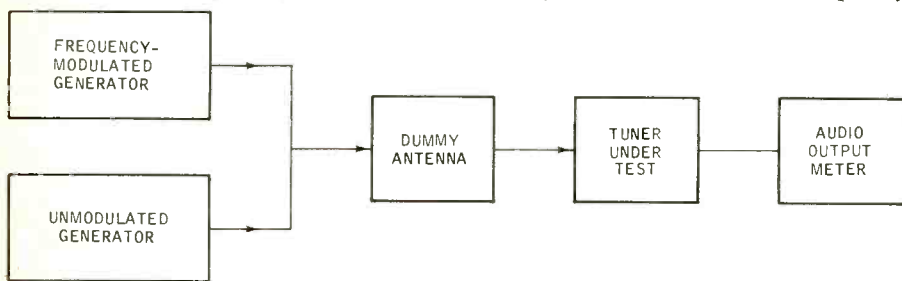


Fig. 7-1. Test sequence for determining capture ratio. Tests for adjacent channel selectivity (or rejection) are identical, except that the unmodulated generator is tuned to an adjacent carrier frequency.

1. With unmodulated generator off, modulated generator is set to designated input test level and audio output meter is read.

2. Unmodulated generator is switched on, and level increased until audio out-

put meter drops 1 dB. Level of unmodulated generator is then read as (A dB above 1  $\mu$ V).

3. Unmodulated generator level is increased until audio output meter drops 30 dB. Level of unmodulated generator is again read, as B dB above 1  $\mu$ V.

4. Capture ratio =  $\frac{B-A}{2}$  dB.

P. O. Box 651, Gold Beach, Oregon 97444



## Pureness of FM

In FM operation, a lower level of the same frequency produces an amplitude beat, due to the fact that the two are not absolutely identical. It will also reduce the measurable frequency shift—due to modulation of the wanted channel—to a much lesser degree. The effect of the unwanted channel on reception depends on how well the tuner is able to separate amplitude modulation from frequency or phase modulation at the relative levels involved.

The test applied for this consists of using two signal generators, one with modulation and the other without. The modulated generator is set first to a specific signal level. Then the signal level from the unmodulated generator is raised until the audio output from the tuner drops by 1 dB. The level of the unmodulated generator that causes this reduction is noted. Now the level is raised until the audio output drops 30 dB, and the level required to do this is again noted.

The two levels of the unmodulated signal generator are related in dB. This value, divided by 2 gives the figure known as the 'capture ratio.' Fig. 7-1 illustrates the test sequence.

The smaller the dB figure, the more effective the receiver at discriminating between two channels on the same frequency. A receiver with no ability to distinguish between frequency and amplitude modulation would yield a capture ratio of about 24 dB. The test can be made with different degrees of modulation, 100 per cent, 30 per cent, and so on, of maximum deviation. The capture ratio will naturally depend on the modulation depth used by the 'wanted' carrier.

## Selectivity

The test for selectivity uses the same method, but with the unmodulated generator tuned to a frequency removed one carrier channel from the modulated generator frequency.

Such tests should be repeated at different levels of wanted signal. The IHF standard specifies taking them at 20-dB intervals (10:1 voltage steps).

In an FM tuner, another important capability to measure is the suppressing of amplitude modulation. The results of the capture ratio test are affected by this ability, but the figures are related to a different reference property. Amplitude modulation of a carrier nominally frequency or phase modulated can occur due to a variety of causes.

Maybe the transmitter does not transmit a perfect frequency modulated signal, free of amplitude modulation. It may have feedback to produce linear

frequency modulation, which may not eliminate amplitude modulation.

For a given deviation ratio, a specified number of FM sidebands, which should be filtered off above a certain order, to conform to FCC requirements, can do one of two things: it can achieve a certain approximation to constant amplitude carrier; or it can achieve a certain degree of linearity in frequency or phase modulation. The two conditions are not coincident.

If the feedback is designed to achieve maximum linearity of modulation, as measured in terms of frequency or phase deviation, it will cause the amplitude to deviate more than if the corresponding amount of feedback is devoted to maintaining constant amplitude of carrier.

Thus, in the basic transmission, there are three mutually dependent variables for a given input signal deviation: (1) number and relative magnitude of sidebands; (2) linearity of phase or frequency modulation; (3) constancy of carrier amplitude. (1) must be controlled to conform to FCC requirements, necessary to avoid interference with other channels. The choice between (2) and (3) is a matter of compromise.

Basically, the important one is (2)—maintaining maximum linearity of modulation in its reference quantity—frequency or phase. Measurement of transmitter performance in these respects is a matter of using accurately designed demodulators with appropriate test signals, as in any other audio system. We are more concerned with measuring tuner performance.

Even if the transmission is perfect in both these respects, then transmitting conditions, between transmitter and receiver, can affect different frequencies differently. As the frequency modulates, reflections may vary, changing the resultant intensity at the receiving antenna. So the receiver needs to be able to ignore such amplitude modulation, whatever its cause.

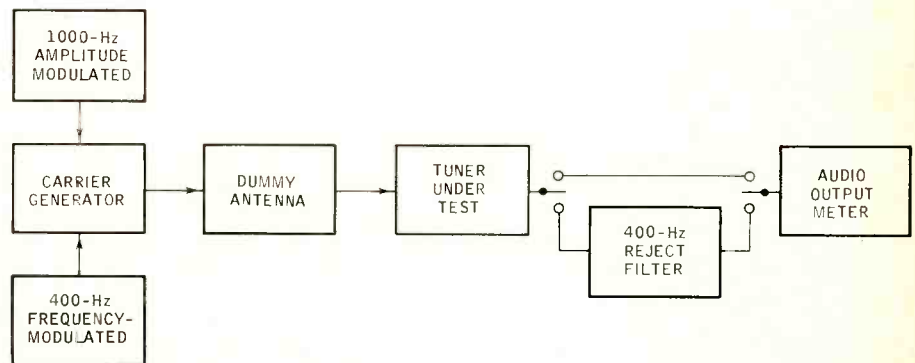


Fig. 7-2. Test set-up for measuring sensitivity of an FM tuner to AM on the same carrier.

The standard test for this, laid down by the IHF, uses a signal that is both frequency and amplitude modulated. It uses a maximum-deviation frequency modulation at 400 Hz, and a 30% amplitude modulation at 1,000 Hz. The output from the tuner is then passed through a 400 Hz rejection filter, so the 1,000 Hz signal and any related products can be measured. The level of the total 1,000 Hz products, referred to the 400 Hz level when not so suppressed, as dB below, is called the amplitude modulation suppression of the tuner. The test sequence is illustrated at Fig. 7-2.

## Second Channel Interference

All modern radio receivers use the superheterodyne principle, in which the incoming radio frequency carrier has its frequency changed to a standard intermediate frequency (i.f.), at which the preselection against adjacent channels is achieved. Different intermediate frequencies are used, according to the frequency band being received. For amplitude modulation, the standard i.f. is 465 kHz. For FM, intermediate frequencies of a few megahertz are used, as they are for television reception.

The main reason for using an intermediate frequency is to get the desired degree of flat-topped response to the wanted channel, along with sharp cutoff between channels (Fig. 7-3). Design of a circuit to have ideal performance of specified width dictates an ideal range of intermediate frequencies. The actual choice is usually finally decided on the basis of possible second channel interference, or rather, the avoidance of it.

The superheterodyne receiver usually employs an oscillator whose frequency is higher than the received carrier by the intermediate frequency chosen. Then the frequency changer mixes the two and picks off the difference frequency product as i.f. The only thing about this is that a second frequency will produce the same i.f. The

second frequency, known as the second channel frequency, is higher than the oscillator frequency by the IF, so it is separated from the wanted carrier frequency by twice the IF frequency (Fig. 7-4).

To test for second channel interference rejection, another generator is tuned through the region of the second channel frequency and measurements made similar to those for other interfering channels, to determine the level of interference. Another possibility that

the concept of pre-emphasis in FM is based on the fact that average program content is of lower level at the upper frequencies, although it is more audible to average human hearing (for a given electrical or acoustic level). Thus the actual energy transmitted in a typical transmission will be more nearly simulated by using a uniform input signal (without pre-emphasis) and accepting the de-emphasis on reception as the energy distribution curve of the transmitted audio input signal.

are meaningful is to have a high quality tuner—better than the one being tested—with which to check the generator and test equipment. The combined performance must be better than the results to be measured on the tuner to be tested, or results will not be valid.

For frequencies above 1,000 Hz, the de-emphasis invalidates the harmonic method, by unduly attenuating any distortion products. In this range, the two-frequency method, using two higher frequency audio signals, differing by less than 500 Hz, is to be preferred.

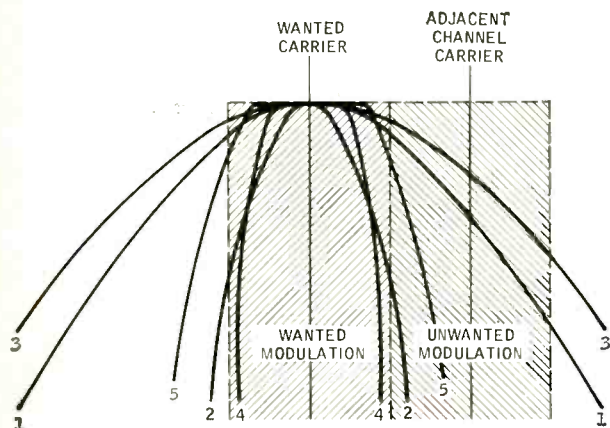


Fig. 7-3. Responses illustrating the general factors governing the choice of an intermediate frequency.

### Frequency Drift

With the high carrier frequencies used for FM modulation, frequency drift, due to change in values of tuning components, can cause serious detuning effects. A good tuner is designed with temperature compensated components to offset this as much as possible. Another cause of drift may be the change in amplitude of the received carrier.

Such amplitude fluctuations may be cared for by clipping the waves, or by automatic gain control, or by a combination of both. In either method, change in level can affect the apparent tuned frequency, due to changes in tube or transistor parameters with signal level being handled, or with bias. These effects are checked by setting up the conditions artificially, deactivating the automatic frequency control, where provided, and checking the effects quite precisely with a generator and attenuator. Time drifts are cared for in the same way, taking careful readings over a satisfactory time interval.

### Automatic Frequency Control

Checking of this follows a fairly obvious procedure. Two facts about the control need determining: the range of frequency, on either side of the carrier frequency, to which the receiver is momentarily tuned, over which the control "holds", without pumping to the next available channel; and the degree with which the tuning is improved by the control.

should be checked is the receiver's sensitivity to a spurious carrier signal at the intermediate frequency itself.

### Frequency Response

This is relatively easy to measure, provided the generator has an external modulation input, to allow modulation by an audio signal generator. For a thorough check, the modulation should include the standard pre-emphasis, so that the de-emphasis in the tuner will produce an over-all result that is level.

Standard pre-emphasis for FM tuners is an inverse time constant of 75 microseconds, which gives a 3 dB turn-over point at 2,120 Hz, with a 6 dB per octave rising characteristic, asymptotic to this point (Fig. 7-5). The de-emphasis part, in the receiver, is simple, but must be right: just a high frequency roll-off with the 3 dB point at 2,120 Hz, or a time constant of 75 microseconds. To perform correctly, both responses must be right; the pre-emphasis and de-emphasis both need to be correct, so the responses match and produce a flat resultant.

A pre-emphasis network must have a "leveling-off" frequency. If the response is to be checked to 20 kHz, the leveling-off frequency should be 40 kHz, which will show a 1 dB loss at 20 kHz when combined with a matching de-emphasis network. A pre-emphasis network with turn-over points at 2,120 Hz and 40 kHz will have an insertion loss of about 26 dB.

There is one disadvantage to this method of matching overall response:

To do this, the generator can be linearly modulated by the audio generator, and the output response is then compared with the standard de-emphasis characteristic, the difference being plotted as the error in frequency response performance.

### Distortion

This measurement poses a little more difficulty with an FM tuner. For audio frequencies up to 1,000 Hz, harmonic measurement is most satisfactory. Either the analyzer or the input/output null method (Fig. 7-6) can be applied here.

A problem with both frequency response and distortion measurement is that of knowing how much of the deviation from ideal occurs in the generator and test equipment, and how much is in the tuner being tested. The only way to be sure the measurements

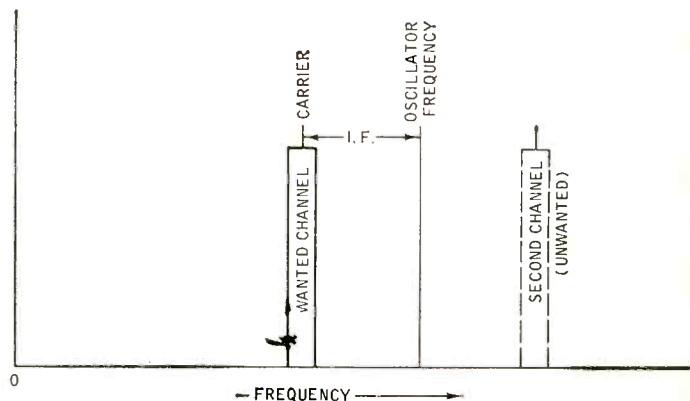


Fig. 7-4. Usual location of second-channel frequency.

(Continued on page 104)



there is  
no margin  
for error  
when striving for  
the ultimate  
in stereo  
sound  
re-creation

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Circle 119 on Reader Service Card

# Patent Infringement Protection Forfeited by Delay

ALBERT WOODRUFF GRAY\*

The moral to be learned from this article is that if you have an invention which you have patented, you should not postpone action against an infringer for a long period, even though you might get away with delaying under some circumstances.

FAMILIAR TO EVERY LAWYER is the old and often repeated adage, "Time is the essence of defense." Defeat often lurks in the failure to strike while the iron is hot. Nowhere does that maxim play a more striking role than in actions brought after a too-long delay by a patent owner against an infringer of his patent.

Suit was brought by the owner of a patent of a device used in loudspeakers for maintaining the voice coil in the air gap of the speaker. For several years after this patent was granted, loudspeakers had been manufactured embodying this device.

Wide sales had been effected by the manufacturers of the alleged infringing articles and a year after the patent in this litigation had been issued the plant capacity for the production of this device had been quadrupled but no notice of infringement had been served by the patent owner.

More than ten years after the issuance of the patent, during which these alleged infringing activities had been continued, suit for infringement was finally brought by the patent owner. In the recent dismissal of this action by a federal court denying protection of this patent the comment was made.

"In 1950, the alleged infringer quadrupled its plant capacity devoted to loudspeaker production and yet no notice of infringement was given to the manufacturer until after five years.

"The patent owner and its predecessors in title to the patent in suit have stood by and done nothing to protect their rights for a number of years while the alleged infringers were building up a business which they thought was legitimate and were spending money in enlarging their plant.

"Thus there is not only a long delay chargeable to the patent owner in instituting litigation on its claims of infringement but also a change in the position of those against whom these charges or infringement are made, to the extent that it would be inequitable

to allow the patent owner to enforce its claim for such infringement."<sup>1</sup>

Only a few months before this decision by the federal court in Illinois a controversy involving this same rule of law had been before a court in New Jersey in an action against the International Telephone and Telegraph Company, brought by the owner of several patents for the control of the electric oscillations basic to the use of radio transmission claimed to result from the incorporation in an electrical circuit of a piezo-electrical crystal.

Application for this patent had been made by the inventor in 1924 but the patent had not been granted until approximately fourteen years later. However, not until 1954, thirty years after the patent applications had been filed and sixteen years after the patent had been issued, did the patent assignee take action against the telephone company charging infringement.

When the telephone company sought a dismissal of this action on the ground that the patent owners had unduly delayed this action, the court refused to grant the application. Of this defense of delay, termed by the courts "laches," it was said here.

Basically the doctrine of laches is a principle of equity. The issue for the court to decide is whether or not it is equitable to permit the patent owner's suit to proceed against this alleged infringer. In other words, the court must as usual, balance against each other, the rights of the adversaries.

"But it is not the lapse of time alone that constitutes laches. The further question remains as to what else the patent owner has done or failed to do and how his actions or inaction in that regard have adversely affected the telephone company.

While situations are to be found in some of the cases intimating that unreasonable delay and mere lapse of time independent of any statute of limitations, constitute a defense, the generally accepted doctrine appears to be that it is not a mere matter of time but is principally a question of inequity in permit-

ting a claim to be enforced, this inequity being founded on some change in the condition or relations of the property of the parties.

"Indeed the United States Supreme Court has stated that to constitute laches the alleged infringer must have had good reason to think that the patent owner believes his asserted rights to be worthless or that he has abandoned them."<sup>2</sup>

Another summary by a federal court was made in the decision of an action brought for an infringement claimed by the owner of patents relating to electrical or radio tubes.

These patents had been issued in 1936 and suit for infringement not filed until eleven years later although receiving sets containing these beam power tubes had been marketed generally throughout this country for the eleven succeeding years.

"However I do not know that the alleged infringer's position has been impaired in respect to the extent that it believed itself free to go ahead with the manufacture and the sale of beam power tubes for this period of years.

"In the absence of clear proof of a changed position by tube manufacturers in general and the patent owners in particular, the defense is not one lightly to be recognized. The patent owner's failure to act in the period of time designated must be interpreted in the light of world events during that time. It has been frequently held that the unusual years during and immediately after the great war constituted a period in which all reasonable postponement and suspension of litigation was a public duty."<sup>3</sup>

<sup>1</sup>Muter Co. v. Schwartz, 156 F.S. 893, Ill., Oct. 9, 1957

<sup>2</sup>Pierce v. Int. Tel. & Tel. Co., 147 F.S. 934, N.J., Jan. 9, 1957

<sup>3</sup>Harries v. Air King Products Co., 87 F.S. 572, N.Y., Dec. 5, 1949

(Continued on page 103)

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# The FM-Stereo Antenna

## Primer

WALTER G. WOHLEKING\*

Presenting the second part of this comprehensive guide to the basic theory behind the design of effective high-frequency antennas and to the practical aspects of their use for FM-Stereo reception.

When an alternating voltage is impressed on a transmission line (as an antenna will do) a current results, the amplitude of which varies with the voltage, and the polarity of which reverses when that of the applied voltage does. Because the transmission line length is invariably greater than the wavelength of an r.f. signal travelling along it, and because this signal is constantly changing its instantaneous amplitude in a sinusoidal fashion, the instantaneous amplitude of the current is different at all points within a one-wavelength section of the line, but will be identical with the instantaneous current at equivalent points within other wavelength sections of line, and will at some point on the line be identical with the instantaneous value of current at the input of the line.

What all this is saying, basically, is that the transmission line has periodicity, with the same things happening over and over again every wavelength. The current and voltage travel along the line in a series of waves, the length of each being a wavelength at the radio frequency. On a matched line an a.c. ammeter inserted anywhere along the line will show the same current, because the ammeter averages out the sinusoidal variation in current amplitude during each cycle. Similarly a voltmeter attached across the line will exhibit constant voltage at any point along the line.

Now, if a short circuit were placed on the end of the line, all the power traveling down the line, upon reaching the short, would be reflected back along the line. The voltage across the short is small and the current through it is quite large. On any other part of the line a voltage and current exist which represent the outward or incident power and a second value of voltage and

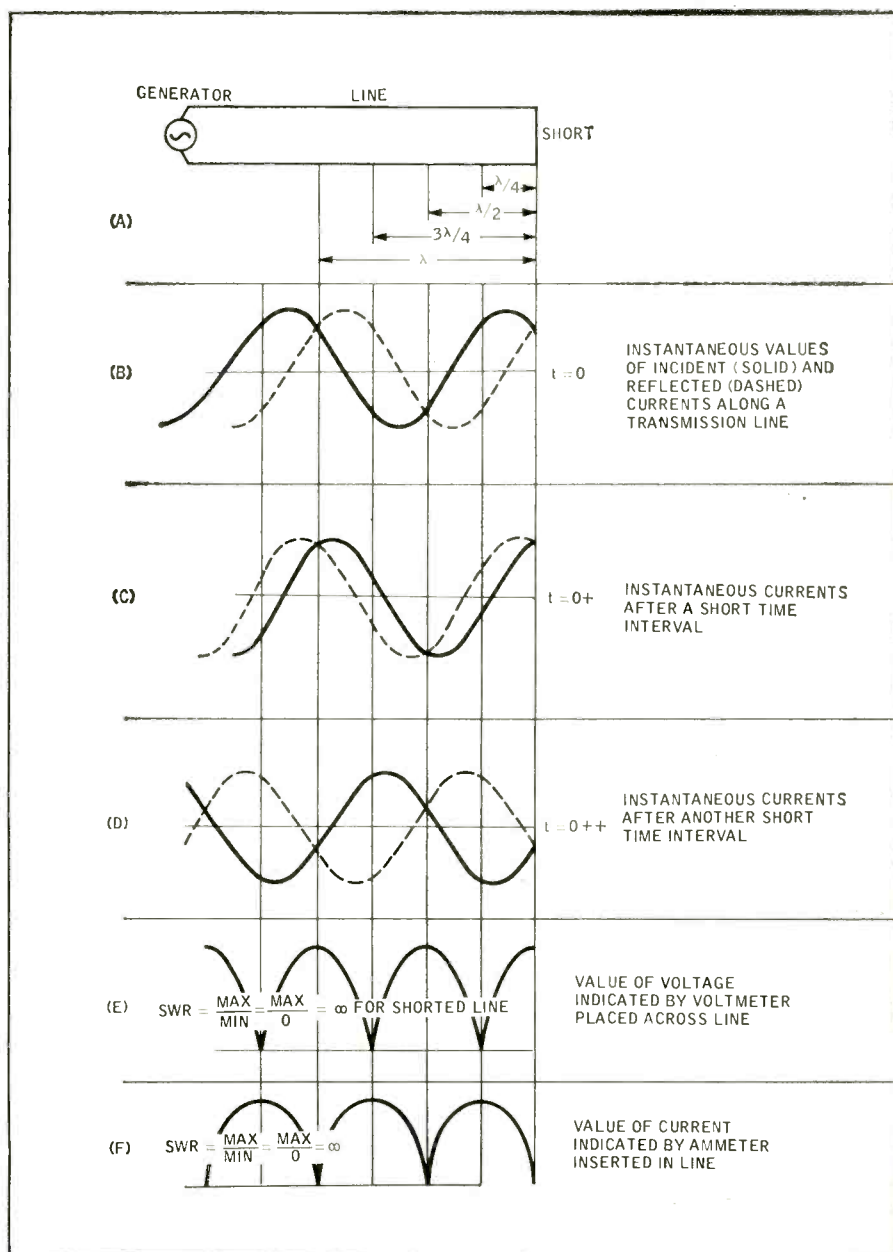


Fig. 6. Standing waves in a transmission line when the line is shorted.

\*10 Cranbrook Drive, Centerport, N.Y. 11721



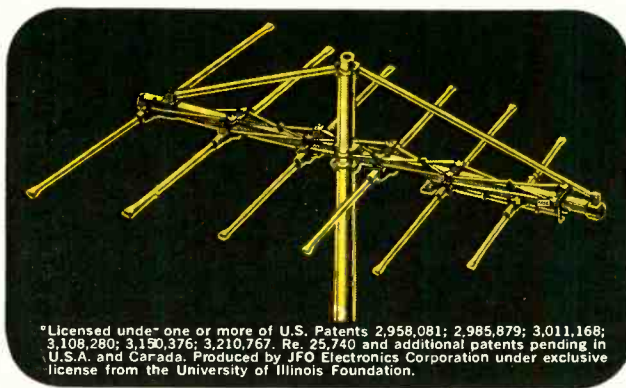
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For the first time, JFD engineers have harnessed the amazing frequency independent telemetry log periodic antenna design to FM stereo. The result is a spectacular advance in the state-of-the-FM antenna art—the patented\* JFD LPL-FM Log Periodic.

Your tuner's multiplex circuits require higher signal levels than monophonic tuner circuits. JFD full-wavelength L-dipole design gives your tuner up to 41 percent more signal voltage than today's best 10-element FM Yagi.

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"With it we get the effective signal into the receiver which we formerly had using a yagi beam and transistor preamplifier. In addition to better limiting in the pickup receiver, we believe that we now enjoy a better noise figure in the overall system. We would recommend the use of this antenna to other broadcast stations."

*Philip Whitney, Manager  
FM STATION WRFL WINCHESTER, VA*

"My experience with this antenna will make me confident to recommend it to anyone who consults us from a difficult reception area."

*Lawrence Gahagan, Chief Engineer  
FM STATION WPRB PRINCETON, N.J.*

"One particularly difficult pick-up is KTHO across 46 miles of rugged mountain range. Your antenna solved all of the difficulties."

*Jerry Cobb  
FM STATION KNEV RENO, NEV.*

"We receive a perfect signal with the LPL-FM antenna, where it was impossible to use the signal heretofore for rebroadcast without a great amount of fading or atmospheric noise."

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FM STATION WTRN TYRONE, PA.*

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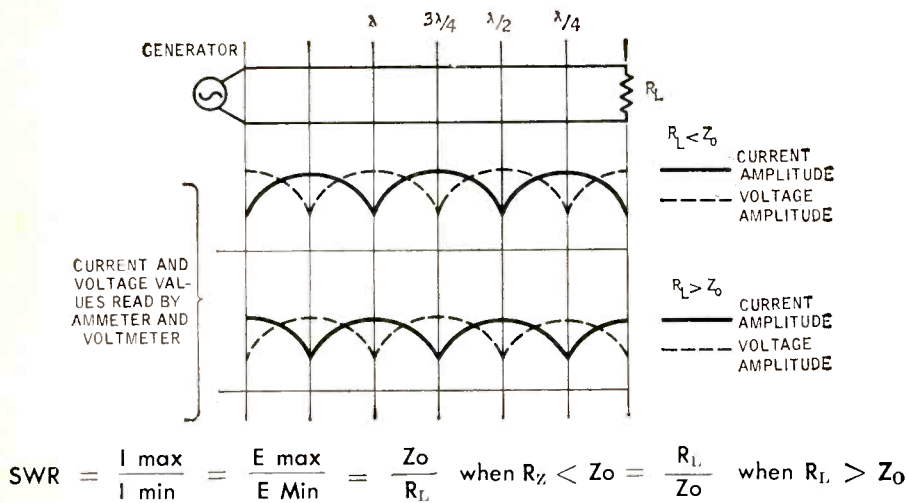


Fig. 7. Standing waves on transmission lines terminated in a resistive load.

current exists which represents the reflected power, as shown in Fig. 6.

At certain points on the line the incident and reflected currents will add in phase to produce a resultant current maximum, and at other points they will add out of phase producing a minimum. An ammeter placed in the line at these points will read the maximum and minimum current values. At points in between, the amplitudes are between these extremes as shown. The ratio of maximum to minimum is the Standing Wave Ratio of the line and because of the very low current minima the SWR of a shorted line is very high (theoretically infinite).

The voltage relationships are similar, with the resultant amplitudes displaced 90 deg. from those of the current as shown at (F) in Fig. 6. At the shorted end of the line the voltage, of necessity, must be a minimum (practically, it is zero.)

At the other extreme is an open circuited line. By reversing the roles current and voltage had in the shorted case, current is now a minimum at the end and voltage a maximum; an analogy can be drawn for the open circuited line which will yield similar ratios of current and voltage maxima and minima, and a SWR of infinity for this case, also.

Directly between the two extremes is our matched load. The matched load absorbs all the power. No voltage or current is therefore reflected and the SWR is 1.0. If the load that is placed on the end of the line is other than matched, part of the incident power will be absorbed and part will be reflected. Because only part of the power (and hence parts of the voltage and current) is reflected, the corresponding values of voltage and current are of lower amplitude than those of the incident components. Therefore, the incident current cannot be completely

cancelled as was the case with the open and short-circuited lines, and the Standing Wave Ratio on the line is considerably lower than in either of these cases, as shown in Fig. 7.

If we were now to take an ammeter and measure the current flowing in various parts of the unmatched line, different values of current would be evident depending on the amplitudes of

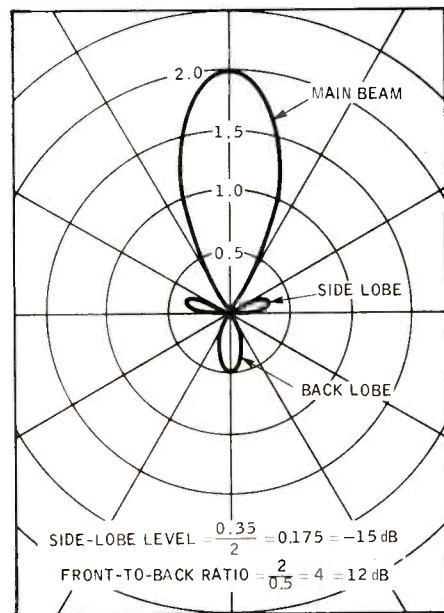


Fig. 8. Typical unidirectional antenna pattern illustrating minor lobes.

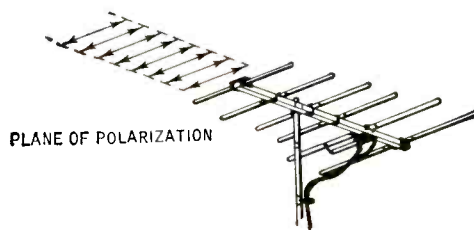


Fig. 9 Polarization of radiated signals.

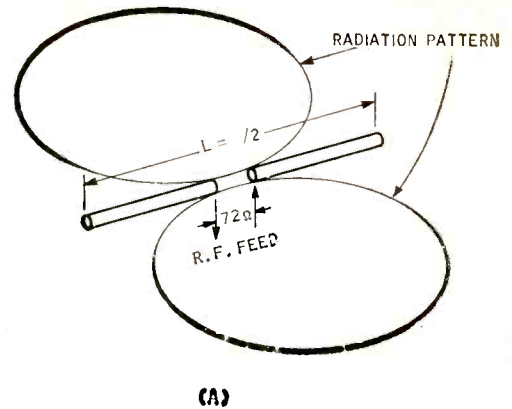


Fig. 10. (A) Dipole, with radiation pattern in a horizontal plane, and (B), a folded dipole.

the in-phase and out-of-phase components of incident and reflected current and the manner in which they add. The ratio of the maximum to minimum current on the line as read by the ammeter is the line Standing Wave Ratio and when the line is terminated in a purely resistive load, equals  $R_L/Z_0$  for  $R_L \geq Z_0$  and  $Z_0/R_L$  for  $R_L < Z_0$ , where  $R_L$  is the value of the terminating resistance and  $Z_0$  is the line characteristic impedance. The SWR is always represented by a number greater than or equal to 1.0 as was the case with antennas.

Both the line SWR and that of the antenna have the same effect on reception of the signal which the antenna is attempting to deliver to the receiver. The greater the SWR of the system (antenna and line combined), the lower the effective signal available at the receiver input terminals.

Therefore, we define *Characteristic Impedance* of a transmission line as the value of the impedance which should terminate each end of the line in order to provide a matched condition and optimum signal transfer.

#### Minor Lobes and Front-to-Back Ratio

Just a few terms remain to complete our basic antenna vocabulary. Since

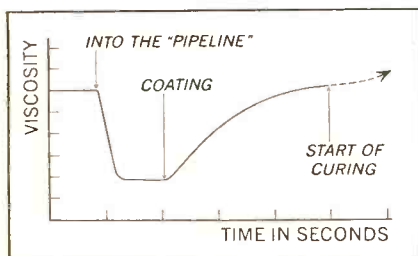




Some plain talk from Kodak about tape:

## The binder that ties things together... and how to sound in the pink

"La sauce, c'est tout,"—the sauce is everything, say the French. An oversimplification perhaps. Still, as far as sound recording tape goes, the sauce—our "R-type" binder—counts for a lot. First off, there must be a mutual affinity between binder and oxide. It must be a good oxide mixer, while still keeping individual oxide particles at arm's length, you might say. Of course, fast drying, superior chemical stability, and a dozen other mechanical and chemical properties are a must. One very interesting point involves the "R-type" binder's extremely interesting viscosity characteristics . . .



"R-type" Binder Viscosity Graph

**A Sticky Problem.** Familiar with no-drip house paints? They're thick in the can . . . thin when you apply them (for low effort) . . . yet thicken again as soon as applied, so they won't drip. Somewhat the same thing has to happen when one applies the binder-oxide mix to the tape backing. It's got to go on smoothly—low viscosity . . . then it's got to stay put—high viscosity. To thicken the plot, once the coating is on, the tape is passed through a very strong magnetic field to physically align the oxide particles—low viscosity again. Once aligned, the particles have got to stay locked in "at attention!"—high viscosity. That's asking a lot of a binder. And ours delivers.

**It's loaded.** Our "R-type" binder not only gives you a more disciplined, smoother, more efficient oxide layer . . . but it allows us to incorporate a high oxide density in the magnetic dispersion. High output is the "proof" of this density. That's why KODAK Tapes give you from 1 to 3 db extra output compared to equivalent competitive tapes.

**Pink noise testing** . . . or how hi-fi is your room? Room acoustics certainly color the sound you hear . . . may even produce effects you have ascribed to electronics. Take test tapes, for example. They frequently make use of pure tones, even pure sine waves that easily go through your amplifier yet give a most confusing impression in your sound-level meter or ears. The culprit? Standing waves caused by hard parallel surfaces—like walls, floor and ceiling—which reflect the sound back and forth. At the point of reinforcement, the sound is loud; at the null point, it's low. What to do? Persian wall-hangings, bearskin rugs and soft rounded forms—if you're lucky enough—help keep standing waves down. But to develop the very best in KODAK Sound Recording Tapes, our engineers turn to "pink noise" testing.

**Why pink?** Unlike pure tones that



make for easy instrumentation, musical sounds are complex—very similar to narrow bands of "white noise." But a white noise generator produces a mixture of all possible tones with equal energy-per-unit frequency. By breaking this white noise down into one-third octave bands of equal energy, we can study portions of the sound spectrum separately, yet have sound waves that are sufficiently complex so standing waves no longer confuse the issue. We call this type of white noise "pink." We're working on a practical simplification that will let you do something of this sort for your



own checkout. But meanwhile, relax to the music of KODAK Tape, secure in the knowledge that it is even "Pink Noise Tested!"

KODAK Tapes—on DUROL Base and polyester base—are available at most electronic, camera, and department stores. To get the most out of your tape system, send for free, 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write: Dept. 940, Eastman Kodak Company, Rochester, N. Y. 14650.

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an antenna is not a perfect device, any attempt made to increase gain and concentrate energy in a specific direction, does not always go the way one would like. Some of the energy radiates to the side, rear, and other undesirable directions, forming lobes similar to the main lobe, but at lower levels. These are called side-lobes, or more generally, minor lobes, and the minor-lobe level can be an important characteristic when interference from a reflected signal is to be minimized.

A comparison of the level of the main lobe with that of the minor lobe appearing 180 deg. from it (there is usually one there) is known as the front-to-back ratio, and for directional antennas, the higher this number the better. Fig. 8 shows a typical antenna pattern containing minor lobes and illustrates the front-to-back ratio and the way minor-lobe level is determined. One might naturally assume from the earlier statements on redirection of energy that if an antenna were made more directional, the energy to increase its gain would have to come from the minor lobes and the front-to-back ratio would then of necessity have to increase. While it is the goal of antenna engineers to draw energy from the minor lobes when at-

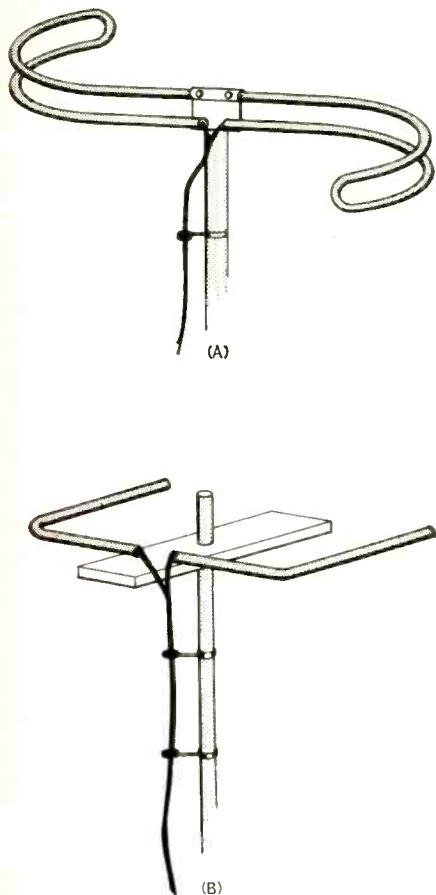


Fig. 11. Two types of omnidirectional radiators. (A), the "S" antenna, and (B), the "U" or ram's horn antenna.

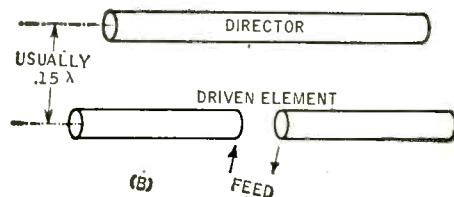
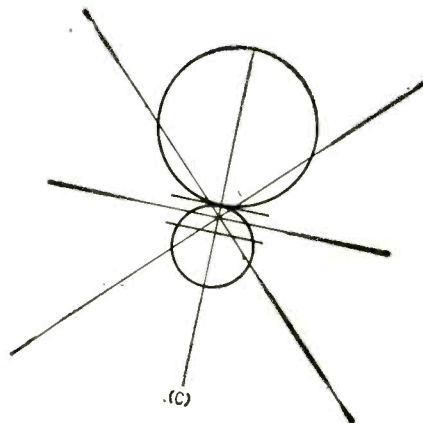
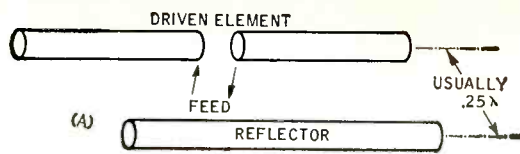


Fig. 12. Dipole antenna and parasitic elements. (A) dipole with reflector; (B) dipole with director; (C) radiation pattern from driven element with either director or reflector.

tempting to increase the directive gain, high-gain antennas—because of their more complicated design and greater sensitivity to dimensional and frequency parameters—often exhibit higher minor-lobe levels relative to the main lobe than do their lower-gain counterparts. Where does the energy come from to increase directivity then, if not from the minor lobes? It comes most often from the main lobe itself, much to the chagrin of those concerned.

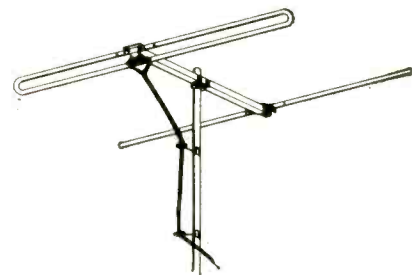
Front-to-back ratio is an important parameter for stereo broadcast reception in an area of relatively high reflected signal level. A low front-to-back ratio increases the possibility of receiving reflected energy at high levels, resulting in multipath distortion in the receiver.

Minor-lobe level is given in dB (below the main lobe). Front-to-back ratio is expressed similarly in dB, and is also a ratio—that of the main lobe to the lobe 180 deg. removed from it.

#### Polarization

The energy that the transmitting antenna launches is polarized in a particular manner, and for satisfactory reception an antenna receiving this energy must be polarized in the same way. Up to just recently, all FM broadcasters used horizontal polarization exclusively. Now a number are transmitting both horizontally and vertically. Automobile radio antennas are more susceptible to vertical polarization than to horizontal, and reception in the growing number of FM radios in cars is greatly improved by this polarization mode.

An antenna is inherently polarized in a way particular to itself. The manner in which it is installed determines its polarization with respect to the ground and the transmitted wave. Almost without exception, commercially available FM antennas are polarized in the plane of their elements as shown in Fig. 9. Aligning the antenna so that its elements are parallel with the ground will place it in proper position for receiving horizontally polarized signals. Likewise, if the desired signal is vertically polarized, the antenna must be oriented



FREQ. MHz	FWD GAIN (dB above isotropic)	FRONT-TO-BACK RATIO (dB)	SWR (to 300- $\Omega$ line)	NOMINAL BEAM WIDTH
88	5.0	6.4	1.5	70°-80°
90	5.2	6.2	1.5	
95	5.0	8.2	1.6	
100	4.5	5.0	1.9	
105	4.0	4.6	2.2	
108	3.5	4.6	3.3	

Fig. 13. Folded dipole and reflector, and its gain, front-to-back ratio, and impedance characteristics over the band.



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Robert E. McClintock, of Mobile, Alabama, told us that. Buyers throughout the country are congratulating us with "The sound cannot be beat" and similar compliments on their new Harman-Kardon music systems. The reason is true-component sound. And Harman-Kardon has matched all the quality components for you.

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**LEADER IN SOLID-STATE STEREO COMPONENTS**

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perpendicular to the ground. There is no station to the author's knowledge broadcasting strictly vertically polarized FM signals. If there is, it will probably remain a big secret because few will receive the station satisfactorily on home systems due to the almost universal horizontal polarization of these antennas.

The effect of a horizontally polarized antenna receiving a vertically polarized signal is similar to a person attempting to view light of one polarization with a glass that is made to transmit light polarized orthogonally to it. Theoretically no signal will be available at the antenna terminals. Actually, the antenna does receive some of the available cross-polarized energy, usually at an extremely low level. The measure of the amount of orthogonally polarized signal an antenna will deliver is known as the cross-polarization level of the antenna. It is a term that is found seldom, however, in FM antenna discussions and is a relatively unimportant characteristic once the antenna is aligned properly.

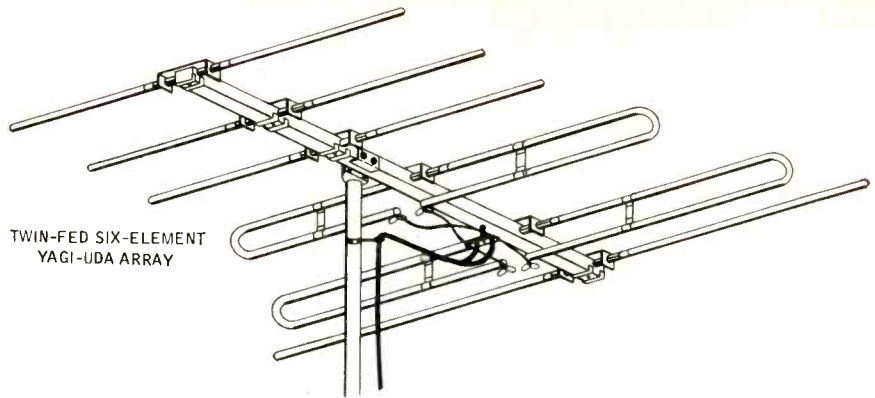
### Selecting the Antenna

Our vocabulary lesson is over and we're ready to get down to the business of selecting the antenna and associated components. The best place to start is with the antenna pattern that will best do the job.

Antenna patterns can be divided into three broad categories: Omnidirectional, Bidirectional, and Unidirectional. We touched briefly on the omnidirectional pattern during the discussion of bandwidth. It is a non-discriminatory pattern that receives signals equally from all directions in a horizontal plane around the antenna. The bidirectional pattern has two main lobes displaced 180 deg. from each other as shown previously in Fig. 3. Obviously the front-to-back ratio of this antenna is 0 dB. Discrimination is afforded on the sides where nulls in the pattern exist. One form of unidirectional pattern has been illustrated in Fig. 8. The antenna producing this pattern offers a wider area of discrimination than the others, provides higher gain and lower front-to-back ratio.

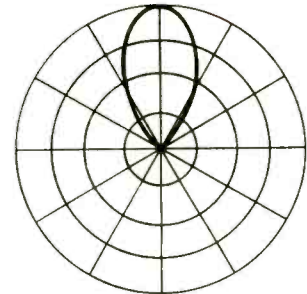
Let's take a look at the antennas that form these patterns. If two conductive metal rods of equal length are fed with r.f. energy 180 deg. out of phase as shown at (A) in Fig. 10, they form what is termed a dipole antenna. At the frequency for which the total length of the rods is a half wavelength, the radiation resistance at the fed ends of the dipole is 72-ohms and the pattern from the rods is bidirectional.

The dipole forms the heart of all FM antennas, be they simple or complex. It can appear in the form just described or "folded" as in (B) of Fig. 10. Folding



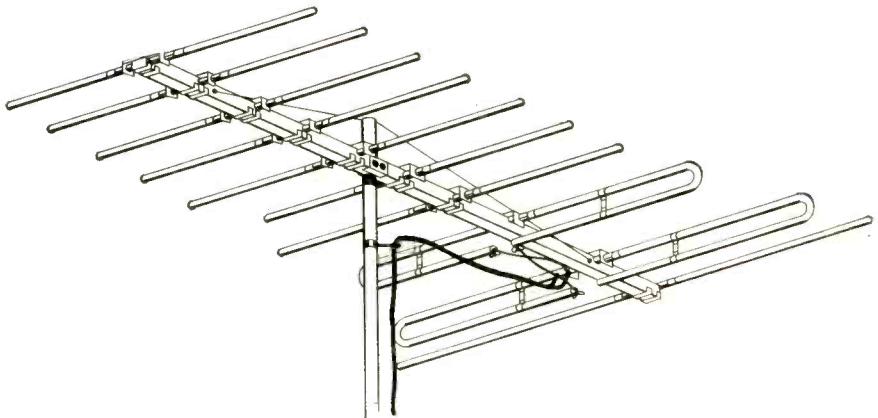
TWIN-FED SIX-ELEMENT YAGI-UDA ARRAY

FREQ MHz	FWD GAIN (dB above isotropic)	FRONT-TO-BACK RATIO (dB)	SWR
88	8.8	16.5	1.2
90	9.4	19.5	1.2
95	10.4	21.0	1.25
100	10.8	22.5	1.3
105	11.4	21.0	1.3
108	11.6	19.0	1.35

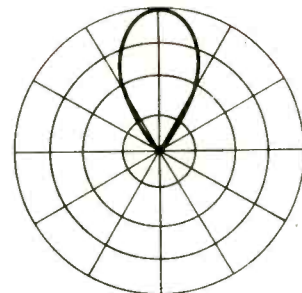


RADIATION POWER PATTERN OF 6-ELEMENT YAGI-UDA ARRAY AT 104 MHz  
BEAMWIDTH AT 104 MHz = 60°

Fig. 14. Twin-fed, six-element Yagi-Uda array and its characteristics.



FREQ. MHz	FWD GAIN (dB above isotropic)	FRONT-TO-BACK RATIO (dB)	SWR
88	10.9	15.5	1.25
90	11.6	19.0	1.25
95	12.4	19.8	1.3
100	13.0	20.7	1.3
105	13.3	19.7	1.35
108	13.6	19.0	1.4



POWER PATTERN AT 104 MHz,  
BEAMWIDTH APPROX. 45°

Fig. 15. Twin-fed, ten-element Yagi-Uda array and its characteristics.

changes the impedance of the dipole to approximately 300 ohms and reduces the impedance variation over the band somewhat, a form of broadbanding. It does not significantly affect the pattern, however.

By positioning two dipoles (folded or otherwise) orthogonally to each other and feeding them 90 deg. out of phase, the patterns discussed earlier and shown in Fig. 4 result. As was stated in Part I, (Continued on page 105)



**“They worked miracles  
with transistors  
in tiny TV and radios.**

**engineered today’s most popular  
tape recorders.**

**gave you the  
home video tape recorder.**

**What is Sony up to now?”**

# Sony presents a new generation of stereo components





**W**hatever Sony has ever done, developed, designed or produced, has always resulted in something to heighten the enjoyment people derive through sight and sound. For Sony to have done less in stereo high fidelity would have been unexpected and unusual. So, Sony has done the expected with the unusual.

**The first truly great solid-state stereo amplifiers.** *The TA-1120 solid-state stereo amplifier/preamplifier* achieves the long-awaited breakthrough in solid-state power amplifier design. The result is a component whose performance capabilities surpass those of the most highly proclaimed units ever produced—vacuum tube and solid-state alike.

The power amplifier section has an IHF power rating of 120 watts at 8 ohms, both channels operating (200 watts at 4 ohms). Indicative of its quality is the extremely low distortion achieved at all power levels, from 0.05% at ½ watt to 0.1% at rated output. No less significant are these characteristics: high internal damping (140 at 16 ohms) and S/N ratio (better than 110db.); frequency response: (+ 0db/−1db from 10 to 100,000Hz). For safety's sake, a silicon-controlled rectifier (SCR) protects the transistors against damage due to accidental shorting of the output.

The control preamplifier section, fully worthy of the amplifier's performance, features the most functional arrangement of controls ever conceived. In metal enclosure with brushed aluminum panel, \$399.50. An optional walnut enclosure is available.

*The Sony TA-3120 solid-state stereo power amplifier* features the same amplifier as employed in the TA-1120. It is the ideal choice in a high quality solid-state power amplifier to go with your solid-state pre-amp, for use with a professional 3-channel tape deck, or for 3-channel systems, \$249.50.

**First rumble-free turntable.** *The Sony Servomatic* is the first turntable ever to employ a servo control amplifier. Rumble is virtually unmeasurable. Wow and flutter content exceed the most optimistic standards ever prescribed for professional equipment. Motor speed is monitored by a servo control amplifier which maintains rotation of the turntable at constant rpm. The Servomatic is powered by a low speed dc

servo motor operating at about 1/6th of the speed of conventional turntable motors. This reduces rumble-producing mechanical vibration to an absolute minimum at its very source. A belt-drive coupling between the motor and the turntable absorbs all remaining mechanical vibration.

The Servomatic operates a 33½ and 45 rpm. A built-in illuminated strobe disc and speed control permit adjusting the turntable to the precise rpm desired. Model TTS-3000, \$149.50.

**First moving coil cartridge with high output.** *The Sony VC-8E* is the first cartridge to realize the full quality capabilities of the moving coil, yet providing high enough output (4mv) to eliminate the need for transformer coupling. It is also the first moving coil design to permit simple stylus replacement. The VC-8E combines a low moving mass with unusually high compliance so that it can track in properly designed arms at as low as ½ gram. Performance is characterized by smooth, peak-free, balanced response over the entire audible spectrum and beyond (10 to 25,000Hz). Effective channel separation extends into the high frequencies. With elliptical diamond stylus, \$65.

**First truly professional arm designed for the non-professional.** *The PUA-237, 12-inch tonearm* combines optimum geometry and mechanical responsiveness for flawless tracking accuracy with the highest compliance cartridges. Despite sensitivity, the PUA-237 exhibits amazing stability. Contributing to this is effective anti-skating compensation at every position on the record, and a lateral stabilizer which locates the center-of-mass in line with pivot and stylus. A built-in cueing device with a silicon-damped piston permits easy location of arm and gentle placement of the stylus in any selected record groove. It also provides a semi-automatic method for lowering the stylus into the lead-in grooves of 7-, 10- and 12-inch records. PUA-237 \$85; PUA-286 (a 16-inch version) . \$99.50.

These new stereo components are now at Sony high fidelity dealers. Stop in and hear them today. For descriptive literature write:

**SONY**® Corporation of America, Dept. H.  
580 Fifth Avenue, N.Y., N.Y. 10036

All prices suggested list

Circle 124 on Reader Service Card

# The 1966/1967 Product Preview

This edition of the Product Preview repeats last year's innovation of tabular design for the product information. Only this time we have simplified the columns so that only vital information is contained. We wanted to simplify them as much as possible—to prevent the occurrence of a column of figures that are all the same. Is there a phono cartridge that doesn't claim 20-20,000 Hz response?

We offered each manufacturer his use of the last column of each table—the Special Features column. Our injunction to each manufacturer was for him to tell his story—in a few words (our letter said 40-50 words maximum). As you will see, some manufacturers adhered to this command—some had only a blip to say—still others had nothing to say.

All information is as supplied by the respective manufacturers. Blank spaces exist in many columns. Truly blank ones mean that the information called for in that column does not apply to the product at hand. However, many spaces have been filled with a dash; this means that the manufacturer did not honor our request for the information.

Any listing of specifications is predicated on the resulting numbers having a direct relationship. In short, *standards of measurement* must exist. When they do exist (as per the IIF standards) we used them as the basis for our informational request. But standards of measurement do not exist for many products. At what recorded velocity do you measure the output of a phono cartridge? At what point do you measure a speaker's power-handling capacity—where it begins to distort or where it approaches the toe of destruction?

As a result we have found ourselves choosing arbitrary standards for the sake of comparison. We are not necessarily advocates of these standards, but we did try to find values that would be meaningful to you and, at the same time, be available from the average manufacturer. The Product Preview Issue is meant as a comparison reference to be used throughout the year. Thus these tables must supply basic statistics and a means for comparing one vendor's wares against another's. This they do.

But no verbal description can possibly do full justice to as sophisticated a product as the average high-fidelity component. Toward that end, we have cross-referenced each listing against advertising that may appear elsewhere. Also, at the end of the Preview there is a comprehensive list of all manufacturers and their addresses. We can only urge you to contact them direct for further information on their products. These tables have been designed to help you find your category of prospective purchase. They should not be the sole determination of what or what not to buy.

Finally, we want you to take note of two categories never before listed. Section 5 is Complete Modular Systems and Section 12 is Video Recorders. Both represent substantial product lines that simply did not exist as such a year ago. And both represent interesting directions in which the audio market is travelling. To the page at right, then, for the beginning of the 1966/1967 Product Preview—the most voluminous project in our history . . .



# AMPLIFIERS-1

## BASIC AND INTEGRATED



ADC SIXTY



EICO 3070



C/M LABS 911



DYNACO STEREO 120



ACOUSTECH V

See Ad on Page No.

MANUFACTURER	MODEL NO.	Power Output										Distortion		Sens. mV.	Overload mV.	Tape Head mV.	High Level V.	Output Imp. ohms.	Damping	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
		Steady		Full		1 watt		THD%	IM%	Power Bandwidth Hz ± dB	Frequency Response Hz ± dB	No. see below rated output dB											
		IHF	Steady	Full	Power	1	Full						Power										
ACOUSTECH	IA	-	80	-	-	0.25	0.25	20-20k	2-150k	95				1.2	4-16	100	15 1/2 x 12 x 5	29	\$395	Factory assembled only.			
	III	-	50	-	-	0.25	0.25	20-20k	2-150k	95				1.2		100	15 1/2 x 12 x 5	22	\$199 \$274	Plug-in boards factory assembled. Factory assembled only.			
	XI	-	35	-	-	0.25	0.25	20-20k	2-150k	95				1.2		100	15 1/2 x 12 x 5	16	\$129.50	Can be used with any preamp; then at a later date preamp module P/M can be added to make an integrated amplifier. See Section 2.			
	V	-	45	-	-	0.25	0.25	20-20k	2-150k	75	2.5 & 10	-	-	.4	4-16	100	15 1/2 x 12 x 5	25	\$349	Factory assembled only.			
	VII	-	30	-	-	0.25	0.25	20-20k	2-120k	75	2.5 & 10	-	-	.4	4-16	100	15 1/2 x 12 x 5	16	\$249	Factory assembled only.			
ADC	Sixty	30	22	0.5	0.1	0.8	0.4	20-20k	10-100k	78	2	80		0.1	4,8,16	50	14 1/2 x 8 1/2 x 3 1/4	12	\$149.50	Will accommodate two pairs of speakers which can be played together or independently.			
BOGEN	TA100	30	25	1	0.5	1	0.75	20-20k	20-20k	70	3.5	50	3.0	0.2	4,8,16	35	15 x 10 1/2 x 3 1/4	11	\$129.95	Complete with walnut textured metal enclosure, all silicon transistors, earphone output, subsonic filter.			
	AP35	17.5	15	0.6	1	0.6	1	-	20-20k	55	4.5	50	3.0	0.25	8,16	30	15 x 11 1/4 x 4 1/4	18	\$99.95	Earphone output, vacuum-tube operation.			
C/M Laboratories	CC-505	-	50	0.5	0.5	0.5	0.5	20-20k	5-60k	70	3	-	6	0.25	4,8,16	200	17 x 6 x 13	40	\$387	Solid-state. Oil walnut cabinet \$24.			
	35D	-	35	0.25	0.25	0.25	0.25	20-20k	1-100k	70				0.65	4,8,16	500	6 1/2 x 10 1/2 x 12 1/4	25	\$285	As above.			
	35MRM	-	50	0.5	0.5	0.5	0.5	20-20k	1-100k	80				0.65	4,8,16	200	19 x 5 1/2 x 13	32	\$237	Mono, solid-state, rack mounted.			
	80MRM	-	80	0.5	0.5	0.5	0.5	20-20k	1-100k	80				0.65	4,8,16	200	19 x 5 1/2 x 13	36	\$297	As above except for power output.			
	911	-	125	0.5	0.5	0.5	0.5	20-20k	1-100k	80				0.65	4,8,16	200	-	-	-	Solid-state basic stereo power amplifier.			
C-T Acoustic Laboratories	CT-20	30	20	0.1	.08	-	-	20-20k	20-20k	70				1	8,16	100	14 x 8 x 22	31	\$99.95	Basic power amplifier.			
CROWN	SA30-30	45	30	0.1	.05	1	1.5	12-100k	6-100k	80				0.8	4-16	200	19 x 9 x 13 1/4	7 1/2	\$199	Low silhouette, double input and output jacks on each channel, concentric-clutched input volume control. Case available.			
DYNACO	Stereo 120	-	60	0.25	0.1	0.5	0.1	5-50k	4-100k	95				-	4-8	40	13 x 10 1/2 x 4	20	\$159.95 \$199.95	Solid-state stereo basic amplifier.			
	Stereo 70	45	35	1	0.1	1	0.1	20-20k	10-40k	90				-	4,8,16	15	13 x 9 1/2 x 6 1/2	32	\$99.95 \$129.95	Vacuum-tube stereo basic amplifier.			
	Stereo 35	22.5	17.5	1	0.1	1	0.1	20-20k	10-40k	80				-	8,16	10	13 x 5 1/2 x 4	16	\$59.95 \$79.95	As above.			
	SCA-35	22.5	17.5	1	0.1	1	0.2	20-20k	20-20k	80	4	120	2.5	1	8,16	10	13 x 10 1/2 x 4	20	\$99.95 \$139.95	Vacuum-tube stereo basic amplifier.			
	Mark III	-	60	1	0.1	1	0.1	20-20k	6-60k	90				-	4,8,16	15	9 x 9 x 7	28	\$79.95 \$99.95	Vacuum-tube mono basic amplifier.			
EICO	3070	35	20	0.8	0.2	1.5	0.5	10-40k	5-100k	72	4.2	90		0.27	4,8,16	30	12 x 8 x 3 1/2	7 1/2	\$89.95 \$119.95	All silicon transistors. Two switchable speaker systems with four position speaker switch. Headphone jack on front panel. Low and high filters.			
	ST70	35	20	0.9	0.3	1	-	10-50k	10-50k	63	4	-	2	0.5	4,8,16	6	15 1/2 x 15 x 5 1/2	44	\$99.95 \$149.95	Vacuum tubes.			
	ST40	20	12	0.8	0.3	1	-	10-50k	10-50k	60	3	-	1.7	-	4,8,16	11	15 1/2 x 13 3/8 x 5 1/2	33	\$79.95 \$129.95	Vacuum tubes.			
ELECTRO-VOICE	1144	32.5	18	1	0.5	2	0.8	-	20-30k	70	4	50		90	4-16	35	15 1/2 x 10 1/4 x 3 3/8	9 3/4	\$124.50	Value-packed 65 watt solid-state stereo amplifier. Includes walnut paneled case, input indicator lights, headphone jack, speaker mute, and tape monitor switches.			
FISHER RADIO	TX200	45	35	0.5	-	0.5	-	12-50k	20-22k	80	4	150	2.6	0.28	4-16	20	15 1/2 x 11 1/8 x 4 13/16	22	\$279.50	Solid-state. Low and high filters, loudness contour switches, tape jacks, mode indicator lamps.			
	TX300	50	36	0.5	-	0.5	-	12-50k	20-25k	86	2.8	150	1.8	0.2	4-16	20	15 1/2 x 11 1/8 x 4 13/16	24	\$329.50	As above.			
	SA-1000	75	65	0.25	0.1	0.4	0.1	12-45k	5-100k	90				0.5	4,8,17	17	15 1/2 x 12 x 7	71	\$329.50	Stereo basic vacuum tube amplifier. Has frequency compensated input attenuator, subsonic filter, metered bias adjust.			

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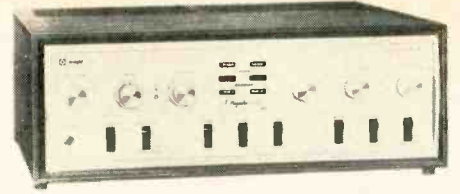
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# AMPLIFIERS



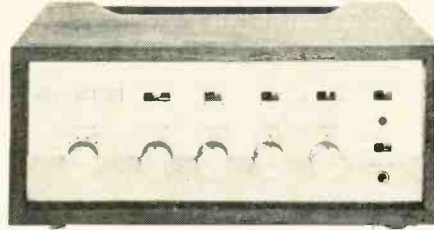
ELECTRO-VOICE 1144



KNIGHT-KIT KG-895



HEATH AA-14



KLH 16



JBL SA600

See Ad on Page No.

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MANUFACTURER	MODEL NO.	IHF	Power Output watts per channel				Distortion		Power Bandwidth Hz. dB	Frequency Response Hz. dB	Noise below rated output dB	Sens. mV.	Overload mV.	Phono		Output Imp. ohms	Damping	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
			Steady	Full power	1 watt	Full power	THD %	IM %						Tape Head mV.	High Level V.						
HARVARD	H3a	100	90	0.2	.05	0.1	.02	20-20k 1	7-180k 1	85			2	16	200	17 x 10 1/4 x 8	35	\$369	Vacuum-tube basic amplifier without driver or output transformers. Uses 4 type 6K6/6-EL505 tubes in each channel. Ideal for use with full-range electrostatic speakers.		
HEATH	AA-21D	50	35	0.5	0.5	1	1	13-25k 1	13-25k 1	60	3	-	2	0.25	4-16	-	15 1/2 x 14 x 5 1/4	25	\$137	All solid-state.	
	AA-22	33	20	0.3	0.3	1	1	15-30k 1	15-30k 1	65	6	-		0.25	4-16	20	15 x 11 1/4 x 3 7/16	14	\$99.95	All solid-state.	
	AA-14	15	10	0.5	0.5	1	1	15-50k 1	12-60k 1	63	4	-		0.3	4-16	50	12 1/2 x 9 1/4 x 3 1/2	8 1/2	\$59.95	All solid-state.	
KLH	16	50	35	1	0.35	2	1	20-20k	15-45k 1.5	75	2.5	85		0.5	4-16	-	11 3/4 x 10 1/2 x 4 1/2	-	\$219.95	Special electronic protection circuit prevents damage from shorted outputs, pulses, etc.	
KENWOOD	TK-400	45	32	0.9	0.2	1	0.17	30-20k 1	20-15k 1	70	2.2	90	2.6	-	4-16	20	15 1/4 x 12 1/4 x 5 3/4	27	\$149.95	Silicon solid-state.	
KNIGHT	KN-975	37.5	20	1	0.5	1	1	-	20-20k 1	80	4	-	4.5	1	4-16	-	14 1/4 x 12 x 4 1/2	17	\$149.95	All solid-state. 6 Rocker switches, tape monitor, five pairs of inputs, temperature regulators for driver transistors.	
	KN-944	22	17	1	0.5	1.5	1	-	20-20k 1	70	2.5	-	2.5	1	4-16	-	13 3/4 x 12 3/4 x 4 1/2	21	\$99.95	All solid-state. Stereo headphone jack. Separate bass and treble controls; complete tape recording facility.	
	KN-935	16	12	1	0.5	1.5	1	-	20-30k 1	70	2.5	-		0.15	8-16	-	13 7/8 x 9 x 4 3/4	26	\$69.95	7 tubes and 4 diodes-rocker switches; stereo headphone jack; tape monitor switch.	
KNIGHT-KIT	KG-895	60	40	0.5	0.5	1	0.7	20-20k 1	18-30k 1	75	2.5	-	2	0.25	4-16	6	16 3/4 x 15 x 5	28	\$149.95	Solid-state.	
	KG-870	35	28	0.5	0.3	1	0.7	25-18k 1	20-25k 1	80	3	-	2	1	8-16	12.5	13 x 11 x 2 3/4	15	\$99.95	Solid-state.	
	KG-854	27	17	1	0.5	1.5	0.8	25-20k 1	20-25k 1	75	3	-	2.5	0.5	8-16	10	13 x 11 x 2 3/4	14	\$79.95	Solid-state.	
	KG-320	16	10	1	0.7	1.5	0.8	-	25-18k 1	75	3	-	2.5	0.4	8-16	-	10 x 8 1/2 x 2 3/4	9	\$59.95	Solid-state.	
	KG-400	19.5	16	1	0.5	1.5	0.35	35-15k 2	30-16k 1	75	2	-	2	0.2	4, 8, 16	-	13 7/8 x 11 1/4 x 4 1/2	18	\$59.95	Vacuum tube center channel output for 8 or 16 ohms.	
LANSING, JAMES B.	SA-600	-	40	0.2	1	0.2	0.7	10-130k 1.5	10-130k 1.5	85	4, 8, or 16	250	2	0.25	4-16	23 at 8 ohms	16 3/8 x 13 3/8 x 5 1/16	25	\$345.	JBL T-Circuit in power stages. Flat to d.c.; aural-null balance for phono cartridge and all other inputs.	
	SA-400s	-	40	0.15	0.15	0.15	0.15	3-200k 1.5	3-200k 1.5	90					4-16	-	15 1/4 x 7 3/8 x 4 1/2 (SE 400S)	22	SE400S-\$285 SE408S-\$270	JBL T-Circuit. Plug-in equalizer boards match damping factor and tailor frequency response for all JBL speakers. SE400S can be equalized for speakers of other manufacture. SE408S mounts in rear of JBL speaker enclosures.	
	SE-408S	-	40	0.15	0.15	0.15	0.15	3-200k 1.5	3-200k 1.5	90					4-16	-	15 1/4 x 7 3/8 x 4 1/2 (SE 400S)	22	SE400S-\$285 SE408S-\$270	JBL T-Circuit. Plug-in equalizer boards match damping factor and tailor frequency response for all JBL speakers. SE400S can be equalized for speakers of other manufacture. SE408S mounts in rear of JBL speaker enclosures.	
LAFAYETTE RADIO	LA-90T	45	37	1	0.25	-	0.6	20-50k 3	30-50k 2	55	2.5	80	3	0.18	4-16	20	13 x 9 x 3 3/4	13	\$129.95	Front panel headphone jack; tape monitor switch; high and low filters; external speaker switch.	
	LA-60T	30	25	1	0.3	-	0.5	30-40k 3	30-40k 2	55	2	63	3	0.15	4-16	25	13 x 9 x 3 3/4	13	\$99.95	Front panel headphone jack; tape monitor switch; external speaker switch.	
	LA-224T	15	9	1	0.35	-	0.6	30-20k 3	30-20k 2	50	3	-		0.25	4-16	-	10 1/4 x 7 3/8 x 4	7	\$59.95	Speaker on-off switch; headphone jack.	
	LA-248	25	20	1	0.3	-	-	50-25k 2	20-20k 1	70	1.4	65	2.7	0.85	4-16	-	13 3/16 x 9 x 9 1/16 x 4 3/8	15	\$84.95	Speaker-earphone switch; 2 a.c. convenience outlets.	
LEAK	Stereo 20	20	11	0.1	-	-	-	20-20k 0.5	80					1	4, 8, 16	25	10 1/2 x 12 1/4 x 6 1/2	22 1/2	\$149	Basic vacuum-tube stereo amplifier.	
	Stereo 60	60	30	0.1	-	-	-	20-20k 0.5	80					1	4, 8, 16	25	10 3/8 x 13 1/8 x 6 7/8	29 1/4	\$219	Basic vacuum-tube stereo amplifier.	
	TL/50 Plus	100	50	0.1	-	-	-	20-20k 0.5	85					1	4, 8, 16	15	11 1/2 x 9 x 6 3/8	28	\$159.50	Basic vacuum tube mono amplifier.	
	TL/25 Plus	60	30	0.1	-	-	-	20-20k 0.5	85					1	4, 8, 16	25	10 x 7 7/8 x 6 3/4	17	\$119.50	Basic vacuum tube mono amplifier.	
	Stereo 30	15	10	0.1	-	-	-	20-20k 0.5	80					0.25	4, 8, 16	60	13 x 4 1/4 x 9	14	\$249.50	Integrated solid-state stereo amplifier.	



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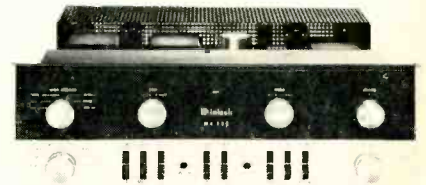
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MANUFACTURER	MODEL NO.	IHF	Power Output Watts per Channel		DISTORTION		Power Bandwidth Hz ± dB	Frequency Response Hz ± dB	Noise below rated output dB	Sens. mV.	PHONO		Output Imp. ohms.	Damping	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES		
			Steady	Full power	THD%	IM%					Overload mV.	Tape head mV.								
																			1 watt	1 watt
MARANTZ	8B	—	35	0.5	—	0.5	—	12-40k 1	3-40k 1	100	—	4,8, 16	20	13½ x 10½ x 7¼	55	285.00	Built-in metered self-tests. Basic stereo vacuum tube amplifier.			
	9	—	70	0.3	—	0.5	—	10-40k 1	3-40k 1	100	—	1,4, 8,16	17	15½ x 10½ x 7¾	60	384.00	Basic mono vacuum tube amplifier. Built-in metered self-tests.			
	15	—	50	0.1	—	0.1	—	—	—	—	—	4-16	Very high	15½ x 8¾ x 5¾	—	395.00	All transistor basic stereo amplifier with complementary NPN/PNP push-pull output. Practically no crossover notch even at 20kHz. Electronic safety circuit. Rack mount available, mono version available. Highly stable. Full specs not available at press time.			
MATTES	SSP/200	160	100	0.5	0.5	0.1	0.3	20-20k	15-30k 1	73	—	1	4-16	250	14¼ x 9 x 5½	27	375.00	Solid-state basic stereo power amplifier. Input gain controls. Short-and open circuit protection. Power safety switch for speakers. Impedance matching switch.		
MCINTOSH	MC225	39	25	0.5	0.1	0.5	0.1	14-100k	20-20k 0-1	76	—	0.5	4,8, 16	10	14½ x 9 x 7	34	198.00	25-V and 70.7-V line output. Stereo basic vacuum tube power amplifier.		
	MC240	64	40	0.5	0.1	0.5	0.1	10-100k	20-20k 1	74	—	0.5	4,8, 16	10	17¼ x 10¾ x 8	56	288.00	As above.		
	MC275	107	75	0.5	—	0.5	—	10-100k	20-20k	72	—	0.5	4,8, 16	10	17¼ x 12¼ x 8	67½	444.00	As above plus 115-V and 230-V line outputs.		
	MA230	44	30	0.5	0.1	0.5	0.1	12-40k	20-20k 0.5	76	1.5	150	1.5	0.25	4,8, 16	10	16 x 14½ x 5¾	43	399.00	Integrated stereo amplifier with solid-state preamplifier.
	MI200	288	200	1	0.1	1	0.1	15-60k	20-20k 1	60	—	0.5	4,8, 16	10	19 x 10¼ x 17½	140	640.00	Heavy duty mono basic amplifier. Outputs as in the MC275 with the addition of a 141-V line in place of 230-V.		
H. H. SCOTT	299J	32.5	18	0.8	0.3	—	—	25-20k	18-25k	80	6 or 9	35, 65	—	0.5	4-16	20	—	12	199.95	
	260	60	40	0.8	0.3	—	—	20-20k	15-30k	80	3, 5, 9	24, 40, 72	2	0.5	4-16	20	—	21	279.95	
	LK60	60	40	0.8	0.3	—	—	20-20k	15-30k	80	3, 5, 9	24, 40, 72	2	0.5	4-16	20	—	21	189.95	Kit
	LK72B	40	33	0.8	0.3	—	—	20-20k	20-20k	80	3 or 9	24, 72	4	0.5	4-16	20	—	31	149.95	Kit
SHERWOOD	S-9000A	80	65	0.25	0.1	0.25	0.1	12-25k 1	12-35k 1	90	1.6	250	1.2	0.25	4-16	40	14 x 12½ x 4	24	309.50	All silicon solid-state.
	S-9900A	70	55	0.6	0.1	1	0.15	12-35k 1	12-35k 1	90	1.6	250	1.2	0.25	4-16	40	14 x 10½ x 4	19	229.50	As above. 70 watts per channel at 4 ohms. Main and remote speaker terminals and switching.
	S-9500A	35	28	0.6	0.1	1	0.15	12-35 1	12-35k 1	80	1.6	250	1.2	0.25	4-16	40	14 x 10½ x 4	16	179.50	All silicon solid-state.
SONY CORP. OF AMERICA	TA-1120	60	50	0.1	.06	0.3	.08	10-100k -1	—	90	1 & 5	100	1	0.2	4-16	70	15½ x 12¼ x 5¾	24.2	399.50	All silicon solid-state integrated amplifier. Independent stepped tone controls in 2dB increments. Lever switch for return to flat without altering control position.
	TA-3120	60	50	0.1	.06	0.3	.03	10-100k -1	—	110	—	—	—	—	—	—	—	—	17	249.50



LAFAYETTE LA-90T



McINTOSH MA230



SHERWOOD S-9000A



H. H. SCOTT 299T

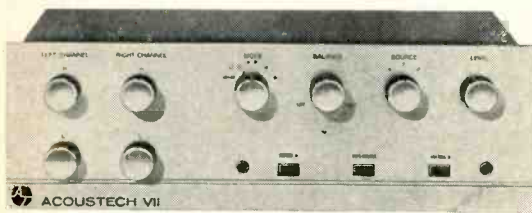


MARANTZ 15



SONY TA-1120

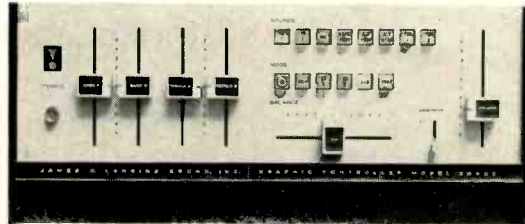
# PREAMPLIFIERS—2



ACOUSTECH VII



FISHER 400CX



JBL SG520

See Ad on Page No.

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MANUFACTURER	MODEL	Frequency Response ±dB	RATED OUTPUT				Phono Sens. mV.	Phono Overload mV.	Tape Head Sens. mV.	High Level Sens. Volts	Tape Mon Impedance Ohms	Dimensions W x D x H	Weight Lbs.	Price	SPECIAL FEATURES
			Volts	THD%	IM%	S/N-dB									
ACOUSTECH	IV	2-250k 3	2	0.1	.09	75	2.5, 10	—	0.4	—	15½ x 8 x 5	11	149.00 K	p.c. boards pre-wired at factory and plug in to receptacles.	
	VI	2-300k 3	2	0.1	.09	75	2.5, 10	—	1.5	0.4	15½ x 8 x 5	11	249.00 wired only	Has 200-ohm output impedance to power amp to permit long separation, Step-type tone controls.	
	P M	2-250k 3	2	0.1	.09	75	2.5, 10	—	0.4	—	—	5	89.50 K	Can only be added to Acoustech XI power amp chassis to make integrated amp.	
DYNACO	PAS-3X	10-40k 1.5	2	.05	.05	70 on phono	2	200	2	0.2	—	13 x 8 x 4	11	69.95 K 109.95 W	Stereo, tubes.
	PAS-2X	10-40k 1.5	2	.05	.05	70 on phono	2	200	2	0.2	—	13 x 8 x 4	11	59.95 K 99.95 W	Stereo, tubes.
	PAM-1	10-40k 1.5	2	.05	.05	70 on phono	3	200	3	0.2	—	12 x 8 x 3	7	34.95 K 59.95 W	Mono, tubes.
C-T ACOUSTIC LABORATORIES	CT-10	20-150k	1	.05	.05	60	1.5	40	5	0.5	56 k	14 x 6 x 4	10	89.95	
FISHER	400 CX	20-25k 1	2.5	.04	.02	80	1.5	200	3	0.2	—	15½ x 10½ x 4½	18	199.50	Center-channel output.
LANSING (JBL)	SGS20	20-20k 0.25	3	0.15	.05	90	2	130	1	0.3	Hi Z	15½ x 11½ x 6½	20	450.00 465.00 with case	Professional-type sliding controls; aural-null balancing; lighted push-buttons; convenience and temporary inputs and outputs behind door in front panel; perm. conns. on rear.
LEAK	Varislope 2 stereo	20-20k 0.5	0.125	0.1	—	78	3.5	—	3	.05	—	10½ x 6½ x 3¼	6½	129.50	Takes power from Leak power amp.
MARANTZ	7 T	20-20k +0, -0.25	10	0.5	0.15	80	0.75	100	1	.075	600	15½ w, 5¾ h	11	325.00	Solid-state; center channel; 600-ohm head phone jack; tape duplicating facilities with front-panel jacks and controls. Dynamic range, approx. 100db.
MC INTOSH	C22	20-20k 0.5	2.5	0.1	0.1	85	2	200	2	0.25	—	16 x 13 x 5½	16	279.00	Step tone controls; front-panel input for tape dubbing.
	C24	20-20k 0.5	2.5	0.1	0.1	85	2	200	2	0.2	—	16 x 11 x 5½	17	249.00	Solid-state.
	MX 110	20-20k 0.5	3	0.2	0.2	85	3	200	3	—	—	16 x 13 x 5½	27½	399.00	This is a tuner 'preamp. See TUNERS for the tuner specifications.



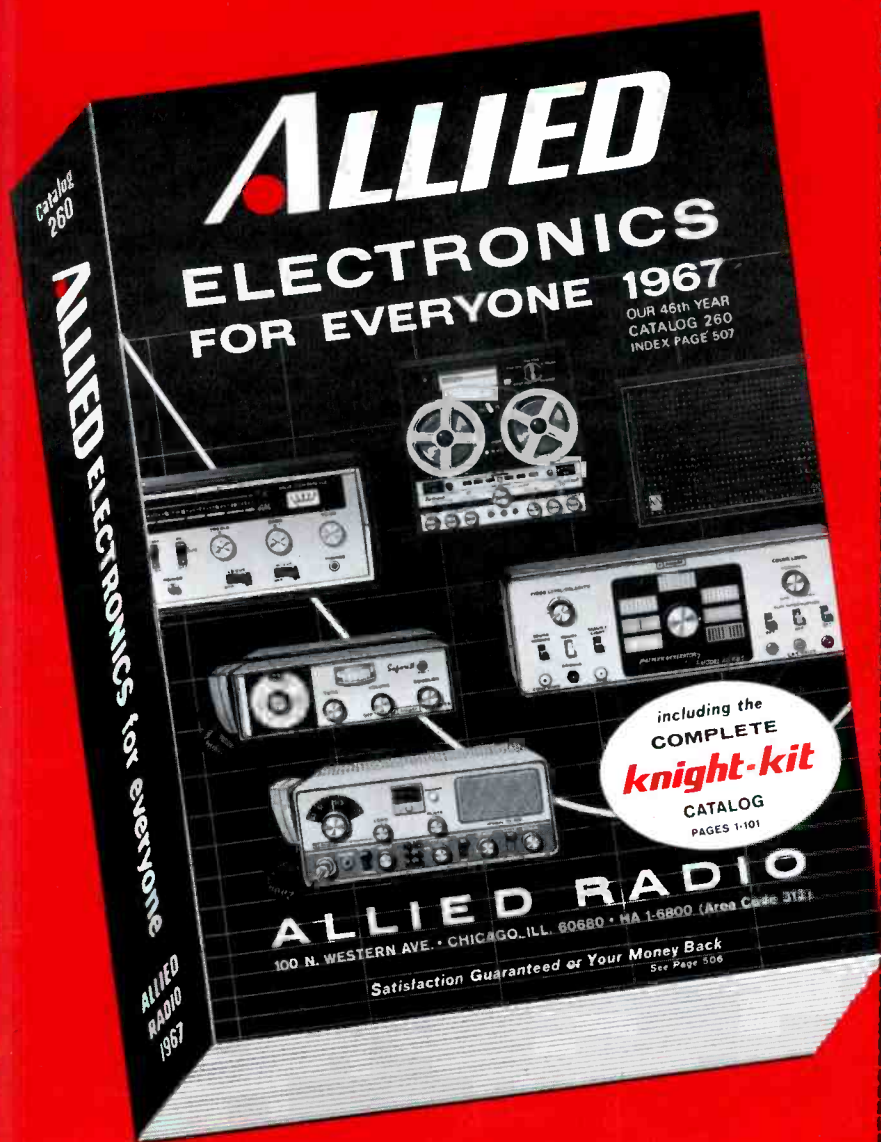
MARANTZ 7T



McINTOSH C-22



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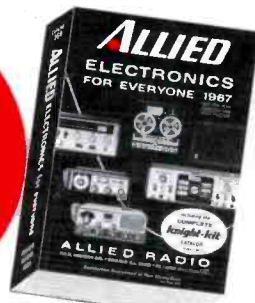
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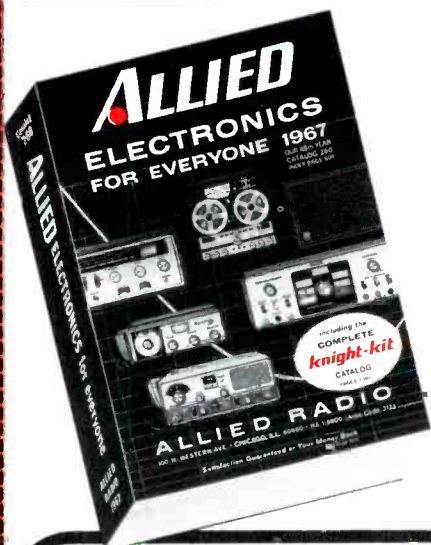
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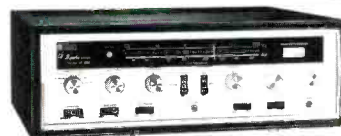
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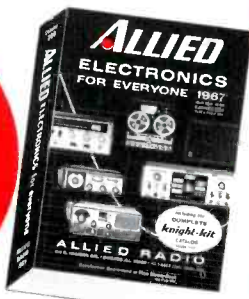


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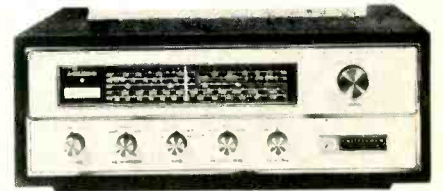
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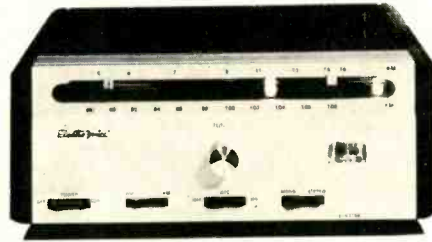
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# TUNERS—SECTION 3



FISHER R-200-B



ELECTRO-VOICE 1156



HEATH AJ-14

See Ad on Page No.

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MANUFACTURER	MODEL NO.	Sensitivity		THD 100% Mod. %	Capture Ratio dB	Drift kHz	Alt. Chan. Selectivity dB	Frequency Response ± dB	AFC ?	AM Suppression dB	Stereo Separation		Tuning ind. type	Stereo ind. type	Auto switching?	Size W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES	
		IHF μV	Vol. μV								1 kHz dB	10 kHz dB								
ACOUSTECH	VIII	2	—	0.3	2	—	—	No	—	35	25	1	meter	light	Yes	—	—	\$299.00	Preliminary data. Model soon to be available.	
BOGEN	TP35	3	3	0.75	3	15	50	30-15k .05	Yes	—	35	25	1	eye	light	No	15 11 1/4 4 3/4	18	\$129.95	Tube-type.
DYNACO	FM-3	4	0	1.0	5	20	54	10-15k 0.5	No	63	30	15	1	eye	eye	Yes	13 8 4	13	\$ 99.95 K 154.95 W	Stereo, tube type.
	FM-1	4	0	0.5	5	20	54	10-40k 0.5	No	63	—	—	—	eye	—	—	13 8 4	12	\$ 79.95 K 109.95 W	Mono, tube type
EICO	3200	2.4	1	0.75	4.5	—	45	20-15k 1.0	Yes	40	40	25	0.75	meter	light	Yes	12 8 3 3/4	7	\$ 89.95 K 119.95 W	
ELECTRO-VOICE	E-V1155	3	2	1.5	2.5	20	60	30-15k 1.0	Yes	40	30	15	2	meter	light	Yes	8 3/4 10 1/2 3 3/4	6	\$160.00	Solid-state; movable station markers may be set for favorite stations; zero-center tuning meter; incl. case with walnut finish panels.
	E-V1156	3	2	1.5	2.5	20	60	30-15k 1.0	Yes	40	30	15	2	meter	light	Yes	8 3/4 10 1/2 3 3/4	6 1/2	\$195.00	Same as E-V1155 but with AM section added. AM sens. 250 μV/meter for 15dB S/N.
FISHER	TFM-200	1.8	below noise	0.57	2.2	10	55	20-15k —	No	60	40	30	0.5	meter	light	Yes	15 1/2 11 1/4 4 1/16	9	\$229.50	Adjustable muting and level controls front-panel tape jack.
	TFM-300	1.8	below noise	0.4	2	10	55	20-15k —	No	60	40	30	0.5	meter	light	Yes	15 1/2 11 1/4 4 1/16	9	\$279.50	Adjustable muting and level controls; front-panel tape jack; push-button mode selector.
	TFM-1000	1.8	below noise	0.2	0.6	10	70	20-15k —	No	70	40	30	0.3	meter	light	Yes	16 3/4 12 3/4 5 1/2	18	\$499.50	Overload suppressor; counter type detector; clear-signal indicator.
	R-200-B	1.8	below noise	0.47	2.5	—	50	20-15k —	No	60	35	—	0.5	meter	light	Yes	15 1/2 13 4 1/16	18.5	\$349.50	Long, medium, and short wave bands; 3-position muting control 3-position AM bandwidth control
HEATH	AJ-43D	2	—	1	3	—	—	20-20k 3	Yes	40	35	30	1.0	2 meters	light	Yes	15 3/4 14 3/4 5 1/2	15	\$109.00 K	All solid-state.
	AJ-33A	3	—	1	4	—	—	20-20k 3	Yes	35	30	25	1.0	meter	light	No	15 3/4 11 1/2 3 3/4	12	\$ 94.50 K	All solid-state.
	AJ-14	5	—	1	3	—	—	20-15k 3	Yes	40	30	—	—	—	light	No	12 1/2 9 3/4 3 1/2	5	\$ 49.95 K	All solid-state.
KLH	18	4	3	0.5	4	10	35	20-15k —	No	50	35	20	0.8	meter	light	Yes	9 5 1/2 4 1/4	5	\$116.95	Zero-center tuning meter; mono-stereo switch; MX noise filter; low-mass coil slugs will not shift in shipment; two sets of outputs, both can be used at once.
KENWOOD	TK-500	1.8	0.9	0.8	2	20	40	50-15k 2	Yes	45	35	26	1.0	meter	light	Yes	15 3/4 12 1/4 5 3/4	14	\$149.95	Solid-state.
KNIGHT	KN-265B	3	2	0.5	3	—	—	20-25k 0.5	Yes	55	35	25	1.0	meter	light	Yes	14 1/2 12 4 1/2	14	\$149.95	4 i.f. stages, all solid-state; AM sensitivity, 5 μV for 20dB S/N.
	KN1-285	3	2.5	1.0	4	—	—	25-20k 1.0	Yes	50	35	20	1.5	eye	light	No	13 7/8 9 4 3/4	26	\$ 79.95	8 tubes, 12 diodes; AM sensitivity 8 μV for 20 dB S/N.

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AUDIO • AUGUST, 1966

# TUNERS



KNIGHT-KIT KG-765



KLH 18



McINTOSH MR-67



SHERWOOD S-3300

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COV II

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MANUFACTURER	MODEL NO.	Sensitivity			Capture Ratio dB	Drift, kHz	Alt. Chann. Selectivity dB	Frequency Response ± dB	AFC ?	AM Suppression dB	Stereo Separation		Stereo THD %	Tuning ind. type	Stereo ind. type	Auto switching?	Size W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES	
		IHF μV.	Voi. μV.	THD 100% Mod. %							1 kHz dB	10 kHz dB									
KNIGHT-KIT	KG-765A	2.5	—	1.0	9	—	20-20k 1.0	Yes	33	30	20	1.0	meter	light	Yes	13 11 2 3/4	13	\$ 99.95	K	Solid-state; also AM.	
	KG-790	2.5	—	0.75	2	—	50-15k 2	Yes	35	40	22	1.0	meter	light	Yes	16 3/8 15 5	20	\$139.95	K	Solid-state; also AM.	
	KG-50	3	—	1.5	—	—	50-15k 1.0	Yes	—	30	20	1.5	eye	neon	No	13 3/8 7 3/4 4 1/2	12	\$ 69.95	K	Tube type; also AM.	
	KG-65	4	—	—	—	—	20-20k 1.0	Yes	—	—	—	—	None	—	No	13 3/8 8 4 1/2	10	\$ 49.95	K	Tube type; mono-only FM; also AM.	
LAFAYETTE	LT-325T	2	5	0.5	3	30	42	20-15k 2	No	42	—	0.5	meter	tone	No	13 9 3/8 3 3/8	9.2	\$ 99.95		Stereo-search (tone) signal all solid-state; stereo noise filter, also AM.	
	LT-250T	4	3	0.9	3.5	30	38	20-15k 2	No	40	30	0.9	meter	tone	No	13 9 3/8 3 3/8	9	\$ 84.95		Stereo-search (tone) signal; all solid-state.	
MARANTZ	10B	2	0.8	0.2	1.75	10	150	20-15k 0.5	No	70	48	33	CRT	light	Yes	15 3/8 15 5 3/4	38	\$750.00		Balanced solid-state demodulator (1st detector); 6 i.f. stages coupled by passive filter networks; CRT display shows tuning, audio signal phasing.	
MCINTOSH	MR-67	2.5	—	0.5	1.7	25	61	20-20k 0.5	No	50	30	17	0.8	meter	light	No	16 13 5 7/16	24 1/2	\$299.00		Built-in multipath indication
	MR-71	2.5	—	0.5	1.5	25	77	20-20k 0.5	Yes	50	30	15	0.8	meter	light	Yes	16 13 5 7/16	27 1/2	\$399.00		Built-in multipath indicator.
	MX-110	2.5	—	0.5	1.7	25	61	20-20k 1.0	No	50	30	17	0.8	eye	light	No	16 13 5 7/16	27	\$399.00		Tuner and phono pre-amp. See pre-amps, sect. K2 for specs.
SCOTT	315	2	0	0.8	3	20	40	50-15k —	No	55	35	—	0.8	meter	light	Yes	15 1/2 13 3/4 5 1/4	8	\$184.95		
	312C	1.7	0	0.8	2.5	20	45	50-15k —	No	55	35	—	0.8	meter	light	Yes	15 1/2 13 3/4 5 1/4	13	\$249.95		
	LT-112	1.8	0	0.8	2.5	20	45	50-15k —	No	55	35	—	0.8	meter	light	Yes	15 1/2 13 3/4 5 1/4	15	\$179.95	K	
	LT-110B	2.2	0	0.8	3	20	40	50-15k —	No	55	35	—	0.8	meter	light	No	15 1/2 13 3/4 5 1/4	15	\$129.95	K	
SHERWOOD	S-3300	1.6		0.25	2.2	20		20-15k 1.0	No	50	35	24	0.25	meter	light	Yes	14 10 1/4 4	10	\$167.50		All silicon solid-state; zero-center tuning meter.
	S-2300	1.6		0.25	2.2	20		20-15k 1.0	No	50	35	24	0.25	meter	light	Yes	14 10 1/4 4	13	\$199.50		All silicon solid-state; zero-center tuning meter; includes AM section, 2 μV. sensitivity.



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**SLT-12 Turntable**, with Straight Line Tracking—a revolutionary development from Marantz. Finally, the art of tracking a record precisely duplicates the art of cutting a record. The Marantz SLT-12 Straight Line Tracking System exactly conforms to the angle, posture and the tracking used in the cutting of an original master stereo record. This perfect compatibility eliminates inherent deficiencies of conventional swing arm record player systems and gives incredibly perfect reproduction. It is the only system available which faithfully reproduces sound as it was originally recorded.

**10B FM Stereo Tuner**—rated by Hi Fi/Stereo Review magazine, “I have never seen a tuner to compare with it...so outstanding that it is literally in a class by itself.”

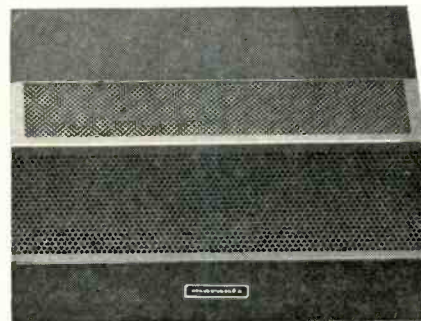
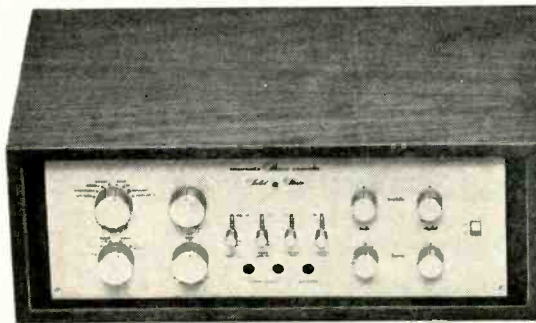
**7T Solid State Stereo Console**—a solid state component unequalled in performance, versatility and flexibility.

**8B Dual 35 Stereophonic Power Amplifier**—American Record Guide magazine says, “The Marantz 8B is a logical choice for ears that demand the best sound for now and for the future.”

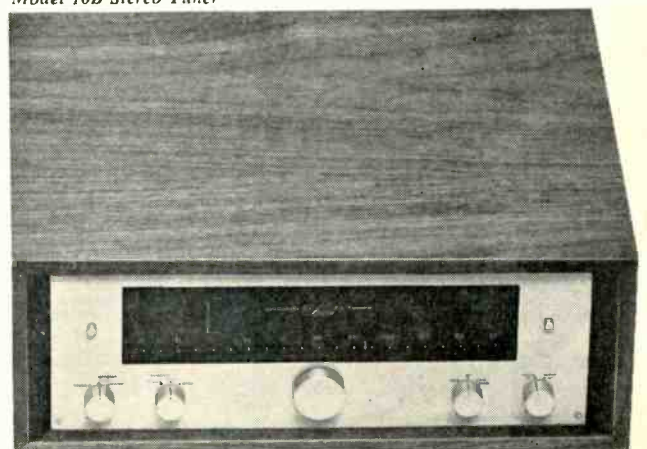
## marantz

MARANTZ, INC. SUBSIDIARY OF SUPERSCOPE INC.  
25-14 BROADWAY, LONG ISLAND CITY, NEW YORK

Model 7T Stereo Pre-Amplifier    Model 8B Stereo Amplifier



Model SLT-12 Turntable    Model 10B Stereo Tuner



*A wonderful adventure in sound awaits you with your discovery that the sound of Marantz is the sound of music at its very best. You, too, can own an incomparable Marantz system. Ask your dealer about the easy finance plan.*

Circle 126 on Reader Service Card

# RECEIVERS

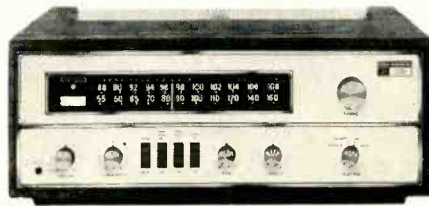
# Section 4



ADC SIX HUNDRED



ELECTRO-VOICE 1178



FISHER 220-T



BOGEN RT-8000

See Ad on Page No.

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1

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BACK COVER

9

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MANUFACTURER	MODEL NO.	IHF power per channel %			THD Full power %		IM full power %		IM one watt		Full power		One watt		S/N dB below rated output		Frequency Response Hz ± dB		Phono sensitivity mV	Phono overload mV	FM/IFH usable sensitivity μV	Volume sensitivity μV	THD% at 100% mode	Capture ratio dB	dB stereo sep. or kHz	Tuning indicator type	Auto switching?	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
		30	0.5	0.8	0.4	20-20k	10-100k	78	2	80	2	—	0.8	3	32	Meter	Yes	14 1/4 x 8 1/2 x 5													
ADC	Six Hundred	30	0.5	0.8	0.4	20-20k	10-100k	78	2	80	2	—	0.8	3	32	Meter	Yes	14 1/4 x 8 1/2 x 5	16	\$248.										Accommodates two pairs of speakers which can be played together or independently.	
ALTEC	711A	50	0.5	1	0.5	15-25k	15-30k	80	2	25	2.2	1.9	—	2.5	40	Meter	Yes	5 3/8 x 16 3/4 x 12	19	\$378.									All silicon transistors.		
BOGEN	RT8000	35	1	1	1	20-20k	20-50k	70	3	50	2.3	2	0.75	33	25	Meter	Yes	16 x 14 x 4 1/2	20	\$319.95									Includes AM, silicon outputs and drivers, speaker switching A-B-both-earphones, built-in subsonic audio filter.		
	RT7000	32.5	1	1	1	20-20k	15-40k	70	3	50	2.5	2	0.75	3	25	Meter	Yes	16 x 14 x 4 1/2	19	\$279.95									No AM.		
	TR100X	30	1	1	1	20-20k	20-20k	70	3.5	50	2.7	2	0.75	3	25	Meter	Yes	16 x 11 1/4 x 4 1/2	17	\$249.95									As in the RT8000.		
ELECTRO-VOICE	1177	32.5	1	2	0.8	—	20-30k	1.5	60	4	50	3	2	1.5	2.5	30	Meter	Yes	15 7/8 x 10 1/4 x 3 3/8	15	\$280.									All solid-state. Color light bars indicate input; connections are concealed. Convenience features include headphone jack, tape monitor switch, speaker mute switch. Walnut paneled case included.	
	1178	32.5	1	2	0.8	—	20-30k	1.5	60	4	50	3	2	1.5	2.5	30	Meter	Yes	15 7/8 x 10 1/4 x 3 3/8	19 1/2	\$315.								As above with AM-250 μV/meter for 15dB/S/N.		
	1179	27.5	1.3	2	0.8	—	20-30k	1.5	55	4	50	3	2	2.5	2.5	25	Meter	Yes	9 1/2 x 10 x 4	14	\$223.								Solid-state. Includes walnut paneled case, color-coded input lights.		
FISHER RADIO	400	32.5	0.8	0.8	0.1	25-30k	25-25k	80	4.4	200	1.8	—	0.5	2.5	35	Eye	No	17 1/2 x 13 1/2 x 5 3/4	30 3/4	\$229.50									Center channel output. High filter and loudness contour switches.		
	800-C	37.5	0.7	0.7	—	24-35k	25-25k	80	3.3	200	1.8	—	0.5	2.5	35	Meter	Yes	17 1/2 x 13 1/2 x 5 3/4	37	\$399.50									AM included. As above plus low filter, 4 position speaker switch. Sharp or broad AM bandwidth switch.		
	440-T	35	0.8	0.8	—	22-30k	—	80	4.5	100	2	—	0.5	2	35	Meter	Yes	16 1/2 x 12 3/8 x 5 1/4	—	\$329.50									All solid-state.		
	200-T	60	0.8	0.8	—	20-30k	—	80	3.5	100	1.8	3	0.4	2	40	Meter	Yes	16 1/2 x 12 3/8 x 5 1/4	24	\$499.50									FET Front end, Guard-o-Matic, otherwise as 800-C without AM.		
	220-T	27.5	0.8	1	—	28-30k	—	80	3	100	2.5	3	0.5	2.2	35	Meter	Yes	15 1/2 x 11 x 4 1 1/16	17.5	\$329.50									FET front end, Guard-o-Matic, AM band, 2 position speaker switch.		
HARMAN-KARDON	SR-300B	30	1	—	—	6-50k	5-60k	90	2.5	—	2.9	—	.05	—	30	Meter	Yes	14 1/2 x 11 1/4 x 4 1/2	14	\$279.									2 system stereo speaker selector and headphone jack. stereo light.		
	SR-400B	30	1	—	—	6-50k	5-60k	90	2.5	—	2.9	—	.05	—	30	Meter	Yes	14 1/2 x 11 1/4 x 4 1/2	16	\$309.									AM sensitivity 50 μV. AM selectivity 10 kHz bandwidth at 6 dB, otherwise as above.		
	SR-600B	40	1	—	—	6-50k	5-60k	90	1.5	—	1.95	—	.05	—	35	Meter	Yes	16 1/4 x 11 1/4 x 5	26	\$369.									Hi-low cut, tone control defeat; on-off pushbutton, otherwise as above. NO AM.		
	SR-900B	50	0.2	—	—	3-75k	2-100k	95	1.5	—	1.85	—	.01	—	40	Meter	Yes	16 1/2 x 11 1/4 x 5	26	\$449.									As above.		
HEATH	AR-13A	33	0.3	1	1	15-30k	15-30k	50	6	—	2	—	1	3	30	Meter	Yes	17 x 14 3/4 x 5 1/2	24	\$184.									Kit. All solid-state.		
	AR-14	15	0.5	1	1	15-50k	12-60k	50	4	—	5	—	1	3	30	No	No	15 3/4 x 12 x 3 7/8	14	\$99.95									Kit. All solid-state.		
KENWOOD	TK-50	30	1	1	0.2	20-20k	20-50k	70	2	90	2.5	0.9	0.8	2.5	35	Meter	Yes	16 1/2 x 12 x 5 1 1/16	28	\$199.95									Silicon solid-state.		
	TK-60	30	1	1	0.2	20-20k	20-50k	70	2	90	2.5	0.9	0.8	2	35	Meter	Yes	17 1/4 x 12 x 5 1 1/16	28	\$239.95									Silicon solid-state.		
	TK-80	45	1	1	0.17	20-30k	20-50k	71	2.2	90	2	0.9	0.8	2	38	Meter	Yes	17 3/4 x 12 x 5 1 1/16	28	\$289.95									Silicon solid-state.		
KNIGHT	KN376	35	1	1	—	30-20k	20-20k	70	4	—	3	2	1	3	36	Meter	Yes	16 1/2 x 13 x 5	19	\$249.95										All solid-state, 4 IF limiters; front panel headphone jack; massive heat sinks; speaker switching circuit gives proper match to all speakers.	
	KN351	28	1	1	—	40-15k	20-20k	65	4	—	3	2	1	4	30	Meter	Yes	16 1/2 x 13 x 5	20	\$199.95										Has AM. All solid-state. 3-position rocker switch for instant switching to remote speakers-main speakers—or all. 4 FM IF states.	
	KN1333	16	1	1.5	—	—	20-30k	0.5	60	2.5	—	3.5	2.5	1	5	30	Eye	No	15 1 1/16 x 13 3/16 x 5 5/8	28	\$149.95									13 tubes, 8 diodes. 3 IF stage stereo headphone jack. Full set of outputs and inputs.	



# RECEIVERS

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INSIDE FRONT COVER

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MANUFACTURER	MODEL NO.	IHF power per channel	THD full power %	IM full power %	IM one watt %	Distortion %		Frequency Response Hz ± dB		S/N dB below rated output	Phono sensitivity mV	Phono overload mV	FM/IHF usable sensitivity μV	Volume sensitivity μV	THD% at 100% mode	Capture ratio dB	dB stereo sep. or 1kHz	Tuning indicator type	Auto switching ?	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
						20-35k	30-50k	75	3														
KNIGHT-KIT	KG-964	32	1	1.5	—	20-35k	20-50k	75	3	—	2.5	—	1	8	35	Meter	Yes	16 3/4 x 15 x 5	26	\$189.95	Has AM. All solid-state.		
	KU-45A	19.5	1	1.5	—	—	30-16k	1	75	2	—	2.5	—	—	30	Eye	No	16 1/2 x 13 x 4 3/4	25	\$129.95	Vacuum tubes. Has AM.		
LAFAYETTE RADIO	LR-450T	15	1	—	0.8	40-20k	30-20k	65	2.5	60	2	5	1	3	30	Meter	No	15 1/2 x 11 1/2 x 4 1/2	15	\$159.95	Patented transistor overload circuit. Stereo FM search signal. Has AM concentric bass and treble controls. Includes case.		
	LR-900T	32.5	1	—	0.8	30-20k	20-20k	72	1.5	53	2	5	0.6	2.5	35	Meter	No	16 1/2 x 12 1/2 x 4 1/2	18	\$199.95	As above.		
	LR-1200T	60	1	0.8	0.3	11-38k	20-50k	78	2	—	1.5	—	—	2.2	38	Meter	Yes	16 x 14 1/4 x 5 1/4	29	\$249.95	Fused transistor overload circuit. Tape monitor remote/main speaker switching, inter-channel muting, variable AFC. Includes AM.		
MCINTOSH	MAC-1500	42	0.5	0.5	0.1	18-33k	20-20k	76	2.8/4.5	56/90	2.5	—	0.5	2	30	Meter	Yes	16 x 13 x 5 1/2	45	\$499.	Twenty transistors and 15 vacuum tubes.		
PILOT	RA250	30	1	—	—	20-20k	15-30k	80	3.5	90	5	3	0.5	4	30	Meter	Yes	15 3/8 x 10 1/2 x 5	—	\$249.95			
	RA300	20	0.5	—	—	15-40k	10-50k	80	2-5/10	50/210	4	2.5	0.5	3	30	Meter	Yes	17 1/8 x 12 3/8 x 5 3/8	—	\$299.95			
	RA300	26	0.5	—	—	15-40k	10-50k	80	2-5/10	50/210	4	2.5	0.5	3	30	Meter	Yes	17 1/8 x 12 3/8 x 5 3/8	—	\$339.95			
	R700	35	0.5	—	—	15-40k	10-50k	80	2-8/10	50/210	3.2	2	0.5	2.5	30	Meter	Yes	17 1/8 x 12 3/8 x 5 3/8	—	\$399.95	Center channel speaker output.		
	R1100	60	0.5	—	—	6-50k	5-50k	85	2-9/10	50/210	2.2	1.7	0.5	1.5	30	Meter	Yes	17 1/8 x 14 1/8 x 5 3/8	—	\$449.95	As above plus front panel recording jack.		
PIONEER	SX-600T	20	1	—	—	25-15k	20-20k	60	2-7/70	—	2	—	1	—	36	Meter	Yes	17 1/2 x 16 1/8 x 5 7/8	27	\$230.	Transistor protection circuit. Mesa-type silicon power transistors.		
	ER-420	20	1	—	—	—	20-20k	55	2-7/29	—	2	—	1	—	35	Meter	Yes	17 1/2 x 17 1/2 x 6	35	\$210.			
	SX-800	37.5	1	—	—	30-15k	20-20k	55	3/30	—	2	—	1	—	35	Meter	Yes	17 1/2 x 16 3/8 x 5 1/2	35	\$290.			
H.H. SCOTT	342	32.5	0.8	—	—	25-20k	18-25k	80	5/9	35/63	2.2	0	0.8	3	35	Meter	Yes	15 x 13 1/4 x 4 3/8	14	\$299.95			
	382	32.5	0.8	—	—	25-20k	18-25k	80	5/9	35/63	2.2	0	0.8	3	35	Meter	Yes	15 x 13 1/4 x 4 3/8	14	\$339.95			
	344-B	42.5	0.8	—	—	20-20k	15-30k	80	3/5/9	24/40/72	1.9	0	0.8	2.5	35	Meter	Yes	15 x 13 1/4 x 4 3/8	25	\$374.95			
	348	60	0.8	—	—	20-20k	15-30k	80	3/5/9	24/40/72	1.7	0	0.8	2.5	40	Meter	Yes	—	28	\$479.95			
	388	50	0.8	—	—	20-20k	15-30k	80	3/5/9	24/40/72	1.7	0	0.8	2.5	40	Meter	Yes	—	29	\$499.95			
SHERWOOD	S-7800	70	0.6	1	0.15	12-25k	12-35k	70	1.6	250	1.6	—	0.25	2.2	35	Meter	Yes	16 1/2 x 14 x 4 1/2	35	\$399.50	All silicon solid-state. Main and remote speaker switching. Has AM-2NV sensitivity. 70 watts per channel at 4 ohms.		
	S-8800	70	0.6	1	0.15	12-25k	12-35k	70	1.6	250	1.6	—	0.25	2.2	35	Meter	Yes	16 1/2 x 14 x 4 1/2	35	\$359.50	As above except no AM.		



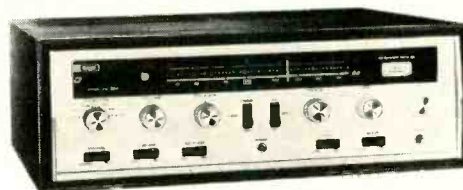
KENWOOD TK-80



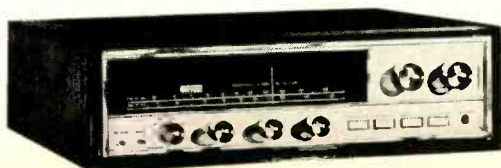
SCOTT 388



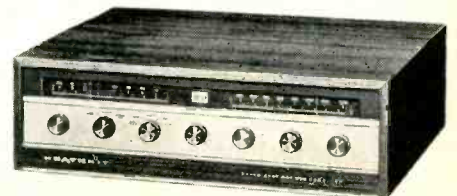
LAFAYETTE LR-1200T



KNIGHT-KIT KG-964



SHERWOOD S-7800

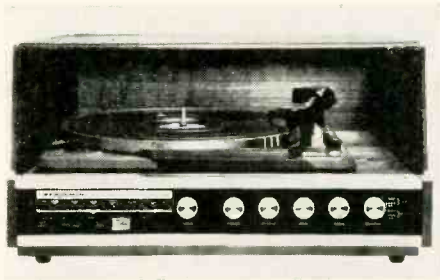


HEATH AR-13





# COMPLETE MODULAR SYSTEMS



Benjamin Stereo 200 FM



Fisher 95-8



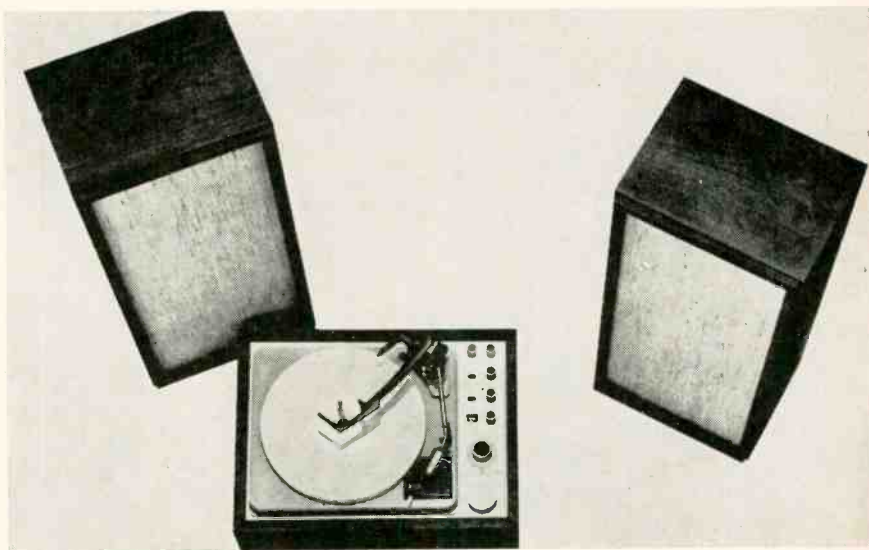
Harman-Kardon SC-440



EMI/Scope 201



Shure M-100L



KLH-20

# TURNTABLES AND ARMS—6

See Ad on Page No.

MANUFACTURER	TURNTABLES														ARMS										SPECIAL FEATURES				
	MODEL NO.	Speeds r.p.m.	Wt. 3 1/2 %	Platter 3 1/2 %	Motor type	Drive	Dia. in.	Wt. lbs.	Platter		Arm mfg. Provision	Size W x D x H in.	Wt. lbs.	MODEL NO.	Overall length in.	Pivot-stylus dist. in.	Coat. mag.	Vertical	Bearings		Stylus force method	Max. sig. error deg.	Cart. mt. range gms.	Arm resonance Hz		Stylus force range gms.	Wt. (l. spg.) lbs.	Price	
									Material	Arm mfg.									Lateral	Rear weight									
ACUSTIC-RESEARCH	XA 33 45	0.1	.05	18-p PM	belt	11	3.3	alum.	integral	16 1/2 12 3/4 5 1/4	13	—	12	9	std. 1/2-in.	nylon	ball siv.	rear weight	0.5	3-20	10-15	0.5 -8	—	—	—	78.00			
	TA 33	0.1	.05	18-p PM	belt	11	3.3	alum.	integral	16 1/2 12 3/4 5 1/4	13	—	12	9	std. 1/2-in.	nylon	ball siv.	rear weight	0.5	3-20	10-15	0.5 -8	—	—	—	75.00			
ADC													ADC 40	10 1/2	9	std. 1/2-in.	single ball	single ball	counter-weight	—	4-15	6	0-4	—	—	—	44.50	Side thrust compensation; plug-in shell.	
													ADC 84 E	10 1/2	9	std. 1/2-in.	single ball	single ball	counter-weight	—	4-15	6	0-4	—	—	—	89.50	As above, but includes Pt. 4E cartridge.	
BENJAMIN	PS-18H 33 45 78	0.1	0.1	hys. sync.	idler	12	6	zinc/alum.	integral	14 1/2 12 1/2 5 3/4	16		12	8	std. 1/2-in.	ball race	ball	balance and spring	2	—	—	0-10	—	—	—	110.00	Push-button operation; cueing device.		
BOGEN	B62 33 45 78	0.2	0.2	4-p	idler	12	7 1/4	—	integral	16 1/2 14 1/4 3	23		—	—	std. 1/2-in.	—	—	rear weight	—	—	—	—	—	—	—	3	67.95	Complete with arm, cueing device, wt. adj. gauge. *Continuously variable speed 29-86 rpm.	
	B52 33 45 78	0.1	0.1	4-p	idler	12	3	form. steel	integral	14 1/2 11 1/4 3	12		11 1/4	9	std. 1/2-in.	—	—	rear weight	—	—	—	—	—	—	—	—	49.95	"Feather-Float" hydraulic cueing; *cont. variable speed, 29-86 rpm.	
EMPIRE	208 33 45 78	.05	.05	hys. sync.	belt	12	6	alum.	cutout for 980 arm	17 15 8 3/4	20	980	12	9	std. 1/2-in.	ball bearing	ball bearing	balance & calib. spring	0.5	2-25	6	0-8	—	—	—	—	50.00	208 Table \$125.00.	
	398 33 45 78	.05	.05	hys. sync.	belt	12	6	alum.	integral	17 15 8 3/4	25																185.00	Includes base as complete Troubador system.	
	498 33 45 78	.07	.07	hys. sync.	belt	12	6	alum.	integral	16 13 7 1/2	25																170.00	Includes base as complete Troubador system.	
EUPHONICS													TA-15	11	8 1/2	*	knife edge	ball	spring bal.	0.75	1.5 only	12	0.5-1.5	12	—	—	32.50	*Accommodates Euphonics cartridge only TK-15-L5, with cart., pwr. source, \$87.50.	
														12	8 1/2	*	knife edge	ball	spring bal.	0.75	1.5 only	12	0.75-3.0	—	—	—	71.50	TK-15-P; with cart., pwr. source.	
													TA-16	13 1/2	11 1/2	*	knife edge	ball	spring bal.	0.25	1.5 only	10	0.5-1.5	14 gms.	—	—	—	42.50	*Accommodates Euphonics cartridge only TK-16-L5, with cart., pwr. source, \$97.50.
															14 1/2	11 1/2	*	knife edge	ball	spring bal.	0.25	1.5 only	10	0.75-3.0	14	—	—	87.50	TK-16-P; with cart., pwr. source.
MARANTZ	SLT-12 33 45	.04	.04	hys. sync.	belt	12	12	alum.	integral	18 14 6 1/2	27						ball race	ball race		0	—	—	—	—	—	—	295.00	Patented straight-line tracking arm with integral cartridge. Tracking force — 1 gm.	
ORTOFON													RMG 309	16	12 1/2	std. 1/2-in.	ball race	ball race	balance and spg.	0.83	max. 19	8	0.8	630 gms.	—	—	60.00		
													RMG 212	12	9	std. 1/2-in.	ball race	ball race	balance and spg.	1.2	max. 19	8	0-8	500 gms.	—	—	60.00		
													SMG 212	12	9	std. 1/2-in.	ball race	ball race	balance and spg.	1.2	max. 19	8	0.8	380 gms.	—	—	30.00		
PIONEER	PL-41 33 45	.08	.08	4-p hys. sync.	belt	12 1/4	4	alum. die cast	integral	20 16 7 3/4			—	9.6	std. 1/2-in.	ball race	ball race	static balance	1.0	—	7	0-4	—	—	—	220.00	With cartridge, walnut base; dust cover without cartridge \$210.00. Without cartridge, cover and base.		
REK-O-KUT	R-34 33 45	.08	.08	hys. sync.	belt	12	4	Alum.	integral	15 15 6	20	S-440	12	9	std. 1/2-in.	ball	ball	balance and spg.	1.0	3-30	9-12	0.2 -5.0	—	—	—	89.95	Integral arm, table, and base.		
	B-12H 33 45 78	.085	.08	hys. sync.	idler	12	5	alum.	hole in deck	18 16 10	19															165.00	High-torque motor for cueing.		
	B-126-H 33 45 78	.09	.09	hys. sync.	idler	12	5	alum.	hole in deck	18 16 8	17															109.95			
	B-16H 33 45 78	.08	.08	hys. sync.	idler	16	9	alum.	hole in deck	20 19 8	34																275.00		
SHURE-SME													S-320	12	9	std. 1/2-in.	ball	ball	balance and spg.	1.0	3-30	9-12	0.2 -5.0	—	—	—	34.95		
													3009	—	9	std. 1/2-in.	knife edge	ball	rear weights	—	—	—	—	—	—	—	100.50	Adjustable anti-skating, viscous arm lift and lower.	
SONY													3012	—	12	std. 1/2-in.	knife edge	ball	rear weights	—	—	—	—	—	—	—	110.50	As above.	
	TTS-3000 33 45	.05	.05	servo cont. d.c.	belt	12	3	alum. die cast	—	14 15 5 1/2	14																—	Slow speed servo-controlled d.c. motor; constant speed can be varied ±5%.	
													POA 237	13 1/2	9 3/4	std. 1/2-in.	micro ball	micro ball	balance weight	1.44	6-18	9	0-3.0	—	—	—	85.00	Skating force cancelled at any point on the disc; independent lateral balancer not affected by stylus force used.	
STANTON													PJA 286	15 1/2	11 1/4	std. 1/2-in.	micro ball	micro ball	balance weight	1.24	6-18	8	0-3.0	—	—	—	99.50		
	800B 33 45	.15	.15	HP sync.	idler	12	3	alum.	rem. board	15 12 6 1/2	13	200 Jnipoise	11 1/2	8 1/2	std. 1/2-in.	Uni-pivot		rear weight	0.5	0-12	11	0-5	4.5 oz.	—	—	—	—	Interchangeable arm boards.	
THORENS	TD-150A B 33 45	0.2	.05	sync. 450 rpm	belt	12	7 1/2	Zn alloy	integral inter-changeable	15 12 5	15	TP-13	12	9	std. 1/2-in.	ball and polished sleeves	polished sleeves	rear weight	0.3	6-19	7 min.	0.5-4.0	—	—	—	99.75	Wooden base integral with unit plate. Turntable and platter on floating inner frame; adj. vert. tkg. angle.		
	TD-124/11 33 45 78	0.1	.05	4-p	belt and idler	12	7	Zn alloy and alum.	built-in wooden panes	15 12 7	18																—	Speed adj. by eddy-current brake; illum. stroboscope; double turntable with clutch assembly; die cast unit plate.	
	TP-14																										—	Arm control with viscous-damped lowering and lifting device; adj. anti-skating device supplied on mtg. board.	



# TURNTABLES AND ARMS



AR-XA



EMPIRE 498



THORENS TD-150



STANTON 800B



REK-O-KUT R-34



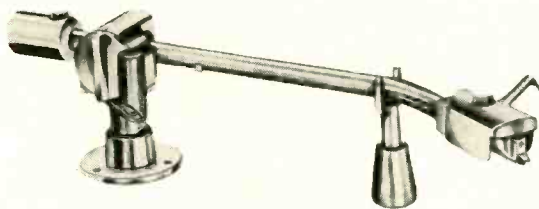
BOGEN B-61



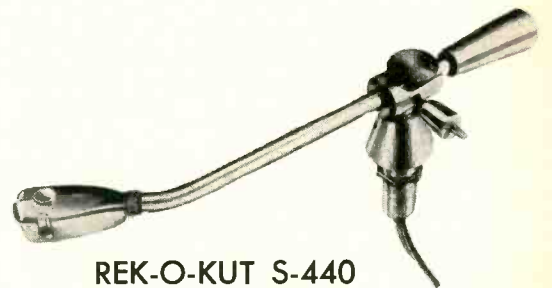
SONY TTS-3000



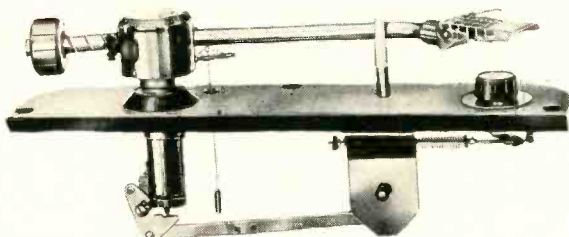
ADC 84-E



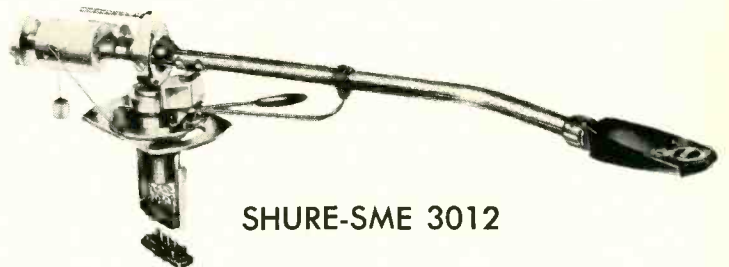
EMPIRE 980



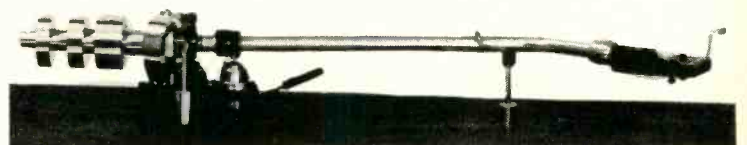
REK-O-KUT S-440



THORENS TP-14



SHURE-SME 3012



SONY RVA

# RECORD CHANGERS—7

MIRACORD  
40H



DUAL  
1019



GARRARD  
LAB 80

See Ad  
on Page  
No.

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MANUFACTURER	MODEL	Performance Characteristics											Dimensions				Price	SPECIAL FEATURES				
		Speeds (r.p.m.)	Platter Dia. in.	Wow, 33 1/3 r.p.m. %	Flutter, 33 1/3 r.p.m. %	Arm Pivot to Stylus in.	Max. Tracking Error deg.	Arm Type	Cartridge Wt. Range gms.	Stylus Force Range gms.	Cartridge Mtg. Type	Arm Resonance Hz.	Max. Stack Records	Chg. Cycle Above in. Below in.	Motor board Clearance	Width in.			Depth in.	Overall Height in.	Weight lbs.	
BENJAMIN (MIRACORD)	PW 40A	16 33 45 78	12	—	—	8	2	Unbal.	—	0-7 Std. 1/2 in.	20	10	11	3 3/4	5 5/8	14 1/2	12 1/2	8	16	99.50	Auto-repeat function, comes complete with Elac. STS-240 stereo cartridge; pushbutton operation.	
	PW-40H	16 33 45 78	12	—	—	8	2	Unbal.	—	0-7 Std. 1/2 in.	20	10	11	3 3/4	5 5/8	14 1/2	12 1/2	8	16	110.00	As above, but with hysteresis motor.	
	PW-50H	16 33 45 78	12	—	—	8	1	Unbal.	—	0-6 Std. 1/2 in.	15	10	11	3 1/4	5 1/8	—	—	8	17	149.50	As above, with addition of stylus overhang gauge, anti-skating compensation, adjustable cartridge retainer, and pilot light.	
DUAL	1019	16 33 45 78	10 2/3	.06	.06	8	1.25	Bal.	1-16	1/2-5	Std. 1/2 in.	8	10	13	3	6	12 3/4	10 1/2	9	16	129.50	Variable anti-skating, auto cueing rotating single-play spindle, plus all features of 1009.
	1009	16 33 45 78	10 2/3	.08	.08	8	1.25	Bal.	1-16	1/2-7	Std. 1/2 in.	8	10	13	3	6	12 3/4	10 1/2	9	15	99.50	6% variable speed control; automatic single play and change; 7 lb platter.
	1010	16 33 45 78	10 2/3	.09	.09	8	1.25	Spring	2-16	2-7	Std. 1/2 in.	12	10	13	3	6	12 3/4	10 1/2	9	10 1/2	69.50	Auto and manual start; interchangeable spindles.
GARRARD	Lab 80	33 45	12	0.1	.02	9	—	Bal.	4-18	1/4-5	Std. 1/2 in.	10	8	10	3 1/2	5 1/2	17	14 1/4	9	16 1/2	99.50	
	A70	16 33 45 78	10 1/2	0.12	.05	8.5	—	Bal.	4-18	1/4-5	Std. 1/2 in.	15	8	10	2 3/8	6	16 3/4	14 3/8	8 7/8	16	84.50	
	AT60	16 33 45 78	10 1/2	0.14	.05	7.5	—	Bal.	4-22	1/4-5	Std. 1/2 in.	15	7	10	2 3/8	4	15 3/8	13 3/8	7 3/4	10	59.50	
	50	16 33 45 78	10 1/2	0.14	.05	7.5	—	Spring	4-18	1/2-8	Std. 1/2 in.	20	7	10	2 3/8	4	14 3/8	12 1/2	7 1/2	9	44.50	
KNIGHT	KN990A	16 33 45 78	10	0.2	.05	7	2	Bal.	2-10	0-5	Std. 1/2 in.	15	14	9	5	3 1/2	14	12	8 1/2	12	47.95	Only 1 cent more for choice of cartridge — Empire, Pickering, or Shure.



# ENDORSED BY ELPA

When you have decided to acquire the highest quality components for your sound equipment, you will do well to look for the distinctive ELPA Seal of Endorsement. This seal is your certification of excellence in high fidelity. It is granted only to that equipment which successfully meets



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**CECIL E. WATTS Ltd.** – Cecil Watts is the recognized master throughout the world of record care and cleaning. Mr. Watts is the consultant of many major record manufacturers and the Watts' products – Preener, Parastat and Dust Bug are the result of his experimentations and investigations. Use a Cecil E. Watts product to help you renew your favorite old records and care for your valued new acquisitions as well.

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Circle 127 on Reader Service Card

# PHONO CARTRIDGES—8

See Ad on Page No.

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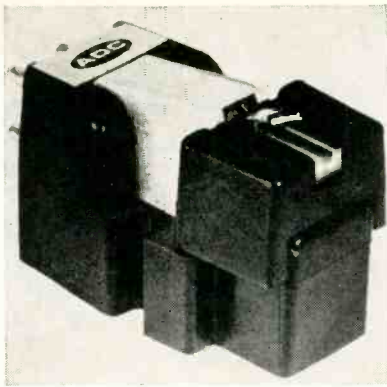
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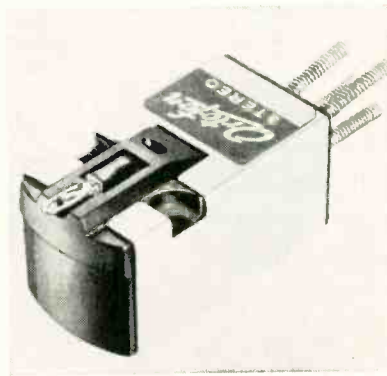
MANUFACTURER	Model	IM Dist. %	Separation		Output 3.54 cm/sec. mV	Tracking Force gms	Eff moving mass mg.	Compliance cm/dyne.		Stylus Type	Stylus radius mils	Re-placement	Max. Shunt cap pF	Mfg. Dim. in.	Weight gms	Price	SPECIAL FEATURES
			1000 Hz dB	10kHz dB				Lat. x10 <sup>-6</sup>	Vert x10 <sup>-6</sup>								
ADC	ADC 10/E	0.5	30	30	4	0.5-1.0	—	35	35	elliptical	0.3x0.7	User	300	std. 1/2-in.	7.0	\$59.50	Induced magnet 15-deg. vertical angle.
	ADC Point 4/E	1.0	30	20	5	0.75-1.5	—	30	30	elliptical	0.3x0.7	User	300	std. 1/2-in.	6.5	\$49.50	As above.
	ADC 809/E	1.0	30	20	5	1.5-3.0	—	25	25	elliptical	0.3x0.7	User	300	std. 1/2-in.	7.5	\$42.50	As above.
	ADC 660/E	1.0	30	20	5	1.5-3.0	—	20	20	elliptical	0.3x0.7	User	300	std. 1/2-in.	6.5	\$39.50	As above.
	ADC 770	1.0	30	—	7	2.0-6.0	—	15	15	spherical	0.7	User	300	std. 1/2-in.	6.5	\$29.50	As above.
BENJAMIN	STS-240	2.0	24	18	9	2.0-4.0	—	10	10	spherical	0.7	User	—	std. 1/2-in.	10.5	\$19.95	All models mount in retaining bracket which automatically sets up correct stylus angle in arm.
	STS-322D	2.0	30	23	5	1.0-3.0	—	16	16	spherical	0.52	User	—	std. 1/2-in.	10.5	\$24.95	
	STS-322DE	1.0	30	23	5	1.0-3.0	—	16	16	elliptical	0.3x0.8	User	—	std. 1/2-in.	10.5	\$29.95	
DYNACO	Stereodyne SD-III	1.0	28	20	5	1.0-2.0	1	14	14	spherical	0.7	User	—	std. 1/2-in.	10	\$19.95	
EMPIRE	888	—	30	20	5	0.75-6.0	<1	10	10	spherical	0.7	User	250	1/2 or 7/16 in.	7	\$19.95	
	888E	—	30	20	5	0.75-6.0	<1	12	12	elliptical	0.4x0.9	User	250	1/2 or 7/16 in.	7	\$25.95	
	888P	—	30	20	5	0.5-4.0	<1	15	15	spherical	0.6	User	250	1/2 or 7/16 in.	7	\$22.95	
	888PE	—	30	20	5	0.5-4.0	<1	20	20	elliptical	0.2x0.9	User	250	1/2 or 7/16 in.	7	\$32.95	
EUPHONICS	CK-15-LS	1.0	30	20	8, or 0.5 V.	0.75	0.6	25	25	elliptical	0.2x0.9	User	—	std. 1/2-in.	2	\$55.00	Lab. Standard kit. — cartridge, power source. Silicon semi-conductor. Freq. resp. 10-50 kHz.
	CK-15-P	1.0	30	20	8, or 0.5 V.	1.3	0.7	15	15	spherical	0.5	User	—	std. 1/2-in.	2	\$30.00	Prof. series kit.—cartridge and power source. Silicon semi-conductor. Freq. response 10-50 kHz.
GRADO	A	0.5	30	25	3.2	1.2	0.3	35	30	elliptical	0.3x0.9	factory	—	std. 1/2-in.	6.5	\$49.50	Moving-coil cartridge.
	BR	—	20	20	5.5	1.5-5.0	—	25	25	spherical	0.6	User	—	std. 1/2-in.	3.5	\$19.95	Flat from d.c. to 50 kHz; also available as model BE with elliptical stylus, 0.3x0.6, \$32.50. Also 3-mil. spherical stylus model, \$19.95.
ORTOPON	SPU-T	—	25	18	8	1.0-2.0	1	10	10	spherical	0.7	User	250	std. 1/2-in.	17.5	\$50.00	
	SPE-T ELL.	—	25	18	8	1.0-2.0	1	10	10	elliptical	0.3x0.8	User	250	std. 1/2-in.	17.5	\$75.00	
	S-15-E ELL.	—	25	18	7	1.0-2.0	1	15	15	elliptical	0.3x0.8	User	250	std. 1/2-in.	18.5	\$85.00	
PICKERING	V-15/ATE-2	1	35	20	5.32	2.0-5.0	1	16	15	elliptical	0.5x1.0	User	275	std. 1/2-in.	5	\$34.95	
	V-15/AME-3	1	35	20	3.54	0.75-1.5	4	26	24	elliptical	0.3x0.9	User	275	std. 1/2-in.	6	\$44.95	Self-supporting 1-gram Dustamatic™ stylus assembly.
	V-15/AM-3	1	35	20	3.54	0.75-3.0	1	24	22	spherical	0.7	User	275	std. 1/2-in.	6	\$34.95	
	V-15/ATE-3	1	35	20	5.32	2.0-5.0	1	16	15	elliptical	0.5x1.0	User	275	std. 1/2-in.	6	\$39.95	
	V-15/AT-3	1	35	20	5.32	1.0-5.0	1	12	11	spherical	0.7	User	275	std. 1/2-in.	6	\$29.95	
SHURE	M44E	—	20	10	9.3	1.75-4.0	—	15	15	elliptical	0.4x0.7	User	250	std. 1/2-in.	7	\$34.50	Des. for automatic turntables which require a cartridge that will track in the 1.75-4 gm range.
	V-15	—	25	20	5	0.75-1.5	—	25	25	elliptical	0.2x0.7	User	250	std. 1/2-in.	11	\$62.50	15-deg. tracking.
	M55E	—	25	20	5	0.75-1.5	—	25	25	elliptical	0.2x0.7	User	250	std. 1/2-in.	7	\$35.50	
	M80E/M70ED	—	25	20	5	1.25	—	25	25	elliptical	0.2x0.7	User	250	std. 1/2-in.	23.5	\$38.00	Mounted in shell; spring suspension for bounce-proof performance. M80 fits Garrard Lab 80. M70 fits Dual 1009.
SONOTONE	M7/N21D	—	20		3.5	2.5 max	—	9	9	spherical	0.7	User	250	std. 1/2-in.	7.9	\$17.95	
	100T-DEV (MK. V)	2.5	27	15	6	1.5-2.5	1.8	15	15	elliptical spherical	0.3x0.8 0.5 or 0.7	User	100	std. 1/2-in.	1.5	\$39.50	Sonoflex, low-mass, highest compliance 20 kHz response.
	9TAFHC-SD	2.5	27	7.5	200	1.5-2.5	3.5	13	13	two spherical	0.7, 3.0	User	100	std. 1/2-in.	2.5	\$15.15	Turnover stylus, LP or 78. 15 kHz response. Plug connector with pin adaptor.
	21T-SD	2.5	21	5	500	5-7	9	5.5	5.5	two spherical	0.7, 3.0	User	100	std. 1/2-in.	3.5	\$11.65	High output; snap-in mtg. bracket.
	24T-SD	2.5	25	5	260	5-7	9	3.5	3.5	two spherical	0.7, 3.0	User	100	std. 1/2-in.	3.5	\$13.95	High capacitance for transistor amplifiers; snap-in mtg. bracket.
25T-SD	2.5	25	6	200	1.5-3.0	3.0	15	15	two spherical	0.7, 3.0	User	100	std. 1/2-in.	2.8	\$14.70	15kHz response; low total mass.	
SONY	VC-8E	—	30	20	4.0	0.5-2.0	—	30	30	elliptical	0.2x0.8	User	—	std. 1/2-in.	15.5		Transformerless moving-coil type.
STANTON	581A	1	35	20	2.48	2.0-5.0	<1	16	14	spherical	0.7	User	275	1/2 or 3/8 in.	6	\$49.50	Longhair™ brush, self-supporting; weight, 1 gm.
	581EL	1	35	20	2.48	0.75-1.5	<1	26	24	elliptical	0.3x0.9	User	275	3/8 or 1/2 in.	6	\$49.50	
	581AA	1	35	20	2.48	0.75-1.5	<1	26	24	spherical	0.5	User	275	3/8 or 1/2 in.	6	\$49.50	



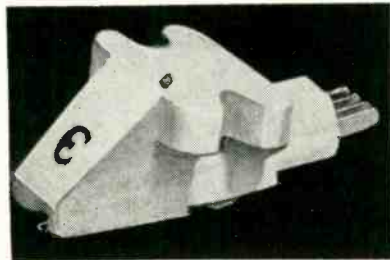
# PHONO CARTRIDGES



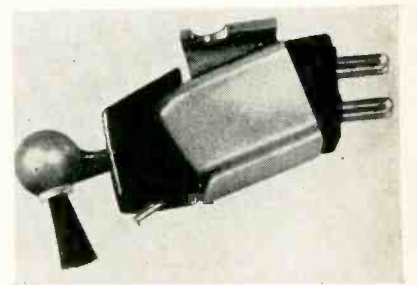
ADC-10/E



ORTOPHON S-15E



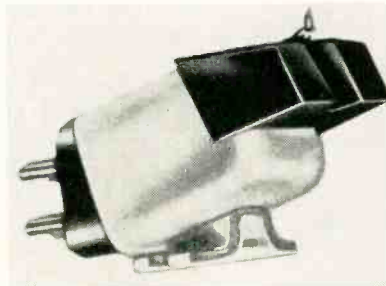
EUPHONICS CK-15-LS



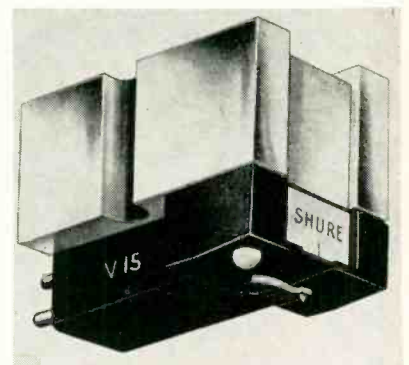
STANTON 581A



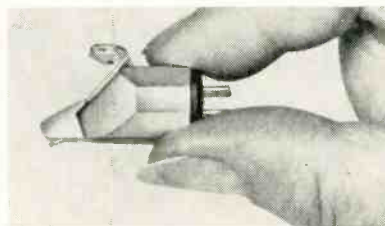
BENJAMIN STS-322



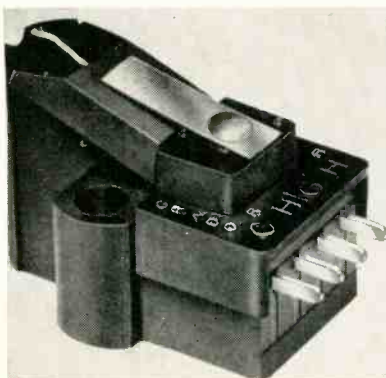
PICKERING V-15



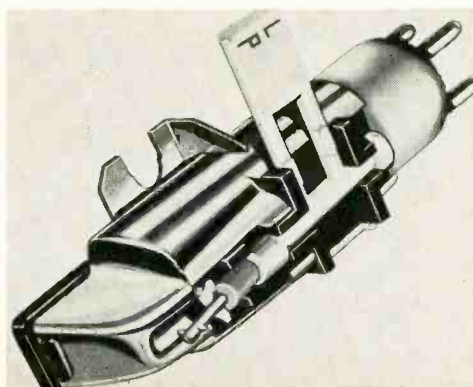
SHURE V-15



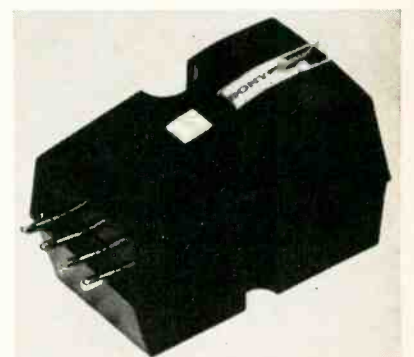
EMPIRE 888E



GRADO BR



SONOTONE



SONY VC-8E

# SPEAKER MECHANISMS—9



**HARTLEY  
310**



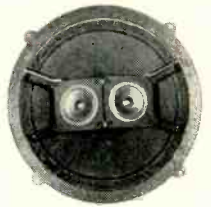
**EMPIRE  
9000 15W**



**ELECTRO-  
VOICE  
15TRX**



**HEATH  
AS-173**



**BOZAK  
B-207B**

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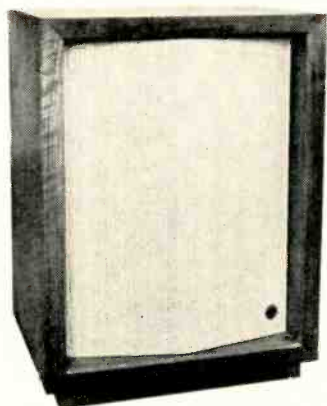
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MANUFACTURER	MODEL NO.	Diameter, in.	Frequency Response Hz ± dB	Resonance Hz.	Cone Material	Suspension			Voice Coil							Price	SPECIAL FEATURES
						Compliance	Type	Magnet Type	Material	Diameter, in.	Power capacity, watt	Impedance ohms	Depth, in.	Weight, lbs.	EIA Efficiency dB		
ALTEC	801C	12	30-22k	39	Paper	Med.	Cloth	A1.V	A1-ribbon	LF-3 HF-3 $\frac{3}{4}$	30	8	5 $\frac{1}{2}$	15	52	\$114.	Coaxial
	605B	15	20-22k	25	Paper	Med.	Cloth	A1.V	LF-copper HF A1. ribbon	LF-3 HF-3 $\frac{3}{4}$	50	16	10	28	50	\$168.	Coaxial
	604E	15	20-22k	25	Paper	Med.	Cloth	A1.V	LF-copper HF A1 ribbon	LF-3 HF-3 $\frac{3}{4}$	50	8	11 $\frac{1}{2}$	34	54	\$199.	Coaxial
	415C	15	25-14k	27	Paper	Med.	Cloth	A1.V	A1-ribbon	3	25	8	7	17 $\frac{1}{2}$	48	\$57.	Full-range 'Biflex'
	755C	8	40-15k	50	Paper	Med.	Cloth	Index V	Copper wire	2	15	8	2 $\frac{1}{4}$	3 $\frac{3}{4}$	48.5	\$32.25	Full-range.
BOZAK	B-207B	12	40-20k	49	Felted paper/ nets/	Med.	Cloth	A1.V	Copper ribbon	1 $\frac{1}{2}$	20	8	7	15	—	\$99	Coaxial.
	B-209C	6	200-3.5k	—	Rigid metal	Med.	Rubber	A1.V	Copper ribbon	1 $\frac{1}{2}$	75	8-16	3 $\frac{1}{2}$	7	—	\$55	Mid-range.
	B-800	8	50-10k	—	Rigid metal	Med.	Rubber	A1.V	Copper ribbon	1 $\frac{1}{2}$	75	8-16	3 $\frac{3}{4}$	7	—	\$50.	Wider range.
	B-200Y	2 $\frac{1}{2}$	1.5k-20k	—	Rigid metal	Med.	Rubber	A1.V	Copper	3 $\frac{3}{4}$	20	8	2 $\frac{1}{2}$	2 $\frac{1}{2}$	—	\$35.	Treble pair.
	B-199A	12	40-4.5k	40	Felted paper	Med.	Cloth	A1.V	Copper ribbon	1 $\frac{1}{2}$	20	8-16	5 $\frac{1}{8}$	9	—	\$55.	Bass woofer.
ELECTRO-VOICE	SP8B	8	35-15k	60	Paper	Med.	Cloth	Cer.	A1. wire	2	20	16	4 $\frac{3}{4}$	7	47	\$32.50	Excellent for restricted space applications. 1 lb 6 oz. magnet.
	SP12B	12	35-15k	50	Paper	Med.	Cloth	Cer.	A1. wire	2	30	16	6 $\frac{3}{4}$	11 $\frac{1}{2}$	49	\$39.	Famous full-range incorporating Radax dual-cone design.
	12TRXB	12	35-20k	50	Paper/Phen.	Med.	Cloth	Cer./A1-V	A1- wire	2/1	30	16	7	14	52	\$69.	As above with Sono-phase VHF tweeter and level control. Single hole mounting.
	15TRX	15	25-20k	25	Paper/Phen.	High	Cloth	Cer./A1-V	A1- wire	2 $\frac{1}{2}$ /1	40	16	8 $\frac{1}{4}$	27	55	\$130.	High-efficiency three-way for deluxe systems.
	30W	30	15-300	15	Foam Polystyrene	High	Cloth	Cer.	Copper ribbon	2 $\frac{1}{2}$	100	16	13 $\frac{3}{32}$	34	54	\$250.	Massive woofer unequalled as the foundation of a superlative system. It is a 9 lb. 4 oz. magnet.
EMPIRE	8000/12W	12	25-500	25	Paper	High	Cloth	Index	A1 form copper wire	4	60	8	3 $\frac{1}{2}$	21	52	\$70.	Woofer.
	9000/15W	15	25-500	20	Paper	High	Cloth	Index	A1 form copper wire	4	60	8	5 $\frac{1}{2}$	23	52	\$85.	Woofer.
	9000/MHX	3/1	500-15k	—	Phenolic	Low	Phen.	Alnico	Copper	3/1	40	8	3 $\frac{1}{4}$	12	54	\$90.	Acoustic lens assy. mid-range and tweeter.
HARTLEY	218MS	18	30-4k	17	Polymer	—	Cloth	Alcomax III	Copper	2	30	16	8	16	—	\$195.	Patd. mag. suspension system. -5dB at 16 Hz. Woofer.
	210MS	10	30-4k 3	20	Polymer	—	Cloth	Alcomax III	Copper	1	30	8	5 $\frac{1}{2}$	7 $\frac{1}{2}$	—	\$115.	As above except for freq. resp.
	220MS	10	30-20k 3	28	Polymer	—	Cloth	Alcomax III	Copper	1	30	8	5 $\frac{1}{2}$	7 $\frac{1}{2}$	—	\$135.	Full-range coaxial. uses an aluminum shorted turn located axially within the main upper winding.
	207MS	7	1k-25k 2	—	Polymer	—	Cloth	Alcomax III	Copper	1	30	8	5	7	—	\$95.	Mid-range and tweeter.
	310	10	30-20k 5	40	Polymerized Paper	—	Cloth	Alcomax III	Copper	1	20	8	5 $\frac{1}{2}$	7 $\frac{1}{2}$	—	\$85.	Full-range coaxial.
HEATH	AS-183	12	20-15k	25	—	High	—	Cer.	—	1 $\frac{1}{2}$ /1	30	8	4	13	—	\$49.95	Coaxial.
	AS-173	12	35-15k	40	—	High	—	Cer.	—	1 $\frac{1}{2}$ /1	25	8	4	12	—	\$39.95	Coaxial.
	AS-163	12	40-15k	60	—	—	—	Cer.	—	1 $\frac{1}{2}$ /1	20	8	4	10	—	\$29.95	Coaxial.
KNIGHT	KN-615HC	15	20-20k	25	Paper	High	Cloth	Cer.	Copper ribbon/ Alum. ribbon	2 $\frac{1}{2}$ /1	50	16	8 $\frac{1}{4}$	28	53	\$69.95	Coaxial 5 lb. ceramic magnet. Compression type tweeter.
	KN-835HC	15	25-20k	30	Paper	High	Cloth	Cer.	—	2/1	40	16	9	15	52	\$49.95	Coaxial—UHF super-tweeter horn.
	KN-612HC	12	22-20k	40	Paper	High	Cloth	Cer.	Copper ribbon/ Alum. ribbon	2 $\frac{1}{2}$ /1	35	16	7 $\frac{1}{2}$	27	53	\$59.95	As KN615HC plus diffraction horn.
	KN-888HC	12	25-19k	25	Paper	High	Cloth	Cer.	—	1 $\frac{1}{2}$ /1	25	8	6 $\frac{1}{8}$	11 $\frac{1}{2}$	53	\$36.95	Axially mounted mid-range cone. Compression-type tweeter horn.
	KN-839	8	45-18k	65	Paper	High	Paper	Cer.	—	2/1	20	8	3 $\frac{7}{8}$	6 $\frac{1}{4}$	45	\$19.95	Coaxial.



# SOUND SYSTEMS

BY



## GUAGUIN III

The ideal size console floor speaker, 3-way system with a specially designed high compliance 12" woofer providing the bass fundamentals, a 4" x 10" exponential horn driver for the mid-range, a 3" x 6" high frequency exponential horn for the treble, with advanced 3-way RC crossover network.

Frequency Response: 30 to 22,000 cycles

Power Handling Capacity: 40 watts

Impedance: 8 ohms

Enclosure: reinforced base reflex design

Finish: Oiled Walnut

Dimensions: 20" x 27 1/4" x 16 1/4"

NET PRICE \$209.50



## ATHENA II:

The same beautiful styling as the "Athena I" with the exception of the overall dimensions, a 2-way system with a 12" Linear suspension woofer for the rich bass frequency and a 3 1/2" closed back tweeter handles the mid-range and treble frequencies, with advanced 2-way RC crossover network.

Frequency response: 30 to 20,000 cycles

Power handling capacity: 40 watts

Impedance: 8 ohms

Finish: Available in Solid Walnut, Oak and Fruitwood

Original Suspension Sound in High Styling.

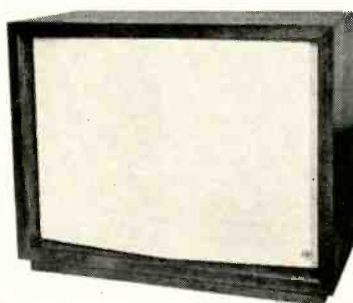
Dimensions: 20 3/4" x 25 1/8" x 20 3/4"

NET PRICE: \$209.50

AZTEC MANUFACTURING COMPANY offers the finest speaker systems that will satisfy the most discriminating ear.

Composed of highest quality speaker components mounted in handmade walnut enclosures, AZTEC sound systems will add the finishing touches to any monophonic or stereophonic system.

AZTEC'S Dramatic answer for traditional styling designed to blend in with Mediterranean or Italian Provincial decor.



## PETITE 500:

A compact 2-way speaker system designed to reproduce the full audio spectrum in the range of 40 to 20,000 cycles. A 8" "Linear suspension" woofer clearly provides the rich bass frequencies, a 3 1/2" closed back tweeter handles the mid and treble frequencies, with advanced 2-way RC crossover network.

Power handling capacity: 20 watts

Impedance: 8 ohms

Finish: Oiled Walnut

Dimensions: 20" x 10" x 9 1/2"

NET PRICE: \$69.95

## MATISSE IV:

The 3-way console floor speaker system unequalled in performance for the size, with a specially designed high compliance 15" woofer providing the deep rich bass response, a 4" x 10" exponential horn driver for the mid-range, a 3" x 6" high frequency exponential horn for the treble, with advanced 3-way RC crossover network.

Frequency Response: 25 to 22,000 cycles

Power Handling Capacity: 40 watts

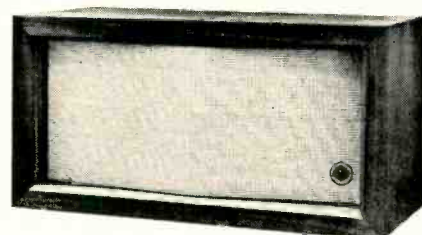
Impedance: 8 ohms

Enclosure: Reinforced tube ducted bass reflex design

Finish: Oiled Walnut

Dimensions: 34" x 27 1/4" x 16 1/4"

NET PRICE \$259.50



## RENIOR II

Combination shelf or floor model 2-way speaker system shown with optional sculptured base. With a 12" heavy duty "Linear suspension" woofer providing the rich clean bass response and a 3" x 6" high frequency exponential horn handling the mid-range and treble, with advanced 2-way RC crossover network.

Frequency response: 35 to 20,000 cycles

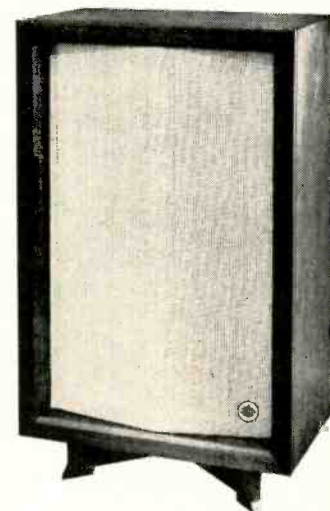
Power handling capacity: 35 watts

Impedance: 8 ohms

Finish: Oiled Walnut

Dimensions: 24" x 16" x 9 1/2"

NET PRICE: \$159.50



AZTEC MANUFACTURING COMPANY, 4040 FOX ST, DENVER, COLO 80216

Circle 129 on Reader Service Card



WHARFE-  
DALE  
SUPER  
12 RS/DD



JBL  
D140F

# SPEAKER MECHANISMS



MICHIGAN  
MC-8



UNIVERSITY

See  
Ad  
on  
Page  
No.

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MANUFACTURER	MODEL NO.	Diameter in.	Frequency Response Hz ± dB	Resonance Hz.	Cone material	Suspension			Voice Coil							SPECIAL FEATURES	
						Compliance	Type surround	Magnet type	Material	Diameter in.	Power capacity cont. watts	Impedance ohms	Depth in.	Weight lbs.	EIA Efficiency dB		Price
LANSING, JAMES B.	D280	8	—	48	LANS-9-PIAS	Med.	—	A1.V	Alum. ribbon	2	12	8-16	2 <sup>7</sup> / <sub>8</sub>	6	—	\$36.	Water-resistant full-range. 3 <sup>1</sup> / <sub>2</sub> lb magnet structure. Used in the L57 carnival system.
	D140F	15	—	21	Felted paper	High	—	A1.V	Alum. ribbon	4	60	8-16	5 <sup>1</sup> / <sub>8</sub>	22 <sup>1</sup> / <sub>2</sub>	—	\$120.	First speaker designed specifically for bass guitar and electronic organ use.
	LES-2	5	100-15k	125	Felted paper	Med.	—	A1.V	Copper ribbon	0.85	8	8-16	3 <sup>1</sup> / <sub>8</sub>	2 <sup>7</sup> / <sub>8</sub>	—	\$30.	Designed for sound reinforcement systems, sound columns etc. Virtually flat between 200 and 2000 Hz.
MICHIGAN	MC8	8	50-13k	75	Paper	Med.	Paper	Cer.	Alum. wire	1	12	8	3 <sup>3</sup> / <sub>8</sub>	4	46	\$14	Value packed line made possible by bringing production line techniques to a traditionally hand-made production without reducing quality. Die-cast baskets and other "high fidelity" features at the price of "radio-set" speakers.
	MC12	12	40-14k	60	Paper	Med.	Paper	A1.V	Alum. wire	2	20	8	3 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>2</sub>	46	\$17.50	
	MT12	12	40-18k	60	Paper/plastic	Med.	Paper	A1.V	Alum. wire	2/1	20	8	5 <sup>1</sup> / <sub>2</sub>	7	46	\$29.50	
PIONEER	PAT-38X	15	to 20k 10	21-29	Paper/Mylar	High	Cloth	A1.V	Alum./copper wire	3.1/1.7/0.95	60	16	12 <sup>5</sup> / <sub>8</sub>	42	—	\$259.	Three-way system with compression-type mid-range and tweeter.
	PAT-30X	12	to 20k 10	23-32	Paper/Mylar	High	Cloth	A1.V	Alum./copper wire	3.1/1.71/0.95	50	16	9 <sup>3</sup> / <sub>8</sub>	28	—	\$208.20	As above.
	PAX-30F	12	to 16k 10	23-32	Paper/Mylar	High	Cloth	A1.V	Alum./copper wire	3.1/0.95	35	16	9 <sup>3</sup> / <sub>8</sub>	9	—	\$59.55	Coaxial-Compression-type tweeter.
	PAX-25F	10	to 16k 10	27-37	Paper/Mylar	High	Cloth	A1.V	Alum./copper wire	2.1/0.95	20	16	8 <sup>5</sup> / <sub>8</sub>	11 <sup>1</sup> / <sub>2</sub>	—	\$58.05	As above.
	PAX-20F	8	to 20k 10	35-50	Paper/Mylar	High	Cloth	A1.V	Alum./copper wire	1.6/0.95	15	16	5 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	—	\$32.40	As above.
SONOTONE	WR8-BH	8	45-20k	90	Paper	Med.	Paper	A1.V	Copper	1	20	8	—	—	—	\$13.50	Coaxial.
	CH-12A	12	35-20k	50	Paper	Med.	Paper	A1.V	Copper	1	40	8	—	—	—	\$31.00	
	HC-80A	8	40-3k	30	Paper	High	Cloth	A1.V	Copper	1 <sup>1</sup> / <sub>2</sub>	50	8	—	—	—	\$16.	
	HC-60	6	45-6k	50	Paper	High	Cloth	Cer.	Copper	1	40	8	—	—	—	\$14.	
UNIVERSITY	HC-40	4	50-8k	60	Paper	High	Cloth	Cer.	Copper	3/4	20	8	—	—	—	\$13.	Three-way speaker — wide dispersion Sphericon tweeter is flat ±2dB to 20kHz. Has 120° dispersion. 5 year warranty.
	M12T	12	35-40k	45	Paper/Paper/Phenolic	Med.	Cloth	Cer.	Copper wire	2/3/4	30	8	3 <sup>3</sup> / <sub>8</sub>	9	54.1	\$44.50	
	312	12	28-40k	30	Paper/Paper/Phenolic	High	Cloth	A1.V	Copper/Alum. wire	2/3/4	35	8-16	6 <sup>3</sup> / <sub>8</sub>	10 <sup>1</sup> / <sub>4</sub>	—	\$97.50	
	315-C	15	—	32	Paper/Paper/Phenolic	High	Cloth	A1.V	Copper wire	2 3/4	50	8-16	12	34 <sup>1</sup> / <sub>2</sub>	—	\$208.75	
	6201	12	—	36	Paper/Phenolic	High	Cloth	A1.V	Copper wire	2 3/4	35	8-16	6 <sup>3</sup> / <sub>8</sub>	10 <sup>1</sup> / <sub>4</sub>	—	\$77.25	
WHARFEDALE	308	8	—	52	Paper/Paper/Phenolic	High	Cloth	A1.V	Copper wire	2/3/4	35	8-16	6 <sup>1</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>2</sub>	—	\$55.75	As above except is three-way diffraxial.
	Super 8/RS/DD	8	40-20k	50-66	Paper	—	Roll	Cer.	Alum.	1	6	10-15	3 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	—	\$26.50	Double diaphragm.
	Super 12/RS/DD	12	25-20k	26-30	Paper	—	Roll	Cer.	Alum.	1 <sup>3</sup> / <sub>4</sub>	20	12-15	7	18 <sup>3</sup> / <sub>4</sub>	—	\$89.50	As above.
	Super 3	3	1k-20k	—	Bakelized Cone	—	Cloth	Cer.	Alum.	1	6	8	2 <sup>3</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	—	\$26.50	
	W12/RS	12	25-4k	25-30	Paper	—	Roll	Cer.	Copper	1 <sup>3</sup> / <sub>4</sub>	15	12-15	5 <sup>1</sup> / <sub>4</sub>	12	—	\$52.50	
W15/RS	15	25-1.5k	24-28	Paper	—	Roll	Alcomax	Copper	2	20	12-15	7 <sup>3</sup> / <sub>8</sub>	13 <sup>1</sup> / <sub>2</sub>	—	\$89.50		
WOLVERINE	LS-8	8	45-14k	75	Paper	Med.	Paper	A1.V	Alum. wire	2	20	8	3 <sup>1</sup> / <sub>2</sub>	4	43	\$20.	A favorite for sound conditioning the home or office. Shallow basket allows mounting between studs in a wall.
	LS-12A	12	40-14k	60	Paper	Med.	Paper	Cer.	Alum. wire	2	20	8	3 <sup>3</sup> / <sub>8</sub>	6	46	\$22.	As above except heavier basket.
	LS-15	15	35-14k	50	Paper	Med.	Paper	Cer.	Alum. wire	2	20	8	6 <sup>1</sup> / <sub>2</sub>	9	47	\$29.50	15-inch speaker ideal for use with Wolverine HF-1 and MF-1 tweeter and mid-range step-up kits.
	LT-8	8	45-18k	65	Paper/Plastic	Med.	Paper	Cer/A1.V	Alum. wire	2 1	20	8	3 <sup>3</sup> / <sub>8</sub>	6 <sup>1</sup> / <sub>2</sub>	45	\$33.	Unique tweeter has ring diaphragm. Variable brilliance control.
	LT-12	12	40-18k	60	Paper/Phenolic	Med.	Paper	Cer/A1.V	Alum. wire	2/1	20	8	5 <sup>1</sup> / <sub>4</sub>	8	47	\$39.	Tweeter incorporates exclusive Sono-phase design. Variable brilliance control.





MAN--YOU GOTTA HEAR THIS NEW  
**action!**  
 SPEAKER



## UNIVERSITY'S NEW UR-4 COMPACT 2-SPEAKER SYSTEM

This is it! The action speaker! University's new UR-4 2 speaker system! Full of go! Full of action! Full of big lively sound! It doesn't miss a thing! Delicate highs — rich, full bass, the *action speaker* handles them all without distortion! This mighty midget (only one cubic foot) goes anywhere! In a book case! A headboard! On the wall! On the floor! And you get all that lively University Sound for less than \$60.00! Man, you gotta hear this one to believe it! Go to the shop where the action is — your University dealer and listen to the *action speaker*. Or write Desk 463.

**SPECIFICATIONS** Frequency Response: 30 Hz to beyond audibility ■ Power Handling Capacity: 30 watts 1PM Music Power ■ Impedance: 8 ohms. ■ Crossover Network: High pass coupling network, 6 db/octave electrical design. ■ Crossover Frequency: 2000 Hz ■ Speaker Complement: 1—8" ultra-linear response, high-compliance woofer, edge resonance damped 1—2½" direct radiator rigid-diaphragm, closed back, cone tweeter ■ Enclosure Design: University's exclusive RRL\* design for extended low frequency response ■ Finish: Oiled Walnut on all four sides ■ Dimensions: 19" x 10½" x 9" (H x W x D) ■ Shipping Weight: 14 lbs. ■  
 \*Radiation Resistance Loading



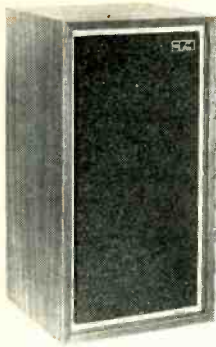
LISTEN—UNIVERSITY SOUNDS BETTER

**UNIVERSITY SOUND**

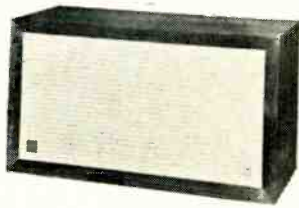
A DIVISION OF LTV LING ALTEC, INC.  
 9500 W. Reno Oklahoma City, Oklahoma 73102



# SPEAKERS IN ENCLOSURES—10

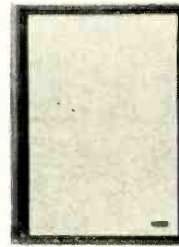


ADC-303



AR-3

AMPEX 915



BENJAMIN 208

See Ad on Page No.

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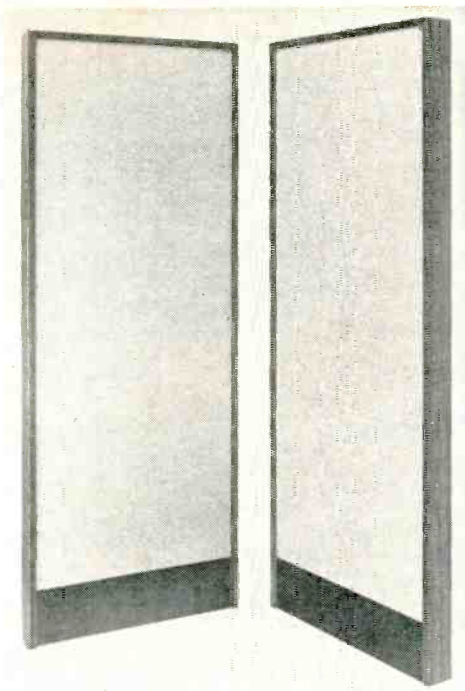
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MANUFACTURER	MODEL NO.	WOOFER				MID-RANGE			TWEETER				Finish	Grille material	Grille color	Frequency Response Hz. ± dB	EIA Efficiency	Crossover Hz	Impedance ohms	Weight lbs.	Price	SPECIAL FEATURES
		Diam. in.	Diaphragm material	Resonance	Diam. in.	Type	Diaphragm material	Diam. in.	Type	Diaphragm material	Dispersion deg.	Dimensions W x D x H in.										
ADC	18	12x16	Poly-styrene	—	—	—	1½	Dome	Mylar	—	17 x 12½ x 4	Oil wal.	Cloth	Light or dark	20-20k 3	—	1k-4k	8-16	80	195.00	Rectangular woofer.	
	303A	8	—	—	—	—	1½	Dome	Mylar	—	13 x 11¼ x 22½	Oil wal.	Cloth	Light or dark	35-20k 3	—	1k-4k	8-16	34	95.00		
	404	6	—	—	—	—	1½	Dome	Mylar	—	7¼ x 8½ x 11½	Oil wal.	Cloth	Light	45-20k 3	—	1k-4k	8	22	56.00	Pair Packaged in stereo twin-pack.	
	325	6	—	—	—	—	3	Cone	Paper	—	19 x 8 x 10½	Oil wal.	Cloth	Light	45-20k 4	—	1k-4k	8	19	49.50		
ACOUSTIC RESEARCH	AR-3	12	Felted paper	44	2	Dome	Phen.	1½	Dome	Phen.	—	25 x 11½ x 14	Several	Saran	Off wt.	—	—	1k, 7.5k	4	50	203.00 225.00	Price dependent on wood finish, walnut highest, unfinished lowest. Mfg. can supply curves of models on request.
	AR-2a <sup>x</sup>	10	Felted paper	57	3	Cone	Paper	1½	Dome	Phen.	—	24 x 11½ x 13½	Several	Burlap	Beige	—	—	1750, 7.5k	8	36	109.00 128.00	As above.
	AR-2 <sup>x</sup>	10	Felted paper	57	—	—	—	—	Cone	Paper	—	24 x 11½ x 13½	Several	Burlap	Beige	—	—	1750	8	32	89.00 102.00	As above.
	AR-4 <sup>x</sup>	8	Felted paper	68	—	—	—	—	Cone	Paper	—	19 x 9 x 10	Several	Burlap	Berge	—	—	1750	8	17	51.00 57.00	As above.
ACOUSTECH	X	—	—	—	—	—	—	—	—	—	26½ x 72 x 4	Oil wal.	Cloth	Boucle white	—	—	1300	—	225	1690.00	Full range stereo pair electrostatic. Price includes dual amplifiers - must be used with Acoustech VI preamp.	
ALTEC	890A	10	Paper	25	—	—	—	—	Horn	Mylar	90	25¼ x 12 x 14½	Walnut	Fabric	Neutral	40-22k	45	3k	8	30	169.00	Includes a 10-inch free-suspension phase inverter to provide increased low-end response.
	843B	2-12	Paper	32	—	Horn	Alum.	—	—	—	—	25 x 18 x 40	Walnut	Fret-work	Brown	30-22k	51	800	8-16	120	399.00	New wood fretwork grille on sculptured walnut cabinet.
	846A	15	Paper	25	—	Horn	Alum.	—	—	—	—	29½ x 27½ x 19	Walnut	Fret-work	Brown	35-22k	49.5	800	8-16	100	333.00	A7 "Voice of the Theater" components.
	A7-500W-1	15	Paper	25	—	Horn	Alum.	—	—	—	—	42 x 32 x 25	Walnut	Fret-work	Brown	30-22k	62.2	500	8-16	170	498.00	A7-500 "Voice of the Theater" components.
	847A	12	Paper	32	—	—	—	—	Horn	Mylar	90	26 x 19 x 14	Walnut	Fret-work	Brown	40-22k	47.5	3k	8-16	60	231.00	Less than 2 square feet of floor space is required for full-range listening.
AMPEX	815	6	Paper	70	—	—	—	3½	Cone	—	90	9¼ x 13½ x 7½	Oil wal.	Cloth	Beige	50-15k	—	1506	8	22 (pair)	65.00 pair	Built-in 15-foot cord with molded phone plug - sold only in pairs.
	915	8	Paper	58	—	—	—	3½	Cone	—	90	13½ x 18 x 9½	Oil wal.	Cloth	Egg-shell	45-18k	—	1500	8	25	79.00	High frequency level control.
	1115	10	Paper	65	two 3	Cone	Paper	1	Cone	—	—	23¼ x 13¼ x 11½	Oil wal.	Cloth	Egg-shell	40-15k	—	2k, 10k	8	36	120.00	As above.
	2115	12	Vinyl-paper	55	3	Cone	Paper	3	Cone	—	—	24 x 14 x 12	Oil wal.	Cloth	Egg-shell	35-15k	—	1800, 8k	8-16	52	140.00	As above.
	4010	12	Vinyl-paper	55	two 3	Cone	Paper	4	Horn	—	—	24 x 14 x 2	Oil wal.	Cloth	Egg-shell	30-18k	—	1800, 8k	8-16	58	210.00	Mid and high frequency level controls.
AZTEC	Petite 500	8	Paper	35	—	—	—	3½	Cone	Paper	—	20 x 9½ x 10	Oil wal. or unfin.	Fiber	White	40-20k 5	—	2k	8	17	69.95	Acoustic suspension, smartly styled tapered grille, hand rubbed on all four sides.
	Renoir II	12	Paper	20	—	—	—	3½	Cone	Paper	—	16 x 9½ x 24	Oil wal. or unfin.	Fiber	White	35-20k 5	—	2k	8	38	159.50	As above for floor or bookshelf use. Optional sculptured solid walnut base.
	Athena II	12	Paper	20	—	—	—	3½	Cone	Paper	—	20¼ x 20¼ x 25¼	Oil wal. or unfin.	Wood Fret-work	Wal, oak or fruit.	30-20k 5	—	2k	8	48	209.50	High styled Mediterranean type - as above except available also in oak or fruitwood.
	Gauguin III	12	Paper	25	—	Horn	Phen.	—	Horn	Phenolic	—	20 x 16¼ x 27¼	Oil wal. or unfin.	Fiber	White	30-22k 5	—	1k, 9k	8	48	209.50	Reinforced ducted-reflex. Tapered grille, hand rubbed finish.
	Matisse IV	15	Paper	20	—	Horn	Phen.	—	Horn	Phenolic	—	34 x 16¼ x 27¼	Oil wal. or unfin.	Fiber	White	25-22k 5	—	1200, 9k	8	72	259.50	As above except floor model.
BENJAMIN	208	8	Paper	45	—	—	—	3	Cone	Paper	—	12 x 9 x 22¼	Oil wal.	Cloth	Brown	30-20k	—	2500	8	23	59.50	Woofer-mid-range combination high-efficiency, high-compliance system. Changeable grille.
BOZAK	B-4000	12	Felted paper	40	8	Cone	Rigid metal	2½	Cone	Metal	—	44 x 28 x 16	Fruit. on mahogany	Cloth with metal grille	—	35-20k	—	200-1500	8	150	535.00	Two woofers and eight tweeters. Changeable grille.
	B-305	12	Felted paper	40	6	Cone	Rigid metal	2½	Cone	Metal	—	28 x 36 x 20	Wal. or fruit. on cherry	Cloth	—	35-20k	—	800-2500	16	140	415.00	Two woofers and four tweeters. Changeable grille.
	B-302A	12	Felted paper	40	6	Cone	Rigid metal	2½	Cone	Metal	—	31 x 28 x 19	Cherry or fruit. on cherry	Cloth with metal grille	—	40-20k	—	800-2500	8	100	325.00	As above except two tweeters.
	B-313	12	Felted paper	40	6	Cone	Rigid metal	2½	Cone	Metal	—	17 x 24 x 12	Matte walnut	Linen	Natural	45-16k	—	800-2500	8	76	195.00	As above.
	B-310	12	Felted paper	40	6	Cone	Rigid metal	2½	Cone	Metal	—	52 x 36 x 14	Matte walnut	Cloth	—	28-20k	—	400-2500	8	225	815.00	As above except four woofers, eight tweeters, two mid-range.

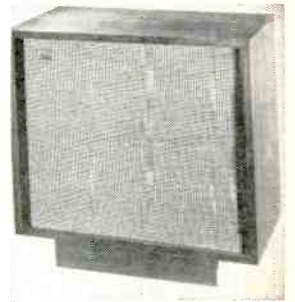




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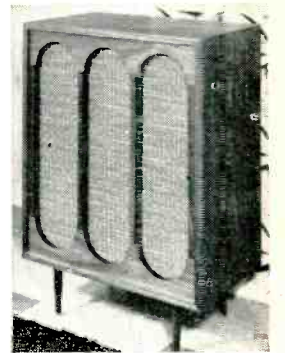


ELECTRO-VOICE SIX



FRAZIER F8-3M

FISHER  
XP-10

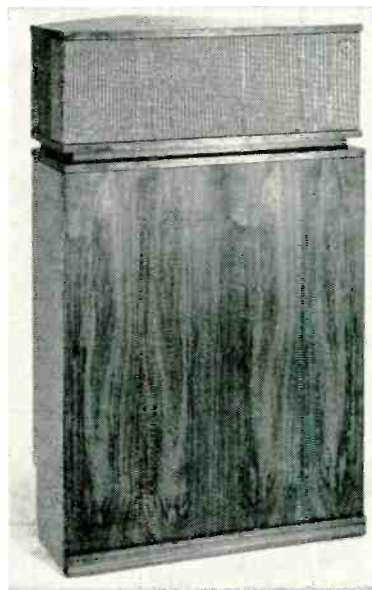


HARTLEY JR.  
CONCERTMASTER

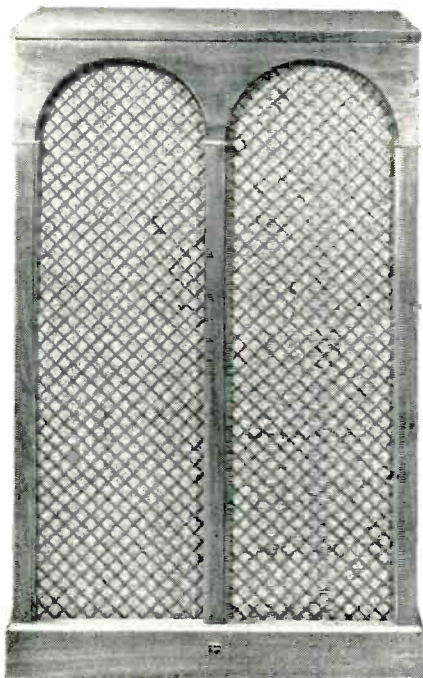
EMPIRE  
8000P



KLIPSHORN  
K-347



HEATH AS-21



BOZAK-B4000



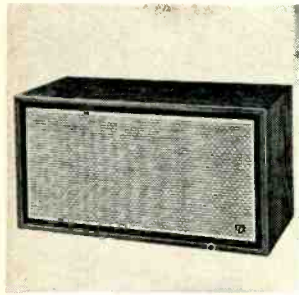
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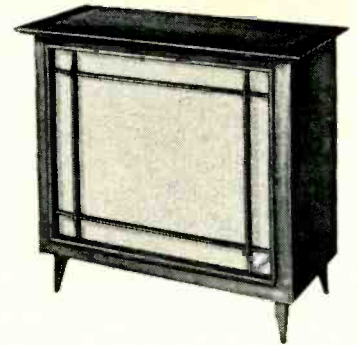
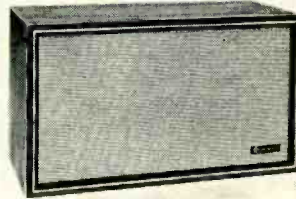
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KNIGHT  
KN-2380



LAFAYETTE 5D



ELECTRO-VOICE SEVEN

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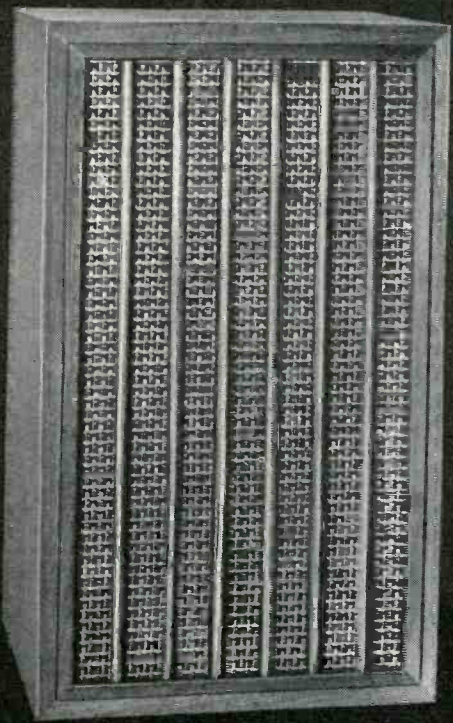
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MANUFACTURER	MODEL NO.		WOOFER			MID-RANGE			TWEETER			Finish	Grille material	Grille color	Frequency Response Hz. ± db	EIA Efficiency	Crossover Hz	Impedance ohms	Weight lbs.	Price	SPECIAL FEATURES	
	Diagm. in.	Response	Diagm. material	Diagm. in.	Type	Diagm. material	Diagm. in.	Type	Diagm. material	Diagm. in.	Type											
C-T ACOUSTIC LABS.	1	6	Paper	45			5	Cone	Paper	—	19 x 6 x 11	Oil wal.	Cloth	Brown & gold	20-18k 5	—	2500	8-16	18	45.50		
	8	6	Paper	45			5	Cone	Paper	—	14 x 8 x 22	Oil wal.	Cloth	Brown & gold	20-18k 4	—	5000	8	30	59.95		
ELECTRO-VOICE	Eight	6	Paper	33			2½	Cone	Paper	120	15½ x 7 x 8¼	Walnut	Cloth	White	60-17k	—	2k	8	16	44.00	Polymer-coated cabinet resists water and alcohol. Double damped tweeter controls fundamental resonance and cone breakup.	
	Seven	8	Paper	30			3½	Cone	Paper	110	19 x 9 x 10	Walnut	Cane	Natural	50-15k	—	2k	8	19	66.50	Distinctive cased-in grille with black border. Brilliance control adjusts "tuit" of response curve.	
	Five-A	10	Paper	24			2½	Cone	Paper	120	21½ x 10½ x 12¼	Walnut	Cloth	White	30-17k	—	1k	8	22	88.00	Cabinet as in model 8. Four-layer voice coil in woofer for better bass at lower cost.	
	Four	12	Paper	17	Horn	Mylar	5	Cone	Paper	90	25 x 13½ x 14	Wal, Matt vhf	Cane	Natural	30-20k	—	800, 3500	8	39	138.00	Etched circuit crossover; step-type level controls.	
	Six	18	Plastic foam	15	8	Horn & cone	Mylar & paper	Horn	Phenolic	120	32 x 17½ x 30	Wal., matt, fruit.	Cane	Natural	30-20k	—	250, 800, 3500	8	107	333.00	Woofer has 4 lb. 10 oz. ceramic magnet for solid bass response. Three other selected drivers cover segments of the audio range for extremely wide smooth response.	
EMPIRE	8000	12	Paper	25	3	Dome	Phen.	1	Dome	Phen.	70	29 x 15¼ D	Polyester walnut laminate		30-20k	52	450, 5k	8	65	185.00	Grenadier Series. Three-way system.	
	8000P	12	Paper	25	3	Dome	Phen.	1	Dome	Phen.	70	29 x 160	Satin wal.		25-20k	52	450, 5k	8	90	250.00	As above with marble top.	
	9000M	15	Paper	20	3	Dome	Phen.	1	Dome	Phen.	70	29 x 220	Satin wal.		20-20k	52	450, 5k	8	120	300.00	As above.	
	8400	12	Paper	25	3	Dome	Phen.	1	Dome	Phen.	70	25 x 13¼ x 12¼	Satin walnut		25-20k	52	450, 5k	8	70	220.00	Three-way system with optional bench.	
	4000M	10	Paper	30				2	Dome	Phen.	50	25 x 180	Satin walnut		30-18k	54	1500	8	75	160.00	Cavalier Series. Two-way system with marble top.	
FISHER	XP-33	6	Paper	35-40				2½	Cone	Fiber	90	13 x 6 x 7	Oil walnut	Woven fabric	Walnut	38-18.5k	—	2k	8	6	99.00 (pair)	
	XP-5a	8	Paper	25				2½	Cone	Fiber	90	70 x 9 x 10	Oil wal., unf. birch	Woven fabric	Walnut	38-18.5k	—	2k	8	16	59.50	
	XP-6	10	Paper	20-22	5	Cone	Paper	1½	Dome	Soft cotton	120	23 x 10½ x 13	Oil walnut	Woven fabric	Walnut	35-20k	—	300, 2500	8	35	99.50	Mid-range isolated foam woofer. Base available.
	XP-10	15	Paper	18-19	8	Cone	Paper	2	Dome	Soft cotton	120	24½ x 14½ x 30½	Oil walnut	Woven fabric	Walnut	28-28k	—	200, 2500	8	90	249.50	Separate balance control for treble and mid-range.
	XP-15	12	Paper	15-17	6	Cone	Paper	1½	Dome	Soft cotton	120	27 x 14 x 27	Oil walnut	Woven fabric	Walnut	26-above audibility	—	300, 1k, 2500	8	90	299.50	Four-way system. Two woofers, two lower mid, two upper mid-ranges. Separate controls.
FRAZIER	Mark V	12	Paper	—	5¼	Cone	Paper		Horn	—	—	14 x 12 x 26½	Oil walnut	Cane	Natural	30-17k	—	200, 3300	16	54	174.95	Black utility available - \$144.95.
	XII	12	—									14 x 12 x 24	Oil walnut	Cane	Natural	30-17k	—	1200	8	54	149.50	Standard model - \$139.50
	F8 - 3M F8 - 3B	8	—									23½ x 11½ x 19	Oil walnut	Cane	Natural	40-15k	—	1000	8	45	89.50 99.50	
	F5 - 2	5¼	—									15½ x 7½ x 9½	Oil walnut	Cane	Natural	60-12k	—		8	11	29.95	Unf. wal. - \$26.95
HARTLEY	Concert-master 3 and 4	18	Polymer	17	10	Cone	Polymer					29 x 16 x 38	Oil walnut	Cloth	Brown, beige, and tan	16-20k 5	—	350, 3k	16	185	525.00	Special woods available on order.
	Concert-master Jr.	10	Polymer	20	7	Cone	Polymer					24 x 14 x 34	Oil walnut	Cloth	Brown & beige	16-25k 5	—	1500	8	95	395.00	
	Holton A or B	10	Polymer	28								24 x 14 x 34	Oil walnut	Cane	Tan	20-20k 5			8	85	245.00	With 220MS full-range speaker. Also available with other speakers. Smaller cabinets available.
HARMAN-KARDON	HK-40	10	Paper	—				3½	Cone	Paper	—	13½ x 10½ x 22½	Oil walnut	Cloth	Beige	30-18k	—	1500	4	25	100.00	Brilliance control. Removable grille cloth. 24 ft. of cord with plug-in connectors.
	HK-30	8	Paper	—				3	Cone	Paper	—	11½ x 8 x 16½	Oil walnut	Cloth	Beige	40-18k	—	2000	4	18	70.00	
KLH	17	10	Paper					1½	Cone	Stiff paper	—	23½ x 11½ x 9	Oil walnut	Cloth	White	—	—	1500	8	27	69.95	Tweeter level control has 3 positions; finished four sides, changeable grille cloth.
	6	12	Paper					1½	Cone	Stiff paper	—	23½ x 12½ x 11½	Oil wal. & others	Boucle cloth	White	—	—	1500	8	34	134.00	As above. Available-mgh, cherry, unfinished birch.
	12	12	Paper	3	Cone	Paper	1½	Cone	Stiff paper	—	22½ x 29 7 15	Oil walnut	Cloth	White	—	—	500, 4k	8	90	275.00	Four separate level controls. Floor standing with changeable grille cloth.	



# Total Sound Spectrum



An exciting journey  
into the World of Sound . . .

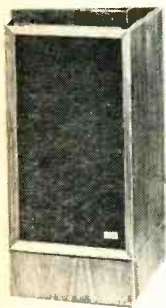
Model XII D Shown

INSTRUMENTS COURTESY RECORD MUSIC CO.

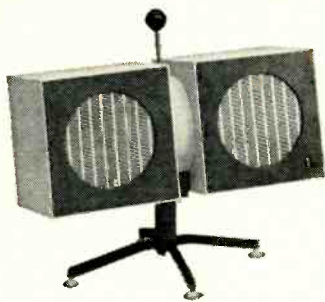
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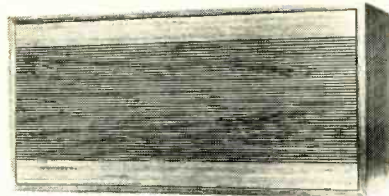


KSC-3



JBL L57

TANDBERG 113



SONOTONE RM-1K

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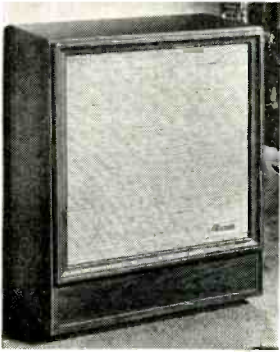
MANUFACTURER	MODEL NO.	WOOFER		MID-RANGE		TWEETER		Dispersion deg.	Dimensions W x D x H in.	Finish	Grille Material	Grille Color	Frequency Response Hz - dB	EIA Efficiency	Crossover Hz	Impedance ohms	Weight lbs.	Price	SPECIAL FEATURES				
		Diaphan. material	Resonance	Diaphan. material	Type	Diaphan. material	Type													Diaphan. material	Type		
KSC	1	10	Paper	35	3 1/2	Cone	Stiff paper	3 1/2	Cone	Stiff paper	90	12 x 12 1/2 x 20	Oil walnut	Woven plastic	Black	50-20k 3	-	750, 3k	8	28	105.00	Three-way system. Available unfr. for \$89.95. Other finishes available. Finished 4 sides.	
	2	10	Paper	36				3 1/2	Cone	Stiff paper	90	12 x 12 1/2 x 20	Oil walnut	Boucle cloth	Sand	45-20k 4	-	1500	4	27	79.50	Two-way system finished four sides for bookshelf use.	
	3	10	Paper	34	6	Cone	Stiff paper	3 1/2	Cone	Stiff paper	360	13 x 13 1/2 x 30	Oil walnut	Woven plastic	Black	35-20k 2	-	700, 3k	8	43	195.00	Three-way system. Mid-range and tweeter project upward into dispersion cone-s for true 360° radiation. Floor standing model has a finished rear panel for free-standing attractiveness.	
HEATH	AS-10	10	-	58				3 1/2	Cone	-	-	24 x 11 1/2 x 13 1/2	Unf. or walnut	-	-	30-15k 5	-	2250	16	28	59.95	Two tweeters. Acoustic suspension kit.	
	AS-15	12	-	25	2	Dome	-	1	Dome	-	-	18 1/2 x 19 x 32 1/2	Walnut	-	-	40-20k	-	1k, 10k	8	69	144.95	Two mid-range domes. Kit.	
	AS-16	8	-	31				3 1/2	Cone	-	-	19 x 9 x 10	Walnut	-	-	45-20k 5	-	1500	8	-	-	Kit	
	AS-21	12	-	-					Horn	-	-	32 x 19 x 32 1/2	Walnut	-	-	30-22k	-	800	16	98	239.95	Two woofers. Kit.	
KLIPSH	Klipshorn k-347	15	Paper	-	1 1/4	Horn	Phen.	1	Horn	Phen.	90	31 1/2 x 28 x 51	Several	Several	-	30-20k	54	400, 5k	16	175	519.00 875.00	Corner system. Prices dependent on cabinetry and finish.	
	Cornwall II	15	Paper	-	1 1/4	Horn	Phen.	1	Horn	Phen.	90	25 1/2 x 15 1/2 x 35 1/2	Several	Several	-	30-20k	-	600, 5k	16	115	311.00 415.00	As above.	
	Model H	12	Paper	-	1 1/4	Horn	Phen.	1	Horn	Phen.	90	15 1/2 x 13 1/2 x 21 1/2	Several	Several	-	45-20k	46	700, 5k	16	45	188.00 225.00	As above.	
	2A Scala K-447	15	Paper	-	1 1/4	Horn	Phen.	1	Horn	Phen.	90	24 1/2 x 24 1/2 x 34 1/2	Black	None	-	40-20k	54	400, 5k	16	115	495.00	Theater system.	
	Rebel 7	12	Paper	-				1 1/4	Horn	Phen.	110	15 1/2 x 13 1/2 x 21 1/2	Oil walnut	Woven plastic	White	45-13.5k	46	650	16	40	175.00		
KNIGHT	KN2380	15	Cloth roll	16		Horn	-	-	Dome	-	-	20 1/2 x 14 x 30 1/4	Oil walnut	Cane	Brown	20-beyond audibility	50	2k, 10k	8	55	149.95	Dome radiator tweeter, compression mid-range, high-compliance woofer.	
	KH2350A	12	Paper	60		Horn	-	-	Horn	-	-	25 x 13 1/2 x 14	Oil walnut	Cane	Brown	20-beyond audibility	44	1k, 5k	8	49	99.95	Mid-range and treble controls. Acoustic-suspension woofer. Compression mid-range and tweeter.	
	KN2300BK	12	Paper	60		Horn	-	-	Dome	-	-	25 x 13 1/2 x 14	Walnut	Cloth	Choc. Brown	25-20k	44	1k, 5k	8	46	69.95 84.95	Kit W	
	KN2260K	12	Paper	-	8	Cone	Paper			Horn			25 x 8 x 17	Walnut	Cane	Straw	30-20k	45	3k, 8k	8	40	59.95 69.95	K W
	KN3030AK	12	Paper	-	6	Cone	Paper	3 1/2	Cone	Paper	-	-	24 x 10 x 14 1/2	Walnut	Cane	Straw	35-17k	-	400, 5k	8	30	39.95 54.95	K W
LANSING JAMES B.	L59	8	Lans-a-plastic								120	22 x 10 x 22	Ant. white	Alum.	Olive					8-16	23	135.00	Full-range unit for indoor-outdoor use. Has aluminum dome for high frequencies. L59 Festival features LE8T for greater efficiency.
	L57	8	Lans-a-plastic										22 x 10 x 22	Ant. white	Alum.	Olive				8-16	20	105.00	L57 uses new D-280 all weather cone. Both this and above unit have PR8 passive radiator which doubles effective cone area throughout lowest frequencies.
LAFAYETTE RADID	Criterion 3X	12	Plastic coated paper	30	6 1/2	Cone	Paper	3	Dome	Alum.	-	22 1/2 x 11 1/4 x 13 1/4	Oil walnut		White	20-25k	-	1200, 6k	8	-	89.95	Acoustic suspension - HF and mid-range controls. Finished four sides.	
	Criterion 200A	12	Foam treated paper	40	8	Cone	Paper	3	Dome	Alum.	-	24 x 12 x 14	Oil walnut		White and gold	20-25k	-	700, 5k	8	30	69.95	As above except not acoustic susp.	
	Criterion 100A	10	Paper	45				4	Cone	Paper	-	21 1/2 x 10 1/2 x 11 1/4	Oil walnut		White & gold	20-19k	-	2800	8	25	44.95	High frequency brilliance control. Finished four sides.	
	Criterion 50	8	Paper	50				4	Cone	Paper	-	19 x 8 1/2 x 10 1/4	Oil walnut		White & gold	35-18k	-	3000	8	9	29.95	Finished four sides.	
	Criterion 30	5	Paper	45				3	Cone	Paper	-	14 x 8 x 8	Oil walnut		White & gold	35-19k	-	1200	8	10	34.95	As above plus tweeter level control.	
PIONEER	AS-305A	12	Paper	30	5	Cone	Paper		Horn							30-20k 10	-	500, 3500	8	-	103.35	Three-way system kit without cabinet.	
	AS-303A	12	Paper	40	5	Cone	Paper		Horn							40-20k 10	-	800, 6k	16	-	72.30	As above.	
SCHOBER ORGAN	LSS-10A	12	Heavy paper	32				8	Cone	Heavy paper		24 x 16 x 34	Walnut finish	Cloth	Beige	32-13k 5	50	250	8	80	150.00 69.50	Std. walnut finish- direct from manufacturer only. W/O cabinet- with const. plans.	
	LSS-100	12	Heavy paper	32	8	Cone	Heavy paper		Horn	Phen.	180	32 x 16 x 51	Walnut finish	Cloth	Beige	32-20k 4	54	150, 1k, 3500	8	125	300.00	Direct from mfr. only. Two woofers and two horns.	
	RV-3C	12	Heavy paper	32				8	Cone	Heavy paper		24 x 16 x 34	Walnut finish	Cloth	Beige	32-13k 5	50	250	8	9	555.00	Reverb tone cabinet includes REVERBATAPE unit and 40W amp. Avail. from dealers only.	





TELMAR

SHERWOOD SR-4



TANNOY TOWNSMAN



WHARFEDALE W-30



UNIVERSITY MEDITERRANEAN

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MANUFACTURER	MODEL NO.	WOOFER			MID-RANGE			TWEETER			Finish	Grille material	Grille color	Frequency response Hz ± dB	EIA Efficiency	Crossover Hz	Impedance ohms	Weight lbs.	Price	SPECIAL FEATURES		
		Diaph. in.	Diaphragm material	Resonance	Diaph. in.	Type	Diaphragm material	Diaph. in.	Type	Diaphragm material											Dispersion deg.	Dimensions W x D x H in.
H. H. SCOTT	S-9	6	Paper	—			3	—	Paper	—	14 x 8 1/2 x 6	Oil walnut	—	Gold	50-15k	40	2500	8	9	39.95		
	S-10	10	Paper	—	5	Cone	Paper			—	23 1/2 x 11 1/4 x 9	Oil walnut	—	White	40-20k	—	1000	8	21	69.95		
	S-11	12	Paper	—	5	Cone	Paper	2 1/2	—		—	24 x 14 x 10 1/2	Oil walnut	—	—	40-18k	—	—	8	37	—	
	S-12	15	Paper	—				1 1/2	—	Paper	—	27 x 21 x 16	Oil walnut	—	—	35-20k	—	—	8	63	—	
SHERWOOD	SR-1	10	Paper	23			4	—	Paper	—	13 x 9 1/2 x 24	Oil walnut	Plastic cane	Brown	53-17k 2.5	—	2800	8	36	84.50	Unfinished birch available. Tweeter level adjustment. Air suspension woofer.	
	SR-2	10	Paper	23	8	Cone	Paper	3 1/2	—	Paper	—	13 x 9 1/2 x 24	Oil walnut	Plastic cane	Brown	53-18k 2.5	—	800, 3k	8	36	99.50	As above.
	SR-3	12	Paper	21	8	Cone	Paper	3 1/2	—	Paper	—	15 x 13 1/4 x 26 1/4	Oil walnut	Plastic cane	Brown	48-18k 2.5	—	800, 3k	8	55	139.50	As above.
	SR-4	10	Paper	18	8	Cone	Paper	3 1/2	—	Paper	—	24 x 13 x 31 1/2	Oil walnut	Plastic cane	Brown	38-18k 2.5	—	200, 800 3k	8	73	219.50	As above.
SONOTONE	RM-1	6	Paper	50			2	Cone	Paper	—	10 1/2 x 14 1/2 x 7 1/4	Oil walnut	Cane	Brown	45-20k	—	5k	8	12	44.50		
	RM-2	8	Paper	30			3 1/2	Cone	Paper	—	11 1/2 x 19 x 8 1/2	Oil walnut	Cane	Brown	40-20k	—	4.5k	8	22	56.50		
	RM-0.5	4	Paper	60			2	Cone	Paper	—	7 1/2 x 10 1/2 x 7	Oil walnut	Cane	Brown	55-20k	—	5k	8	8	38.75		
	RM-1K	6	Paper	50			2	Cone	Paper	—	10 1/2 x 14 1/2 x 7 1/4	Unfin. birch	Cane	Brown	45-20k	—	5k	8	12	35.50	Kit.	
	SE 880	8	Paper	90						—	17 1/2 x 24 x 11	Oil walnut	Cane	Brown	45-20k	—	6k	8	36	69.75	Two woofers with whizzer cones.	
TANDBERG	113	6 1/2	—	90			2	—	—	—	7 x 9 x 9	Teak	Teak slats	—	60-60k	—	3k	4	—	49.50		
	112	10 x 6	—	85			2	—	—	—	20 1/2 x 10 1/2 x 9 1/2	Teak	Teak slats	—	60-60k	—	3k	3.2	—	74.50		
	114	10	—	65			2 1/2	—	—	—	28 x 14 x 11	Teak	Teak slats	—	45-60k	—	3k	4	—	99.50		
TANNOY	Townsmen	12	Paper	20			1	Horn	Fibre phen.	—	23 x 10 1/2 x 13 1/2	Oil walnut	Cloth	Brown	35-20k	—	5k	16	27	110.00	Bookshelf, finished four sides.	
TELMAR	Baby Grad	5	Styrene	—			3	—	—	—	11 1/2 x 6 1/4 x 7 1/4	Oil walnut	Leopard, zebra, tiger skin cloth	—	40-20k	—	—	8	—	39.95		
UNIVERSITY	UR-4	8	Stiff paper	40			2 1/2	Cone	Paper	110	19 x 10 1/2 x 9	Oil walnut	Cloth	Beige and gold	30-to beyond audibility	—	2k	8	14	71.25	5 year warranty. RRL enclosure. High-compliance system.	
	Mediterranean	12	Stiff paper	18	8	Cone	Stiff paper		Horn	Phen.	120	22 1/2 x 24 1/2 x D	Ant. white or butternut	Cloth	Egg-shell or beige	22 to beyond audibility	—	800-5k	8	74	390. wht. 338.00 butternut	Mediterranean commode enclosure decorator styled. Three-way control. 5 year warranty.
	Ultra D	10	Stiff paper	28	4	Cone	Stiff paper	3 1/2		Stiff paper	100	23 1/2 x 11 1/2 x 9 1/2	Oil wal. or unf.	Cloth	Egg-shell	28 to beyond audibility	—	1k-5k	8-16	24	99.50	As UR-4.
	Senior 66	12	Stiff paper	25	3	Cone	Stiff paper	—	Dome	Phen.	120	23 1/2 x 15 1/2 x 11 1/2	Oil wal.	Cloth	Egg-shell	26-40k	—	2k-4k	8-16	44	135.00	As above with Sphericon tweeters ± 2dB to 22kHz.
	Miniflex 66	6 1/2	Stiff paper	40	3	Coaxial cone	Stiff paper	3 1/2	Cone	Stiff paper	100	15 x 9 1/2 x 6	Oil wal.	Cloth	Beige & ebony	45-10 beyond audibility	—	800, 2k	8	7 1/2	66.75	5 year warranty. Ideal for apartment dwellers or as sound system.
WHARFEDALE	W90C	12	Paper	22	5	Cone	Paper	3		Paper	—	30 1/2 x 23 1/2 x 13 3/8	Oil wal. or unf. birch	Boucle	Beige	—	—	—	4-8	115	279.95W	Mid-range and treble controls. Removable grille, optional legs.
	W70C	12	Paper	22	8	Cone	Paper	3		Paper	—	23 1/2 x 24 x 14	Oil wal. or unf. birch	Boucle	Beige	—	—	—	4-8	74	179.95W	As above.
	W60C	12	Paper	26	5	Cone	Bakelized	3		Mylar	—	24 x 14 1/2 x 13	Oil wal. or unf. birch	Boucle	Beige	—	—	—	4-8	52	129.95W	As above except has optional base.
	W40C	10	Paper	38	5	Cone	Bakelized	3		Mylar	—	23 1/2 x 12 1/2 x 10 1/2	Oil wal. or unf. birch	Boucle	Beige	—	—	—	4-8	40	89.95W	As above.
	W30C	8	Paper	38				4		Paper	—	19 x 10 x 9 1/4	Oil wal. or unf. birch	Boucle	Beige	—	—	—	4-8	22	69.95W	Continuously variable treble control, removable grille.

# TAPE RECORDERS—11



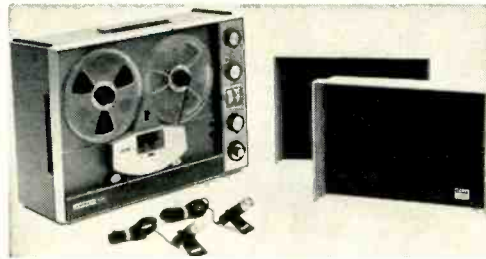
HEATH AD-16



AMPEX PR-10



KORTING TR-4000



AMPEX 800 Series



KNIGHT-KIT KG-415

See Ad on Page No.

MANUFACTURER	MODEL NO.	Speeds	Number of Heads	Head config.	Tracks	Mode	Number of magnets	Drive motor type	Reel motor type	Capstan drive	Max. reel size in.				Wow %		Flutter %		TID's max. record level	Timing accuracy %	±200 ft. rewind sec.	Max. power amps?	Sens. mV	Imp. ohms	Hi-level input imp.	Mixing facility?	Vol. indicator type	Line level output/imp. ohms	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
											7 1/2	3 1/2	7 1/2	3 1/2	160	Yes	1	250k														
AMPEX	860	1 1/4, 3 3/4, 7 1/2	2	R/P E	4	Stereo	1	Ind.	Belt	7	0.15	0.2	0.15	0.2	—	—	160	Yes	1	250k	—	—	—	No	VU meter	Low imp.	19 x 13 1/2 x 7 1/2	37	319.00	Basic deck without power amps; Model 850-\$269. Bidirectional playback; Model 890-\$389.		
	1160	1 1/4, 3 3/4, 7 1/2	3	R/P E	4	S	1	Ind.	Belt	7	0.15	0.2	0.15	0.2	—	—	160	Yes	3	250k	—	—	—	No	VU meter	Low imp.	19 x 13 1/2 x 7 1/2	37	469.00	Automatic threading. Model 1150 deck: \$399. 1165 unit has reverse play: \$489.		
	2060	1 1/4, 3 3/4, 7 1/2	3	R/P E R P	4	S	1	Hyst. sync.	Belt	7	0.12	0.15	0.12	0.15	—	—	115	Yes	3	250k	—	—	—	No	Neon	Low imp.	19 x 13 1/2 x 7 1/2	37	509.00	Automatic threading, automatic reverse play.		
	RP-10	1 1/4, 3 3/4, 7 1/2, 15	4	E R P P	4,2	S	1	Hyst. sync.	Belt	7	0.18	0.25	0.18	0.25	—	—	—	—	—	—	—	—	—	—	VU	600	19 x 8 1/2 x 6	44	1295.00	Deck only. May be remote operated. Has additional 2-track play only head.		
CONCORD	776	3 3/4, 7 1/2	2	E R P	4	S	1	Sync.	Belt	7	0.15	0.18	—	—	—	—	—	—	Yes	2	—	—	—	Yes	2 VU	30	13 x 13 x 20	40	349.95	Automatic reverse play.		
	727	3 3/4, 7 1/2	2	E R P	4	S	1	Sync.	Belt	7	0.15	0.18	—	—	—	—	—	—	Yes	2	—	—	—	Yes	2 VU	30	13 x 13 x 20	40	299.95			
	700	7 1/2, 3 3/4, 1 1/4	2	E R P	4	S	1	Sync.	Belt	7	0.2	0.24	—	—	—	—	—	—	Yes	2	—	—	—	Yes	VU	High imp.	11 x 12 x 18	30	249.95			
	F90	3 3/4, 1 1/4	2	E R P	2	Mono	1	DC servo	Belt	3 1/2	—	—	—	—	—	—	—	—	—	Yes	1	—	—	—	VU	—	9 1/2 x 4 1/2 x 10 1/2	5	89.95			
	F100	1 1/4	2	E R P	2	M	1	Servo drive	—	Spec. cart.	—	1 1/4	0.025	—	—	—	—	—	—	Yes	1	—	—	—	VU	—	8 x 4 1/2 x 2 1/2	3	99.95			
CROWN	SS724	1 1/4, 3 3/4, 7 1/2	3	E R P	4	S	3	Hyst. sync.	Ind.	Belt	10 1/2	0.9	0.18	0.9	0.18	1	99.8	38	No	0.15	100k	100k	Yes	2 VU	5k	19 x 9 x 17 1/2	46	1240.00	Plug-in modules; glass lifters, remote control option. Other speeds and head configurations available.			
	SS822	3 3/4, 7 1/2, 15	3	E R P	2	S	3	Hyst. sync.	Ind.	Belt	10 1/2	0.9	0.18	0.9	0.18	1	99.8	38	No	0.15	100k	100k	Yes	2 VU	5k	19 x 9 x 17 1/2	50	1440.00	As above.			
DYNACO	2000	7 1/2, 3 3/4, 1 1/4	3	E R P	4	S	1	Hyst. sync.	Idler	7	0.07	0.11	0.07	0.11	1	—	180	Yes	0.05	200	100k	Yes	2 VU	—	—	18 x 14 x 10	46	498.00	Slide mixing controls; 6 selected inputs by means of plug-in boards. 2-track recorder avail.			
EICO	RP-100	7 1/2, 3 3/4	3	E R P	4	S	3	Hyst. syn.	Ind.	Belt	7	0.15	0.29	0.15	0.29	—	—	45	No	0.5	3k	600	Yes	2 VU	—	15 1/2 x 13 1/2 x 7 1/2	48	299.95K 450.00W				
HEATH	AD-16	7 1/2, 3 3/4	3	E R P	4	S	3	Hyst. syn.	Cap. ind.	Belt	8 3/4	0.18	0.25	—	—	1.5	99	120	No	0.28	50k	50k	Yes	2 VU	Low	17 1/2 x 13 1/2 x 8 1/2	35	414.00	All solid-state kit. This is a Magnacord 1020 in kit form.			
KNIGHT	4450	7 1/2, 3 3/4	3	E R P	4	S	2	4-pole	Take-up direct ind.	Belt	7	0.02	0.03	0.02	0.03	1	99.8	90	No	3	3000	1k	Yes	2 VU	Low imp.	14 x 14 x 8	30	299.50	All solid-state. Three hyperbolic heads; has sound-on-sound and echo. Selector control keyed to six indicator lights.			
KNIGHT-KIT	KG-415	7 1/2, 3 3/4	3	E R P	4	S	2	4-pole	Take-up direct ind.	Belt	7	0.02	0.03	0.02	0.03	1	99.8	90	No	1-5	3000	50k	Yes	2 VU	Low imp.	—	—	249.95	As above. Earphone output peak for low-impedance phones.			
KORTING	TR-4000	1 1/4, 3 3/4, 7 1/2	3	E R P	4	S	1	—	—	7	0.17	0.2	—	—	—	—	—	120	Yes	—	200	—	—	Eye	—	20 1/2 x 14 x 8	33	399.95				
	TR-3000	3 3/4, 7 1/2	2	E R P	4	S	1	—	—	7	0.2	—	—	—	—	—	—	—	—	Yes	—	200	—	—	Eye	—	20 1/2 x 13 x 7 1/2	36	299.95			



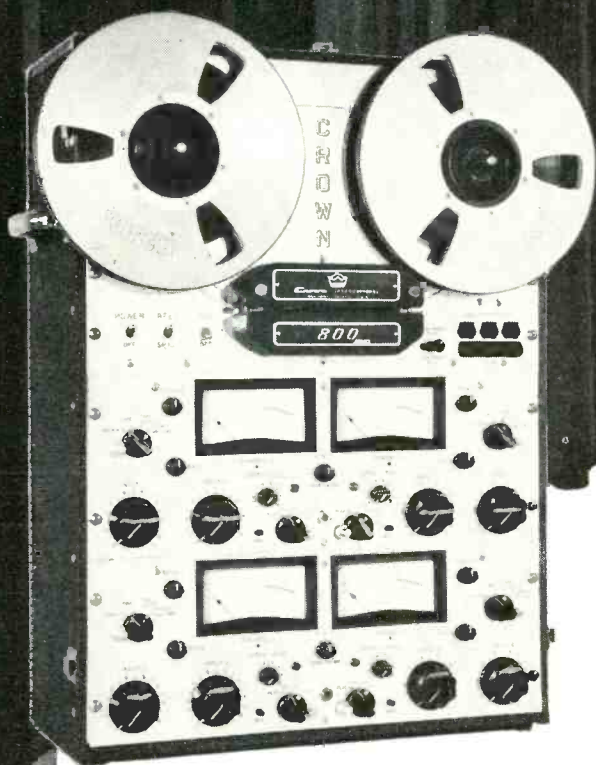
# Leadership PERFORMANCE

## ELECTRONIC ADVANCES

- ☞ Performance as yet unequalled
- ☞ Two years proven Solid State circuitry
- ☞ Extremely low noise Control Center
- ☞ Plug-in etched circuit modules

## TRANSPORT ACHIEVEMENTS

- ☞ Patented Electro-Magnetic Brakes never need adjusting
- ☞ Complete head accessibility
- ☞ Precision Construction
- ☞ Low Wow and Accurate Timing



**SS844 Four Channel**  
from \$3060.

ips	db	cps	s/n	w & f
7-1/2	±2	50-25,000		0.09%
3-3/4	±3	50-15,000	50db	0.18%
1-7/8	±3	100-9,000	42db	0.30%

**SS822 Two Channel**  
from \$1770.

ips	db	cps	s/n	w & f
15	±2	50-20,000	57db	0.06
7-1/2	±2	30-20,000	55db	0.09
3-3/4	±2	30-10,000	51db	0.18



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Circle 132 on Reader Service Card

# TAPE RECORDERS

See Ad on Page No.

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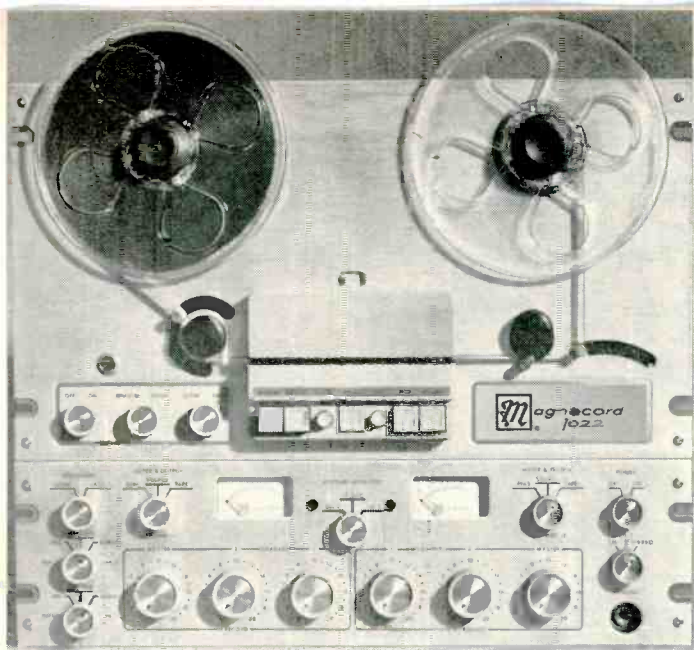
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MANUFACTURER	MODEL NO.	Speeds	E R P	Tracks	Mode	Number of motors	Drive motor type	Reel motor type	Capstan drive	Max. reel size in.	Wow %				Flutter %		TMD's max. record level	Timing accuracy %	1200 ft. rewind spec.	Has power amps?	Sings only	Mic. Input		Hi-level/linear imp.	Mixing facility?	Vol. indicator type	Line read output	Imp. ohms	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
											7 1/2	3 1/2	7 1/2	3 1/2	7 1/2	3 1/2						Imp. ohms	Hi-level/linear imp.									
LAFAYETTE RADIO	RK-880	1 1/2, 3 1/2, 7 1/2	3	E R P	4	S	—	Hyst. syn.	—	Belt	7	0.15	0.25	0.15	0.2	1.25	98.8	1.25	—	No	0.4	10k	500k	—	2 VU	—	11 1/2 x 7 x 11 1/2	22	249.95	S-O-S; individual bias adjustment; tape equalization adjust; headphone jack.		
	RK-860	1 1/2, 3 1/2, 7 1/2	2	E R P	4	S	—	4-pole	—	Belt	7	0.15	0.03	0.12	0.3	1.3	99	—	Yes	1.6	—	—	—	2 VU	—	15 1/2 x 7 1/2 x 14	25	219.95	S-O-S; S-W-S; two 5-x7-in speakers; direct phone pick-up.			
	RK-840	1 1/2, 3 1/2, 7 1/2	2	E R P	4	S	—	4-pole	—	Belt	7	0.2	0.3	0.2	0.3	1.4	98.6	—	Yes	0.2	10k	500k	—	2 VU	—	15 1/2 x 7 1/2 x 14	24	169.95	Two 5-inch speakers; S-W-S; direct mag-phone pickup; solid-state circuitry.			
	RK-820	1 1/2, 3 1/2, 7 1/2	2	E R P	4	S	—	4-pole	—	Belt	7	0.15	0.25	0.15	0.25	—	98.6	—	No	1.6	10k	500k	—	2 VU	—	—	15	109.95	S-W-S; solid-state pre-amps; automatic shut-off.			
	RK-830	1 1/2, 3 1/2, 7 1/2	3	E R P	4	S	—	4-pole	—	Belt	7	0.15	0.25	0.14	0.2	1.5	99	—	No	1.6	10k	500k	—	2 VU	—	12 1/2 x 6 x 10 1/2	15	159.95	Tape and input monitoring; S-O-S; S-W-S; solid-state preamp.			
MAGNECORD	1020	3 1/2, 7 1/2	3	E R P	4	S	3	Hyst. syn.	Ind.	Belt	8 1/2	0.18	0.25	0.18	0.25	1	—	80	No	1	50k	22k	Yes	2 VU	Low imp.	17 1/2 x 13 1/2 x 6 1/2	35	570.00	Dual stereo phone jacks; all solid-state.			
	1024	3 1/2, 7 1/2	3	E R P	4	S	3	Hyst. syn.	Ind.	Belt	8 1/2	0.18	0.25	0.18	0.25	1	—	80	No	0.32	50k	22k	Yes	2 VU	Low imp.	19 x 15 1/2 x 12	48	648.00	As above plus 2-speed motor; separate meter switching; master gain control.			
	1021	3 1/2, 7 1/2	3	E R P	1	M	3	Hyst. syn.	Ind.	Belt	8 1/2	0.17	0.25	0.17	0.25	1	—	80	Yes	.038	150	22k	Yes	VU	150-600 bal.	19 x 15 1/2 x 12	48	708.00	Broadcasters special - speed and track options.			
	1022	7 1/2, 15	4	E R P-P	2	S	3	Hyst. syn.	Ind.	Belt	8 1/2	15 0.15	7 1/2 0.17	15 0.15	7 1/2 0.17	1	—	80	No	.038	150	22k	No	2 VU	150-600 bal.	19 x 15 1/2 x 12	48	1788.00	As above plus 1/4 track play head.			
	1028	7 1/2, 15	3	E R P	2	S	3	Hyst. syn.	Ind.	Direct	10 1/2	15 0.1	7 1/2 0.15	15 0.1	7 1/2 0.15	1	—	45	No	.90 dBm	150	50k	No	2 VU	150-600 bal.	12 1/2 x 17 1/2 x 9 1/2	55	1995.00	As above without extra head.			
NEWCOMB	TX-10-4	3 1/2, 7 1/2	3	E R P	4	S	1	Hyst. syn.	—	Belt	10 1/2	0.15	0.2	—	—	—	99.5	90	No	2	—	500k	Yes	2 VU	Low imp.	12 1/2 x 6 1/2 x 9 1/2	—	—	Joystick operation. Has S-O-S.			
NORELCO	Carry-over 150	1 1/2	2	E R P	4	M	1	d-c	—	—	cart.	—	—	—	—	—	—	—	Yes	—	—	—	No	VU	—	—	—	90.00	Battery operated - uses the Norelco cartridge. This cartridge is also used in a variety of mono and compatible stereo machines for home and auto.			
	201	3 1/2, 7 1/2	2	E R P	4	S	—	—	—	—	—	0.14	—	0.14	—	—	—	120	Yes	—	—	—	No	Eye	—	—	—	149.50	—			
OKI	222	3 1/2, 7 1/2	2	E R P	4	S	—	—	—	—	7	0.2	—	0.2	—	—	—	—	Yes	—	10k	500k	No	VU	—	—	—	16	149.95	Mono record, stereo play.		
	555	3 1/2, 7 1/2	2	E R P	4	S	—	—	—	—	7	0.12	—	0.12	—	—	—	—	Yes	—	10k	500k	No	2 VU	—	—	—	349.95	S-O-S, S-W-S, separate speakers.			
	300D	3 1/2, 7 1/2	2	E R P	4	S	—	—	—	—	7	0.2	—	0.2	—	—	—	—	No	—	10k	500k	No	2 VU	—	—	—	159.95	Deck only, walnut housing.			
REVOX	G-36	3 1/2, 7 1/2	3	E R P	4	S	3	Hyst. syn.	Ind.	Direct	10 1/2	—	—	—	—	1	—	45	Yes	3	500k	1 meg	Yes	2 VU	Low imp.	11 1/2 x 13 1/2 x 18 1/2	45	500.00	Also available in 2-track version and, or in 7 1/2-15 ips version. 2-track unit is also \$500. 15 ips unit is \$700.			
ROBERTS	1725	1 1/2, 3 1/2, 7 1/2	2	E R P	4	S	1	Ind.	—	Belt	7	0.2	0.25	—	—	3	99	75	Yes	2.5	2 meg	500,000	No	2 VU	High imp.	13 1/2 x 7 1/2 x 13 1/2	33 1/2	269.95	Electrically switched speed change. 50 Hz operation possible.			
	770X	1 1/2, 3 1/2, 7 1/2	3	E R P	4	S	1	Hyst. syn.	—	Belt	7	0.15	0.25	—	—	3	99.5	75	Yes	1.5	500,000	1 meg	No	2 VU	Low imp.	20 x 13 x 9	47	399.95	S-O-S; S-W-S; Cross-Field head; 4-digit counter.			
	5000	3 1/2, 7 1/2	4	E R P X	4	S	3	Hyst. syn.	Ind.	Direct	10 1/2	0.12	0.18	—	—	3	99.7	45	Yes	0.5	5000	100,000	Yes	2 VU	15k	15 1/2 x 16 1/2 x 9 1/2	70	699.95	S-W-S; Cross-Field head; piano key controls.			
	7000RX	1 1/2, 3 1/2, 7 1/2	3	E R P X	4	S	1	Hyst. syn.	—	Belt	7	0.15	0.25	—	—	3	99.5	75	Yes	0.5	5000	100,000	Yes	2 VU	15k	15 1/2 x 16 1/2 x 9 1/2	45	579.95	Automatic repeat; automatic reverse; Cross-Field head.			
	400X	3 1/2, 7 1/2	4	E R P X	4	S	3	Hyst. syn.	Ind.	Belt	7	0.12	0.18	—	—	3	99.7	45	Yes	0.5	5000	100,000	Yes	2 VU	15k	17 1/2 x 16 x 12 1/2	69 1/2	799.95	As above plus S-O-S; S-W-S.			

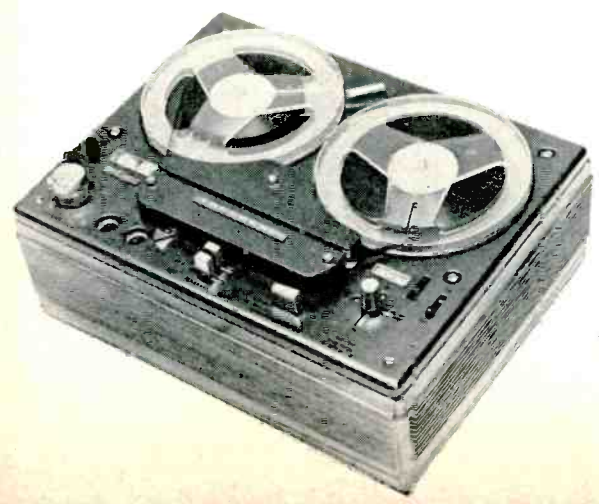




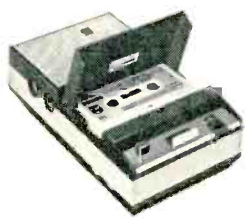
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SONY  
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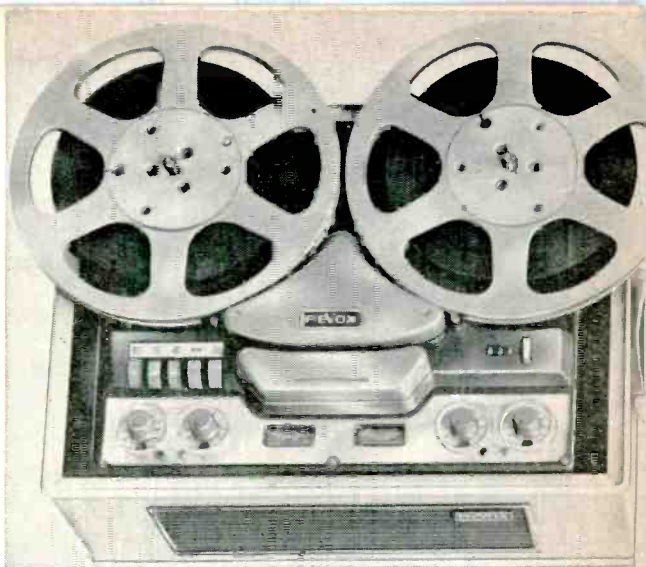
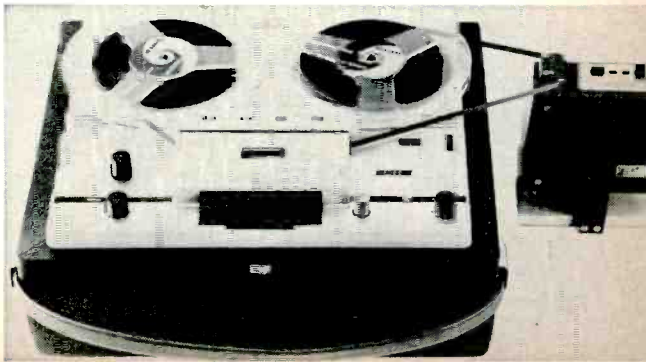


TANDBERG  
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NORELCO 150

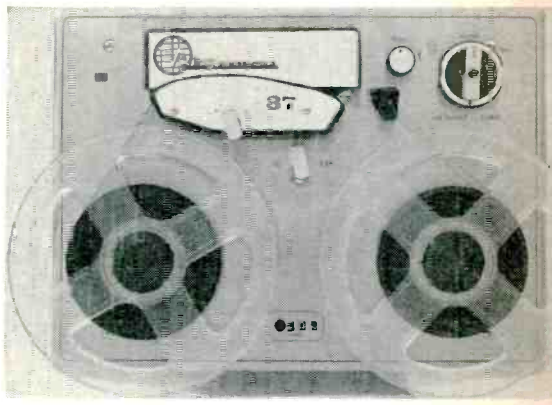
UHER  
6000  
Dia-Pilot



REVOX G-36



ROBERTS 5000



VIKING 807



# TAPE RECORDERS

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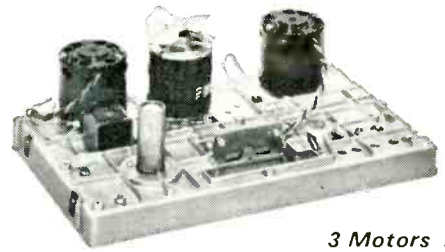
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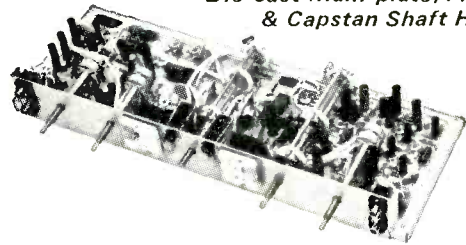
MANUFACTURER	MODEL NO.	Speeds	Number of heads	Head config.	Tracks	Media	Number of motors	Drive motor type	Reel motor type	Capstan drive	Wow %				Flutter %				Timing accuracy, %	1200 ft. rewind sec.	Tape power amps.	Spins. out.	Mic. input		Hi-level input imp.	Mixing facility?	Vol. indicator type	Line feed output/imp. ohms	Dimensions W x D x H in.	Weight lbs.	Price	SPECIAL FEATURES
											7 1/2	3 1/2	7 1/2	3 1/2	7 1/2	3 1/2	7 1/2	3 1/2					THD % max. record level	Imp. ohms								
SONY-SUPERSCOPE	660	3 1/2, 7 1/2	4	E R/P R/P E	4	S	3	Hyst. syn.	Ind.	Belt	7	0.06	0.1	0.06	0.1	1.5	99.8	60	Yes	-	Low	High imp.	No	2 VU	-	17 x 17 x 10 1/2	55	575.00	ESP automatic reverse; quad-radial 4-speaker system.			
	530	1 1/2, 3 1/2, 7 1/2	2	E R/P	4	S	1	Ind.		Pulley	7	0.1	0.12	0.1	0.12	1.5	99.8	120	Yes	-	Low	High imp.	No	2 VU	-	19 1/2 x 10 x 15 1/2	38	399.50	Quad-radial 4-speaker sound; 20 w.p.c. amplifiers; RPR auto retracting pinch-roller.			
	260	3 1/2, 7 1/2	2	E R/P	4	S	1	Ind.		Pulley	7	0.19	0.25	0.19	0.25	1.5	99.8	120	Yes	-	Low	High imp.	No	2 VU	-	21 1/2 x 15 1/2 x 7 1/2	34	249.50	XL-2 Radial 2-speaker sound; solid-state; 10 w.p.c.			
	350	3 1/2, 7 1/2	3	E R/P	4	S	1	Hyst. syn.		Pulley	7	0.19	0.25	0.19	0.25	1.5	99.8	120	No	-	Low	High imp.	No	2 VU	-	17 1/2 x 12 1/2 x 6 1/2	20	199.50	Tape/source monitoring; phone jack; solid-state.			
	250A	3 1/2, 7 1/2	2	E R/P	4	S	1	Ind.		Pulley	7	0.19	0.25	0.19	0.25	1.5	99.8	120	No	-	Low	High imp.	No	2 VU	-	14 1/2 x 11 1/2 x 6 1/2	15 1/2	149.50	Solid-state.			
TANDBERG	11	1 1/2, 3 1/2, 7 1/2	3	E R/P	2	M	1	d.c.		Belt	7	0.2	0.3	0.2	0.3	0.5	99	80	Yes	4.5	200	-	No	VU	600	13 x 10 x 4	71	595.00	Electronic tape speed control. Solid-state.			
	12	1 1/2, 3 1/2, 7 1/2	2	E R/P	4	S	1	4-pole		Belt	7	0.15	0.2	0.15	0.2	0.5	99	115	Yes	0.15	200	1 meg.	Yes	Eye	Low imp.	15 1/2 x 11 1/2 x 6 1/2	23	498.00	Bass and treble playback control. Solid-state.			
	64	1 1/2, 3 1/2, 7 1/2	3	E R/P	4	S	1	Hyst. syn.		Belt	7	0.1	0.15	0.1	0.15	0.5	99	100	No	1.25	5 meg.	1 meg.	Yes	Eye	Low imp.	-	-	498.00	Deck only. Solenoid operation for remote start-stop.			
	92	1 1/2, 3 1/2, 7 1/2	2	E R/P	2	M	1	4-pole		Belt	7	0.15	0.2	0.15	0.2	-	-	-	Yes	-	1 meg.	100,000	No	2 eyes	-	15 x 6 1/2 x 11 1/2	22	256.10	Model 92F identical except it has remote control solenoids built in.			
UHER	4000	1 1/2, 3 1/2, 7 1/2	3	E R/P	4	M	1	Hyst. syn.		Belt	5	0.1	0.15	0.15	0.15	-	-	-	Yes	.075	200	1 meg.	No	VU	Low imp.	11 x 8 x 3	6	440.00				
	5000	1 1/2, 3 1/2, 7 1/2	2	E R/P	4	M	1	Hyst. syn.		Idler	6	0.1	0.15	0.15	0.15	-	-	-	Yes	.075	200	1 meg.	No	VU	Low imp.	6 x 10 x 12	16	300.00				
	6000	3 1/2, 7 1/2	2	E R/P	2	M	1	Hyst. syn.		Belt	7	0.1	0.15	0.15	0.15	-	-	-	Yes	.075	200	1 meg.	No	VU	Low imp.	14 x 13 x 7	-	160.00				
	7000D	3 1/2, 7 1/2	2	E R/P	4	S	1	Hyst. syn.		Belt	7	0.1	0.15	0.15	0.15	-	-	-	Yes	.075	200	1 meg.	No	VU	Low imp.	15 x 14 x 7	-	-				
	8000E	3 1/2, 7 1/2	4	E R/P D	4	S	1	Hyst. syn.		Belt	7	0.1	0.15	0.15	0.15	-	-	-	Yes	.075	200	1 meg.	Yes	VU	Low imp.	15 1/2 x 6 1/2 x 13	23 1/2	420.00				
VIKING	807	3 1/2, 7 1/2	1	P	4	S	2	4-pole	Ind.	Belt	7	0.2	0.3	0.2	0.3	-	-	99.5	90	No	-	-	-	-	-	6 1/2 x 13 1/2 x 16	15 1/2	124.95	Playback only. Base included.			
	88	3 1/2, 7 1/2	3	E R/P	4	S	2	4-pole	Ind.	Belt	7	0.2	0.3	0.2	0.3	1	99.5	90	No	1	High imp.	0.1	No	2 VU	Low imp.	13 x 13 x 7 1/2	22	339.95	Deck has source/tape comparison and tape pause control.			
	880	3 1/2, 7 1/2	3	E R/P	4	S	2	4-pole	Ind.	Belt	7	0.2	0.3	0.2	0.3	1	99.5	90	Yes	1	High imp.	0.1	No	2 VU	Low imp.	22 x 15 x 9	44	439.95	As above but with satellite speakers in portable case. Head phone output.			
	Studio 96	3 1/2, 7 1/2	3	E R/P	1,2 or 4	M or S	3	Hyst. syn.	Ind.	Belt	10 1/2	0.2	0.3	0.2	0.3	1	99.5	30	No	-	-	-	-	-	-	-	-	585.00 and up	Professional tape transport with automatic sequence function. Speed options.			
	230	7 1/2	3	E R/P	1,2 or 4	M or S	3	Hyst. syn.	Ind.	Belt	7	0.2	-	0.2	-	1	99.5	45	No	-	-	-	-	-	-	-	-	346.00 and up	Transport has interchangeable head blocks. Momentary push button operation. Speed options.			
WOLLENSAK	1500SS	3 1/2, 7 1/2	2	E R/P	2	M	1	4-pole		Belt	7	0.25	0.25	0.25	0.25	1	-	135	Yes	2	50k	300k	No	VU	-	6 1/2 x 10 1/2 x 11 1/2	18	184.95				
	5710	1 1/2, 3 1/2, 7 1/2	1	ERP	2	M	1	2-pole		Idler	7	0.25	0.25	0.25	0.25	1	-	70	Yes	1	50k	300k	No	VU	-	16 x 7 x 10	20	159.95				
	5740	1 1/2, 3 1/2, 7 1/2	1	ERP	4	S	1	2-pole		Idler	7	0.25	0.25	0.25	0.25	1	-	70	Yes	1	50k	300k	No	2 VU	-	21 1/2 x 10 1/2 x 10 1/2	27 1/2	229.95				
	7000	1 1/2	2	E R/P	2	S	1	4-pole		Idler	Cart.	1 1/2	0.3	1 1/2	0.3	-	-	60	Yes	2	10 meg.	1 meg.	No	2 neon	-	16 x 8 1/2 x 15 1/2	43 1/2	459.95	Accepts up to 20 3M cartridges for automatic play.			
	4100	1 1/2	2	E R/P	2	M	1	d.c.		Belt	Cart.	1 1/2	0.35	1 1/2	0.35	-	-	70	Yes	-	-	-	-	Meter	-	4 1/2 x 2 1/4 x 7 1/4	3	99.95	Uses Scotch/Norelco cartridge. Battery operation. Includes 3 cartridges, patch cord and mixer.			



# How To Get A \$570 Stereo Recorder For \$400



3 Motors . . .  
Solenoid Operated . . .  
Die-cast Main-plate, Flywheel  
& Capstan Shaft Housing



All Solid-State Electronics . . . Record  
4-Track, Stereo-Mono, Sound-On-  
Sound, Sound-With-Sound & Echo!

## Build The New Heathkit®/Magnecord® 1020!

### You Save \$170!

Thanks to Heath, you can now save \$170 on the new Magnecord 1020 4-Track Transistor Stereo Tape Recorder by building it yourself. And the only difference between this Heathkit version and the original is the \$170 you save (think of all the tape you can buy with that!).

All parts are made at the Magnecord factory . . . under a quality control system that meets the demanding requirements of the National Aeronautics & Space Administration (NASA).

Add to this Magnecord's years of pioneering and developing tape equipment for the broadcasting and recording industries, and you have a sophisticated recorder that will give you years of professional quality and reliability.

### Professional Recording Facilities

With the 1020, you can record "live" from microphones, or from auxiliary sources like tuners, phonographs, TV's, etc., and playback . . . in 4-track stereo or mono at either 7½ or 3¾ ips. And you can make sound-on-sound, or sound-with-sound (mixing) recordings, or create interesting echo effects.

### Professional Tape Transport

The tape transport is powered by 3 separate motors. The hysteresis synchronous capstan motor has a dynamically balanced flywheel and a ballbearing inertial stabilizer mount for constant, accurate speed. Two permanent split-capacitor type motors drive

the reels. With the convenient push-button controls, you can change operational modes instantly and gently with the touch of a button. Compliance arms insure correct tape tension at all times.

The military-type differential band brakes are solenoid operated for instant, gentle stops. And when the tape runs out an automatic switch shuts off all motors and retracts the tape pressure roller eliminating unnecessary motor wear and prevents deformation of rollers. The tape gate and pressure roller also are solenoid-operated for positive action.

### 3 Professional Tape Heads

Selectable ¼ track erase, record and play. Engineered and lapped to a precise hyperbolic curve for smooth low frequency response . . . made with a deep gap, deposited quartz for high frequency response and long life. Removable shields afford double protection against external magnetic fields. Protective, snap-mounted head covers provide easy access for cleaning and de-magnetizing. And for quick, accurate editing, there are center-line marks.

### Other Professional Features

All parts mount on a thick, die-cast main-plate that won't warp, reduces wear, provides rigid support and stable alignment. Two V.U. meters for visual monitoring of signal levels from either tape or source . . . allows quick comparison of source with re-

corded signal. Inputs for microphones and outputs for headphones are all front-panel mounted for easy access. Digital counter with push button reset. Low impedance emitter-follower outputs deliver 500 millivolts or more to amplifier inputs. Individual gain controls for each channel. And all solid-state circuitry . . . 21 transistors and 4 diodes . . . your assurance of cool, instant operation, long reliable life.

### Famous Heathkit Know-How Speeds Assembly

Simple step-by-step-instructions with generous use of giant pictorials guide you every step of the way. You just wire two circuit boards and do the easy mechanical mounting for the transport components.

And to make construction even easier, the connecting wires and shielded cables are pre-cut, stripped, and marked . . . even the connectors are installed where necessary; just plug them in! The only soldering you do is on the circuit board! Total assembly time is around 25 hours . . . that's like getting \$7 an hour for your efforts.

Get today's best buy in a professional stereo tape recorder . . . order the Heathkit version of the Magnecord 1020 now!

- Kit AD-16, deck & electronics, 45 lbs. . . . \$399.50
- ADA-16-1, walnut base, 8 lbs. . . . \$19.95
- ADA-16-2, adapter ring for cabinet or wall mounting, 2 lbs. . . . \$4.75
- ADA-16-3, slides, (combine with walnut base for tape drawer), 7 lbs. . . . \$9.95

**FREE!**

### World's Largest Kit Catalog

108 pages! Describes this and over 250 kits in stereo hi-fi, color TV, organs, ham, test, CB, marine, home and hobby. Mail coupon, or write Heath Company, Benton Harbor, Michigan 49022.

Heath Company, Dept. 41-8, Benton Harbor, Michigan 49022

- Enclosed is \$ \_\_\_\_\_, plus shipping. Please send model (s) \_\_\_\_\_
- Please send FREE Heathkit Catalog.

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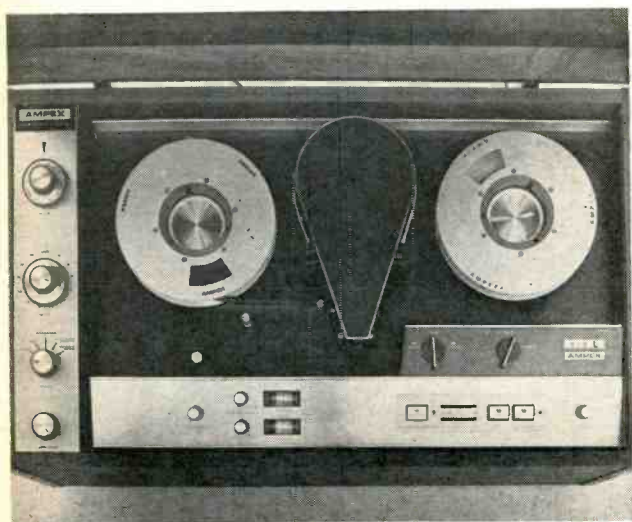
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Prices and specifications subject to change without notice.

HF-194



# VIDEO RECORDERS—12



AMPEX VR-6275



CONCORD VTR-600

See Ad  
on Page  
No.

Manufacturer	Model	Scan System	Tape Width in.	Tape Speed ips	Equiv. Tape Speed ips	Video Bandwidth Hz : dB	Lines Resolution	Audio Frequency Response Hz : dB	Weight lbs.	Price	Special Features
AMPEX	6000	helical	1	9.6	1000	30-2.5 m 3	250	90-10k 4	85	\$1095.	With a video control console. Model 6275 is \$1495.
	7000	helical	1	9.6	1000	30-3.5 m 3	350	50-12k 4	100	\$3150.	Model 7100 Video trainer with camera, tripod, monitor, and cable in a rollaway cart is \$5945.
CONCORD	VTR-600	helical	1/2	12	487.4	2.7 m	250	50-12k	52	\$1150	Has still frame feature, lightweight.
PANASONIC	NV-7000	helical	1/2	12	—	2 m	200	80-10k	54 1/2	\$1250 \$1280	With 9-inch monitor. With 12-inch monitor. Pushbutton operation, simple button for instant cleaning of recording heads. Two motor operation — one operates recording heads only, other operates transport.
SONY CORP. OF AMERICA	TCV-2010	helical	1/2	7 1/2	433	2.2 m -3	200	50-12k	66	\$ 995	Built-in 9-inch monitor/TV portable with carrying handles. Simple to operate. Camera ensemble available.
	TCV-2020	helical	1/2	7 1/2	433	2.2 m -3	200	50-12k	70	\$1150	As above with built-in clock timer for preset automatic recording. Handsome oil walnut cabinet.
	CV-200	helical	1/2	7 1/2	433	2.2 m -3	200	50-12k	46	\$ 725	Deck version of 2010. Connects directly to commercial monitors, and with our adapter, to home TV's.
	CV-200 OD	helical	1/2	7 1/2	433	2.2 m	200	50-12k	42.5	\$ 695	Deck version of 2020 in wood case, otherwise as above.
WOLLENSAK	VTR-150	helical	1/2	7 1/2	180	2 m	160	50-10k	50	\$1495 \$2995	Recorder alone. Complete console. 8 second runup, simplified threading and operation, intermachine compatibility, tape economy.

33-35  
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WOLLENSAK VTR-150



SONY CV-2000 OD



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Imagine.

## Instant Movies in Sound (produce your own or tape them off the air)

The new Sony Videocorder<sup>®</sup> is a complete Home TV Studio<sup>™</sup>: a video tape recorder, built-in monitor, and optional camera outfit. Takes TV pictures and sound right off the air, and puts them on tape. And with the TV camera attached, and microphone plugged in, you can do the same with live action. When you're done—presto, switcho, rewind, playback! And there, on the TV monitor screen, is the same picture with the same sound, as easy as operating an ordinary tape recorder.

**First Unit ever designed for the home.** There's nothing really new about taping sight and sound. TV stations have been doing it for years. But the equipment costs tens of thousands of dollars. That's a long way from home.

But, when you can bring the complete system—recorder and monitor—down to under \$1000, plus an optional \$350 for the camera outfit, you're home. And that's exactly what Sony did. They achieved the most exciting home entertainment concept since television.

**New recording/playback technique.** Known as a pioneer in transistor developments, Sony is also one of the foremost producers of tape heads and tape transport mechanisms and the tape itself. Sony also manufactures TV picture tubes and vidicon tubes. Sony drew from this veritable storehouse of specialized experience to create this all-new, all-Sony TV tape system for the home. It was out of this same resourceful know-how that the ingenious idea of alternate-field recording and repeat-field playback was conceived. Combining it with helical

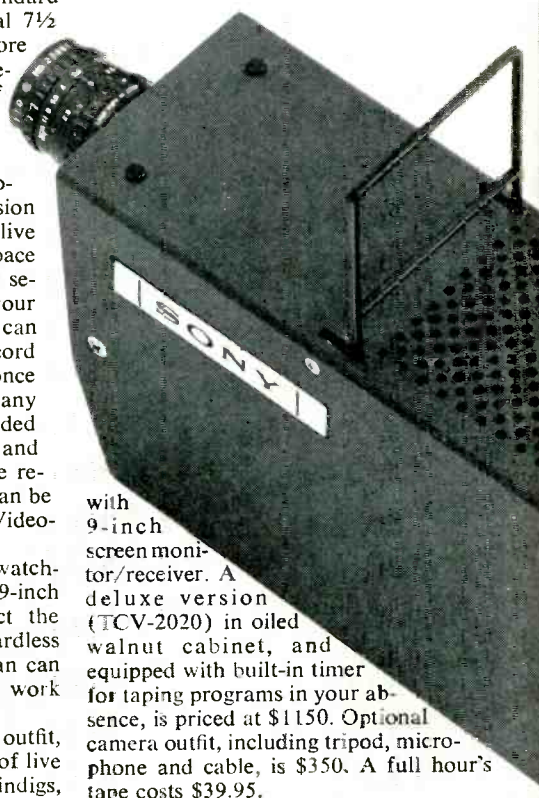
tracking, it made possible the development of a unit that would use standard 1/2-inch video tape at conventional 7 1/2 ips speed, yet capable of storing more than 60 minutes of program material on a 7-inch reel. The dream of a home TV tape recorder became a reality.

**Unlimited applications.** The Videocorder adds a thrilling new dimension to home entertainment. Want to relive some telecast event? Watch a space launch again? A ball game? Some selected program? Tape it with your Sony Home Videocorder. You can even use a timer attachment to record a program while you're out. For, once it's on tape, you can watch it at any time. And you can erase the recorded material, and reuse the tape over and over again. What's more, any tape recorded on one Sony Videocorder can be played back on any other Sony Videocorder.

Moreover, you're not limited to watching playback on the built-in Sony 9-inch screen monitor. You can connect the Videocorder to any monitor, regardless of size. A competent TV technician can even adapt your Videocorder to work with your TV set.

And with the optional camera outfit, you can record picture and sound of live events—family functions, social shindigs, community activities—you name it. You can also apply it to your business or profession or your hobby interests.

**Now available. Prices start under \$1000.** The basic Sony Home Videocorder (TCV-2010) is priced at \$995 complete



with 9-inch screen monitor/receiver. A deluxe version (TCV-2020) in oiled walnut cabinet, and equipped with built-in timer for taping programs in your absence, is priced at \$1150. Optional camera outfit, including tripod, microphone and cable, is \$350. A full hour's tape costs \$39.95.

Visit your Sony dealer today for an unforgettable demonstration. For free booklet describing the many uses for your Videocorder write: Sony Corp. of America, 580 Fifth Ave., N. Y., N. Y. 10036.

**SONY<sup>®</sup> VIDEOCORDER<sup>®</sup>**

Circle 134 on Reader Service Card

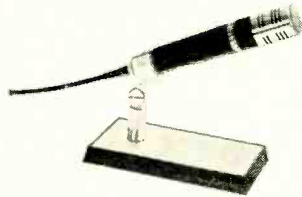
# MICROPHONES

—13

DYNACO  
50 Series



ELECTRO-  
VOICE 635A



AMERICAN D-50



NEUMANN  
U67



KNIGHT  
KN-4545



LAFAYETTE  
99-4581



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MANUFACTURER	MODEL NO.	Directional pattern	Operating principle	Diaphragm material	Case material	External finish	Impedance ohms	Frequency response Hz ± dB	EIA Sensitivity	Mic. connector type	Cable length ft.	Cable plug type	Dimensions L x Diam. in.	Weight oz.	Mounting method	Price	SPECIAL FEATURES
ALLIED RADIO	KN4550	Card.	Dyn.	Accoust-alloy	—	Satin Chrome	Low & High	45-14k	—	18	None	7/8 x 1 1/8	32	Std.	\$34.50		
	KN14520	—	Dyn.	—	—	Black	3000	80-12k	—	4 1/2	None	6 d.	24	Adapter	\$10.85	Pipe adapter included.	
	KN4545	—	Dyn.	—	—	Satin Chrome & Black	250,20k	30-15k	—	8	None	6 3/8 x 1 3/4	64	Std.	\$24.76	Includes desk stand.	
AMERICAN	D-20	Omni.	Dyn.	Mylar	Zinc	Matte Black	200,25k	80-12k 4	—	None	4 1/2	None	6 3/8 x 1 5/16	5 1/2	Std.	\$12.	Use hand held or as a lavalier.
	D-30	Omni.	Dyn.	Mylar	Zinc	Matte Black	50k	100-10k 4	—	None	16	None	3 1/4 x 1 3/16	4	Sp. Stand	\$12.	As above plus on-off switch.
	D-40	Omni.	Dyn.	Mylar	Zinc	Brushed Chrome	3k,40k	60-12k 4	—	Special	16	None	8 1/4 x 1 1/4	14 1/2	Std.	\$24.	Floor or table stand. On-off switch in stand.
	D-50	Card.	Dyn.	Mylar	Zinc	Matte Black	150,50k	80-10k 4	—	None	6	None	5 1/2 x 1	3	Std.	\$36.	Excellent for PA or recording.
AMPEX	701	Omni.	Dyn.	Alum. & Mylar	Zinc	Paint	40k	80-12k	—	None	5	Phone	3 1/2 x 7/8	4.3		\$9.95	Stand and lavalier cord included.
	2001	Omni.	Dyn.	Mylar	Alum. & CYCOLAC	Brush Alum. & Black	40k	50-15k	—	None	9	Phone	1 3/8 x 7	7.5	Adapter	\$34.95	Swivel adapter to pipe, satin chrome base included.
DYNACO	50	Fig. 8	Ribbon	Dural.	Brass	Satin	50	30-13k 2.5	—	Special DIN Plug with Model 100 and 200	20	None	8 x 1 1/4 200-10 1/4 L	15	Adapter	\$59.95	Model 53 has multi-impedance 50, 250, hi Z outputs—\$69.95. Model-100 has 200 ohm output —\$89.95. Model 200 is two stereo-matched units for dual-channel recording—\$149.95.
ELECTRO-VOICE	635A	Omni.	Dyn.	Accoust-alloy	Steel	Matte Satin Nickel	150	60-15k 2	149	Cannon	18	None	5 3/16 x 1 1 1/2	6	Adapter	\$49.20	Built-in pop filter and wind screen. Shockproof professional unit.
	RE-15	Super Card.	Dyn.	Accoust-alloy	Steel	Satin Chrome Gold or Grey	150	60-15k 2	149	Cannon	18	None	6 7/16 x 1 1/8	8	Adapter	\$107.10	Professional super cardioid. Rejection is greatest 150°, off axis. No off axis coloration, response is similar to on axis but attenuated.
	676	Card.	Dyn.	Accoust-alloy	Zinc	Satin Chrome Gold or Grey	150,HiZ	50-15k 3	151 low	Amphenol	15	None	8 3/4 x 1 1/4	12	Adapter	\$60.	Slim cardioid-use hand-held or stand mounted. 3-position bass tilt for exact PA and recording.
	674	Card.	Dyn.	Accoust-alloy	Zinc	Satin Chrome Gold or Grey	150,HiZ	50-15k 3	152 low	Amphenol	15	None	7 7/8 x 1 1/4	14	Std.	\$60.	As above plus stand mount end on-off switch.
	664	Card.	Dyn.	Accoust-alloy	Zinc	Satin Chrome Gold or Grey	150,HiZ	40-15k 3	148 low	Amphenol	15	None	7 7/8 x 1 3/4	26	Std.	\$51.	Widely used microphone with on-off switch.
LAFAYETTE RADIO	99-4588	Omni.	Dyn.	Mylar	Zinc	Black & Silver	10k	80-12k	-65	—	8 1/2	Phone	5 1/2 x 1	5	Adapter	\$14.95	Includes stand
	99-4593	Omni.	Dyn.	Mylar	Zinc	Brushed Satin	50k	50-11.5k	-56	—	19 1/2	None	9 x 1 1/8	18	Std.	\$11.95	On-off.
	99-4582	Omni.	Dyn.	Mylar	Alum.	Satin Black	50k	100-10k	-60	—	18	None	7 x 1 1/8	8	Adapter	\$9.95	On-off switch and clamp mount.
	99-4581	Omni. Card.	Dyn.	Mylar	Alum.	Chrome	600,50k	100-10k	-58	—	20	None	5 x 2	19 1/2	Std.	\$9.95	On-off switch.
	99-4591	Card.	Dyn.	Mylar	Alum.	Satin	50k	100-15k	-55	—	5	None	4 1/2 x 1 7/8	5 1/2	Adapter	\$7.95	Includes stand.
NEUMANN	U-64	Card.	Cond.	Mylar	Metal	Satin Chrome	30,50, 150,250	40-18k	137	Cannon	25	Cannon	4 1/2 x 3/4	3.5	Std.	\$360.	Miniature type. Switchable 10 dB ovid protection.
	U-67	Card.	Cond.	Mylar	Metal	Satin Chrome	30,50, 150,250	40-16k	142	None	25	Cannon	7 1/8 x 2 1/4	16	Std.	\$460.	Pattern converts to Fig. 8. Switchable ovid protection.
	M-49C	Card.	Cond.	Mylar	Metal	Satin Chrome	30,50, 150,250	30-15k	139	None	25	Cannon	6 1/8 x 3	29	Std.	\$495.	Remote controlled pattern conversion.
	KM-56C	Card.	Cond.	Mylar	Metal	Satin Chrome	30,50, 150,250	30-15k	139	None	25	Cannon	6 x 7/8	5	Std.	\$460	Miniature type-Pattern convertible to Fig. 8.





## D-19E/200

is a cardioid microphone for high quality recording and sound reproduction, and provided with bass roll-off switch for exceptionally clear speech intelligibility and excellent output for above average "reach." It features effective front-to-back discrimination and a non-metallic diaphragm—preventing popping and harshness on close-ups.

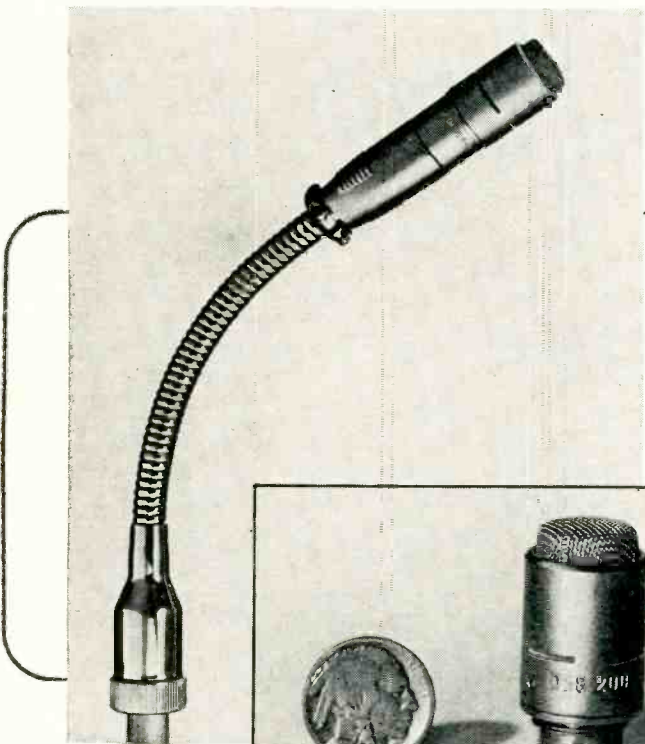
### TECHNICAL DATA

Frequency range	40-16,000 cps.
Frequency response	± 3 db
Sensitivity	- 53 db
Impedance	200 ± 20%
Dimensions	7¼" long by 1¼" diameter
Weight	7 ounces

Here are two economical microphones for a variety of recording, broadcast and public address applications. An accessory W-24 Windscreen is available for the D-19E/200; also fits the D-24E microphone.

Truly noise canceling, the D-58E microphone is the ideal choice for sportscasts, industrial uses or any similar noisy environment.

**Send today for data sheets and prices.**



## D-58E

is a noise-cancelling microphone limited to the speech range and offers crisp, clear speech reproduction, for maximum intelligibility. It effectively discriminates against any sound originating beyond 5" from the microphone.

### TECHNICAL DATA

Frequency range	70-12,000 cps.
Sensitivity	- 58 db
Impedance	200 or 60 ohm ± 15%
Dimensions	1¾" long by 1¼" diameter
Weight	1.1 ounces
Goose neck	8" or 20" length (optional)

MADE IN AUSTRIA BY AKG GMBH.

**Norelco**®

**PROFESSIONAL  
SOUND PRODUCTS**

**NORTH AMERICAN PHILIPS COMPANY, INC.**  
Professional Products Division, 100 East 42nd St., New York, N. Y. 10017

# MICROPHONES

See Ad on Page No.

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MANUFACTURER	MODEL NO.	Directional pattern	Operating principle	Diaphragm material			Case material	External finish	Impedance ohms	Frequency response Hz ± dB	EIA Sensitivity	Mic. connector type	Cable length ft.	Cable plug type	Dimensions L x Diam. in.	Weight oz.	Mounting method	Price	SPECIAL FEATURES
				Mylar	Metal	Satin													
NORELCO (AKG)	C-60	Card.	Cond.	Mylar	Metal	Satin	50,200	30-18k 2.5	-42	Cannon	33	None	10 1/8 x 1 1/16	48	Std.	\$260.		Gold deposit diaphragm. Crisp and clean reproduction of entire available range. High reliability.	
	D-202ES	Card.	Dyn.	Mylar	Metal	Dark Grey	200	30-15k 2	-53	Cannon	15	None	8 1/2 x 2	9.5	Adapter	\$130.		Dual system—one for low frequencies, one for high. Maximum front-to-back discrimination.	
	D-109	Omni.	Dyn.	Mylar	Metal	Satin	200	50-15k 5	-56	Cannon	15	None	2 3/4 x 3/8	1.5	Lavalier	\$49.		High output. Natural speech reproduction.	
	D-150	Omni.	Dyn.	Mylar	Metal	Satin	200	40-18k 3	-55	Cannon	15	None	5 3/4 x 3/8	4	Adapter	\$90.		As above — studio quality.	
	D-119ES	Card.	Dyn.	Mylar	Metal	Satin	50,200, HiZ	40-16k 3.5	-53	Cannon	15	None	7 1/4 x 1 1/16	7	Adapter	\$69.		On-off switch. Professional quality at a modest price. Bass attenuation.	
SENNHEISER	MD407	Card.	Dyn.	Plastic	Plastic	Dark Grey	200, HiZ	100-12k	-56	None	5	Phone	3.2 x 1.5	9		\$32.		Self-standing — for home tape recorders.	
	MD403	Card.	Dyn.	Plastic	Metal	Brushed Chrome	200,80k	80-12k 3	-56	None	5	Phone	3.5x2.2x1.5	11		\$41.50			
	MD21	Omni.	Dyn.	Plastic	Metal	Chrome	200	50-15k	-53	None	5	Phone	4.7 x 1.8 1.8	9.2		\$57.00		Thread or goose-neck for TV news recording.	
SHURE	S45L	Unidirect	Dyn.	Polyester	Alum.	Satin	150	50-15k	151.5	—	20	None	5 1/4 x 1 1/4	7	Adapter	\$70.		Lavalier — Gooseneck adapter.	
	S65	Unidirect	Dyn.	Polyester	Steel	Chrome	High & Low	50-15k	151	Amphenol	18	None	6 1/4 x 2	10 1/2	Adapter	\$95.			
	S85SA	Unidirect	Dyn.	Polyester	Steel	Chrome	High Z	50-12k	152.5	Amphenol	15	None	6 3/4 x 2 3/16	13 1/2	Adapter	\$65.			
	S85SB	Unidirect	Dyn.	Polyester	Steel	Chrome	150,250	50-12k	151	Amphenol	15	None	6 3/4 x 2 3/16	13 1/2	Adapter	\$58.			
SONOTONE	DM10-500	Omni.	Dyn.	Polyester	Zinc	Satin Chrome	200	40-18k	152	—	15	None	5 x 1 1/16	8	—	\$24.50			
	DM20-550	Omni.	Dyn.	Polyester	Zinc	Satin Chrome	200	40-18k	156	—	15	None	4 3/8 x 1 3/16	5	—	\$25.50		On-off switch.	
	CDM-80	Card.	Dyn.	Polyester	Zinc	Satin Chrome	200,50k	80-10k	155	—	15	None	5 1/8 x 1 1/4	6	—	\$43.50		As above plus front-to-back rejection of 16-20 dB.	
	CM-10A	Omni.	Ceramic	Alum.	Zinc	Satin Chrome	2 meg.	40-12k	156	—	8	Phone	5 x 2 1/8	7.5	—	\$18.40			
	CM-1050-WR	Omni.	Ceramic	Alum.	Zinc	Satin Chrome	250k	40-10k	160	—	8	Phone	5 x 1 1/16	7.5	—	\$19.45		High capacity "low" impedance ceramic.	
	CM-1050-WR	Omni.	Ceramic	Alum.	Zinc	Satin Chrome	250k	40-10k	160	—	8	Phone	5 x 1 1/16	7.5	—	\$19.45		High capacity "low" impedance ceramic.	
SONY-SUPERSCOPE	C-37A	Card.	Cond.	Polyester	Stainless Steel	—	50,250	30-16k 2.5	—	—	30	None	7 11/16 x 1 7/8	19 1/2	Std.	\$295.		Pattern convertible to omni.	
	F-96	Omni.	Dyn.	Polyester	Alum.	—	600,10k	50-10k	—	—	—	Phone	5 x 1	8	—	\$17.50		Plastic stand.	
	F-121	Card.	Dyn.	Polyester	Stainless Steel	—	50,150, 10k	50-12k	151.8	—	—	Cannon	7 x 1 1/2	8	Std.	\$99.50			
SYNCRON	AU79	Card.	Cond.	Mylar	Alum.	Beige	50,200	40-20k 3	142	Spec.	20	None	9 3/4 x 1 7/8	23	Std.	\$169.50		Transistorized, self-contained battery powered.	
	S-10	Omni.	Cond.	Mylar	Alum.	Beige	50 to HiZ	40-20k 3	-53dB	Cannon	20	None	7 3/8 x 7/8	9	Adapter	\$240.		As above.	
TRUSONIC	C-3	Omni.	Cond.	Mylar	Alum.	Satin	see last column	20-20k	-40dB	BNC	50	Cannon XL	7 1/2 x 1 1/16	1.5	Adapter	\$190. system		No polarizing voltage — tuned RF circuit. Convertible to lavalier. Smallest condenser made. Cathode follower output or plug-in transformers for 50,250, 600 ohms.	
	500	Omni.	Cond.	Mylar	Plastic with copper shield	Satin	see last column	20-20k		BNC	None	Cannon XL	—	1	Lavalier	\$575. system		FM transmission wireless. Continuous tuning 40-50 MHz. S/N better than -60 dB. Has AFC — adjustable squelch, monitor output, level adjust, telescoping antenna — output as above.	
UNIVERSITY	5020	Super-Card.	Dyn.	Unilar	Alum.	Satin Chrome	200,20k	25-17.5k	147	Amphenol	15	None	8 3/16 x 2 3/16	—	Adapter	\$94.95		Golf-ball type.	
	6000	Card.	Dyn.	Unilar	Alum.	Chrome and Black	150	50-15k 4	151	None	15	None	3 11/16 x 1 1/16	5	Adapter	\$66.25		Miniature lavalier — Neck cord included.	
	8100	Card.	Dyn.	Unilar	Zamak 3	Chrome and black	250,20k	70-15k	154	Cannon	15	None	6 3/8 x 1 23/32	—	Adapter	\$63.25		Shock mounted. Built-in on-off switch.	
	1050	Card.	Dyn.	Unilar	Zamak 3	Silver Grey & Black	50, 200, 20k	30-16k	147	Cannon	18	None	10 3/8 x 1 3/4	—	Adapter	\$144.25		Shock mounted. Supplied with on-off switch and swivel adapter.	
	2000	Omni.	Dyn.	Unilar	Zamak 3	Silver Grey & Black	50,20k	50-14k	143	None	15	None	6 x 1 1/2	—	Adapter	\$44.75		Can be used as lavalier. Comes with stand adapter.	
VEGA	20	Omni.	Cond.	Mylar	Alum.	Black Vinyl	—	10-20k 2.5	157	None	20	Cannon	5 x 7/8	6	Std.	\$185.		Switchable impedance. Switchable low-frequency filter.	
	22	Omni.	Cond.	Mylar	Alum.	Black Vinyl	—	10-20k 2.5	157	None	26	Cannon	5 x 7/8	6	Std.	\$315.		As above — includes 2 mikes and dual power supply.	
	40	Omni.	Cond.	Mylar	Alum.	Matte Beige	—	10-20k 2.5	157	Cannon	20	Cannon	6 x 7/8	7	Std.	\$240.		As Model 20.	
	Mike	Omni.	Dyn.	Mylar	Alum.	Grey Enamel	—	80-14k	140	None	—	—	5 x 1	7 1/2	Lavalier	\$546.		Wireless microphone — Includes receiver.	



THE NEW

# action!

MICROPHONE!



## UNIVERSITY'S NEW SUPER CARDIOID DYNAMIC MICROPHONE

From a soft, sweet ballad to the dynamic, vibrant discotheque . . . you get ACTION with the new University 5000! No feedback problems — no sound of rustling clothes — any way you use it, the 5000 delivers only the music not the noise! The super cardioid wide-angle pattern of the 5000 is designed for ACTION — ideal for the modern day performer, small combo, singing group and all "sound-on-the-go" applications. Try this action microphone at your University Franchised Dealer today. Toss it around — talk to it — sing to it — you'll know it's your kind of mike!



**MODEL 5000**  
With wired-in  
15 foot cable  
and SA-10  
Stand Adaptor.

**MODEL 5020**  
Complete with  
SA-10 Stand  
Adaptor, 15 foot  
cable.

**MODEL 5050**  
Switch and  
Swivel  
Stand Adaptor,  
15 foot cable.

**SPECIFICATIONS:** Frequency Response: 25 to 20,000 Hz ■ Impedance: Variable, 200 and 20,000 ohms (wired at the plug.) ■ Sensitivity Rating: -147 db (EIA) ■ Output Level -200 ohms: -54 db/ 1 mw/ 10 microbar. 20,000 ohms: 13 mv/ 10 microbar ■ Dimensions: 2 3/16" max. dia., 9 5/8" max. length (Model 5050) ■ Shipping Weight: 2 1/2 lbs. ■ Finish: Satin Chrome.



LISTEN—UNIVERSITY SOUNDS BETTER

**UNIVERSITY SOUND**

A DIVISION OF LTV LING ALTEC, INC.  
9500 W. Reno Oklahoma City, Oklahoma 73101

Circle 136 on Reader Service Card

# HEADPHONES—14



KNIGHT



BEYER



SUPEREX



KOSS

See Ad on Page No.

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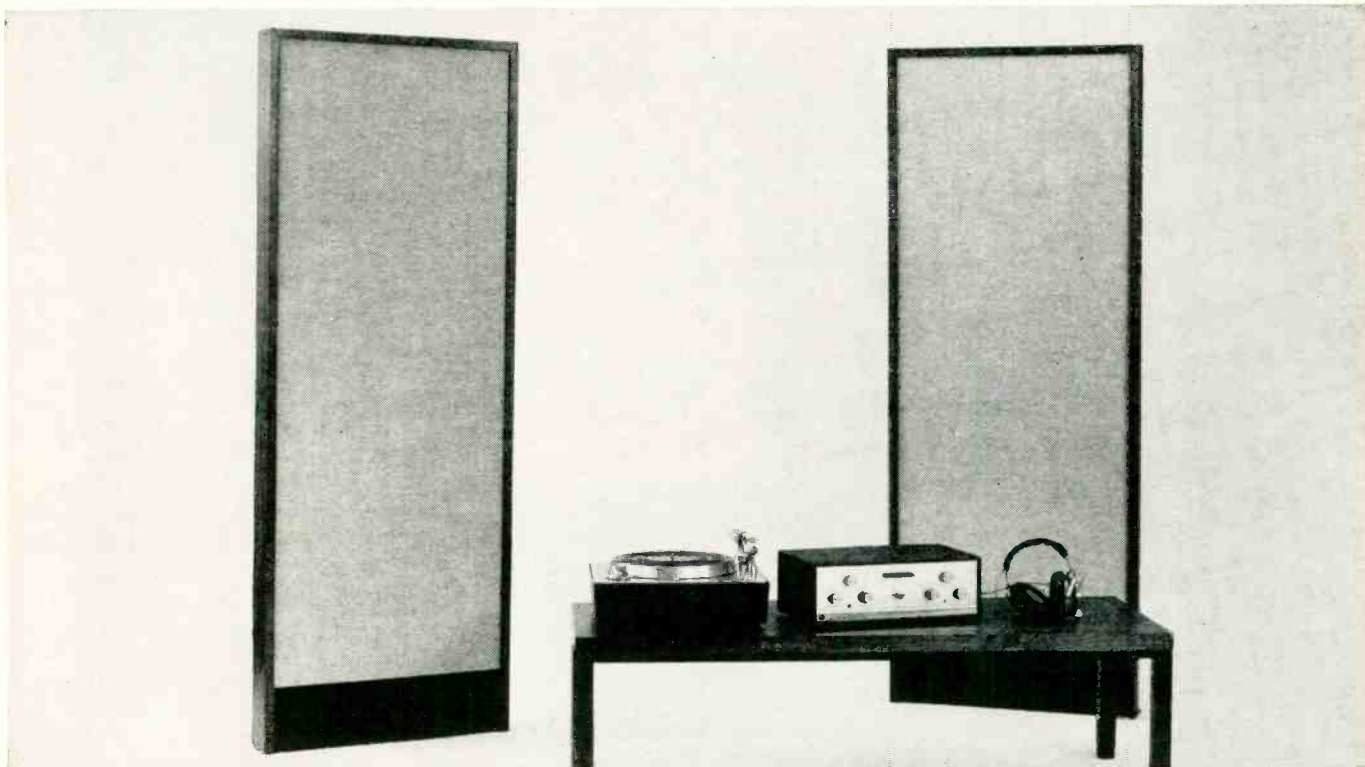
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Manufacturer	Model	Type	Freq. Resp. Hz	Impedance ohms	Sensitivity mW	Max. Output dBm	Max. Input W	Distortion %	Plug Type	Cord Length ft.	Weight oz.	Price	Special Features
AMPEX	140	3 1/2" dyn.	10-15k	4-16	—	120	2	—	std. stereo	8	19	\$36.95	Adapter cable supplied.
	141	3 1/2" dyn.	10-15k	8	—	120	7	—	std. stereo	10	19	\$46.95	Adapter cable supplied volume/balance control.
BEYER	DT-48	dyn.	16-18k ±1 db	5	5	114/mW	0.4	0.5	two std. plugs	5	12	\$79.50	Accessories: TR48 transformer for 600-ohm line, \$17.40; UG-8U speaker/phone switchover box, \$7.75; cup or flat cushions.
KNIGHT	KN878	dyn.	20-16k	4-8	—	—	1	1	std. stereo	8	14	\$ 9.95	
	KN876	dyn.	16-16k	3-16	—	—	1	1	std. stereo	8	16	\$19.95	
KOSS	KO-727	dyn.	10-15k	4	—	143	10	<1	std. stereo	8	15	\$34.95	Fully adjustable; removable cushions.
	PRO-4	dyn.	30-20k	50	—	120	1	<1	std. stereo	8	19	\$45.00	Fluid-filled cushions.
	SP-3X	dyn.	10-15k	4	—	143	10	<1	std. stereo	8	15	\$24.95	Extremely sensitive.
	SP-5NS	dyn.	10-15k	5, 3 and 100	—	143	10	<1	std. stereo and 2-cct	8	15	\$24.95	Switched lavaliar for dual mode.
	SP-5SM	dyn.	10-15k	5, 3	—	143	10	<1	std. stereo	8	15	\$24.95	For use with electronic organs.
LAFAYETTE PIONEER	F-767	dyn.	30-15k	8	—	—	—	—	std. stereo	6	11 1/4	\$11.88	Foam ear pads; includes overload junction box.
	SE-21	dyn.	30-18k	16	—	—	0.125	—	std. stereo	6'4"	14	\$18.00	2-way system with level control.
	SE-2p	dyn.	25-16k	8	—	—	0.5	—	std. stereo	6'4"	14	\$15.00	
SHARPE	HA-660 PRO	dyn.	15-35k 20-20k ±3 db	8-16 or 500	110 4.3V.	110	2	<1	std. stereo	10	25	\$60.00	Guar. freq. resp. to specs; fused circuit protects drivers; vol/bal. controls on each cup; tinsel cables.
	HA-10A	dyn.	15-35k	8-16	115/1.0V.	130	2	<1	std. stereo	10	24	\$43.50	New headband assembly.
	HA-8A	dyn.	20-16k	8-16	120/1V.	135	2	<1	std. stereo	6	16	\$24.50	Lightweight.
	CM-4	dyn.	20-14k	8-16	120/1V.	135	2	<1	std. stereo	6	12	\$14.50	Super-lightweight; inexpensive.
SUPEREX	ST-PRO	dyn./cer	40-22k	16	30	125	2		std. stereo	7	15	\$50.00	Soft vinyl foam-filled pads; 2-way — tweeter is ceramic.
	ST-M	dyn./cer	40-18k	16	20	125	2		std. stereo	7	15	\$29.95	
	ST-S	dyn.	40-15k	16	20	125	2		std. stereo	7	14	\$24.95	Soft vinyl foam-filled pads.
	SX-700	dyn.	40-15k	16	15	110	0.5		std. stereo	7	6	\$22.95	
	SX-300	dyn.	40-14k	12	10	110	0.5		std. stereo	7	7	\$14.95	
SONY/- SUPERSCOPE	DR-3A	dyn.	40-10k	8 or 10k	10	100	1	1	std. stereo	10	10	less than \$22.50	
	DR-3C	dyn.	40-10k	8 or 10k	10	100	1	1	std. stereo	10	10	less than \$27.50	
TELEX	Adjusta-tone	dyn.	10-15k	3-16	100/mW		10	<1	std. stereo	8	12	\$15.95	Light weight; foam cushions 3 1/2-in. soft cone spkrs; will adjust sound in head or out front, depending on position.
	ST-10	dyn.	16-15k	3-16	95/mW		2	<2	std. stereo	8	10	\$24.95	
	ST-20	dyn.	16-15k	3-16	95/mW		2	<2	std. stereo	8	11	\$29.95	Channel control built into each ear cup.
	Serenata	dyn.	20-20k	3-16 also 600	92/mW		2	<0.5	std. stereo	8	16	\$59.95	Tone control; removable cord; headband pressure control; resistor network; all new transducers.



*"The finest stereo reproduction that it has ever, and anywhere, been my good fortune to witness . . . the new system is some five years ahead."*

Percy Wilson, *The Gramophone*, September 1965



**In every field there is always one name that is associated with the finest**



## Acoustech

Solid state amplifiers, kits, and electrostatic loudspeaker systems "... the most nearly perfect amplifier it has ever been my good fortune to come across . . ." *The Gramophone*. "... outclasses all its vacuum-tube competitors and even more its transistor competitors. Never in fact had we heard with so much pleasure as with this amplifier, the best recordings of our record library." *Toute l'Electronique*, France. These are just examples of the acclaim that has greeted the extraordinary Acoustech solid state amplifiers. Acoustech equipment is available factory wired or in kit form at all price ranges from moderate right up to the matchless Acoustech X electrostatic loudspeaker/amplifier system.



## Koss Stereophones

The name "Koss" is synonymous with quality stereo headphones. There are more Koss phones used with fine home music systems than all other stereophones combined. This unquestioned leadership is the result of the highest standards of design and production. Shown here is the renowned PRO-4 professional headset. Engineered to meet the most rigid requirements, it incorporates high quality drivers in acoustically designed enclosures which furnish an unusually smooth frequency response.



## Rek-O-Kut Turntables and Tone Arms

For over 25 years, Rek-O-Kut has been the standard with which other turntables are compared. Broadcasting stations, recording studios, and similar professional users have automatically selected Rek-O-Kut for their most demanding requirements. For this reason, the serious music lover with a large record collection has found that a Rek-O-Kut turntable and tone arm is the surest way to safeguard his investment. Rek-O-Kut equipment is available at varying price levels from the moderately priced R-34 to the professional B-12GH shown here.

Acoustech, Koss and Rek-O-Kut are all divisions of:

# KOSS ELECTRONICS, INC.

2227 N. 31ST STREET, MILWAUKEE, WISCONSIN 53208

In United Kingdom and Continental Europe write: Koss-Impetus, 2 Via Berna, Lugano, Switzerland

Circle 137 on Reader Service Card

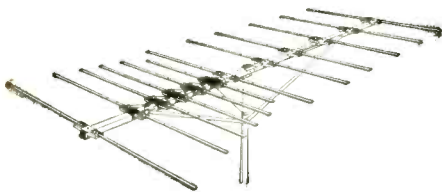
# MISCELLANEOUS—SECTION 15

## FM Antennas

THE FINNEY COMPANY

### FM Antennas

**FINCO Model FM-4G Broadband** (88-108 mc) Twin driven, wide-spaced, 6-element, 300-ohm antenna with very high front to back ratio. Up to 9.6 dB gain across FM band. Pre-assembled with snap-out self-aligning elements. 7'9" square boom, 55 1/2" turning radius. Gold Corodized. Price—\$24.90.

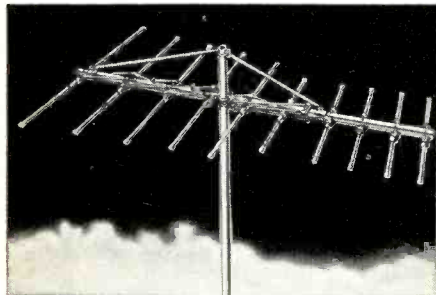


**Finco Coaxial Cable Kit, model 7512-AB** is an outdoor matching transformer, indoor matching transformer, complete weatherproof fittings, mounting hardware. All that is needed is standard RG 59U 75Ω cable. Thus, a system may be established that helps to eliminate multipath pickup, mismatch due to gutter proximity, and line loss due to weather. Price—\$8.95.

**FINCO Model FMSL "Stereo Log Broadband"** 10 elements with 5-element multiple drive, 4 directors, 1 reflector, narrow pattern. Up to 11.0 dB gain. Same size as FM-5. Price—\$39.95.

**FINCO Model FMSL-12.** As above, but with 12 elements; 6 directors, 1 reflector; up to 12 dB gain. 13" square split boom with tube supports, 87" turning radius. Price, \$49.95.

**FM Band-Pass Filter, FINCO Model 3007.** Passes only FM band frequencies with less than 1 dB loss. Effective in eliminating interference to FM reception caused by TV, radio amateurs, CB, auto ignition, fluorescent lights, etc. Price—\$6.95.



JFD ELECTRONICS

### FM Antennas and Accessory Equipment

**Model LPL-FM10 Log Periodic FM Antenna.** Ten elements, including 5 driven cells and 5 co-linear directors provide gain up to 41% better than the best 10-element Yagi. Narrow beam width of 37.50 and front-to-back ratio of 26 dB, coupled with a VSWR of 1.5:1, gives superior performance. Gold-anodized protective finish. Impedance, 300 ohms. Price—\$49.95 list.

**Model FT-1 FM Signal Booster, Outdoor type.** Separate s/s ruggedized amplifier may be mounted on antenna boom of mast; powered by low voltage through lead-in wire from indoor power supply. Provides output for two FM tuners at gain of 16 dB and noise figure of 5.3 dB. Maximum input signal, 45,000 microvolts; maximum output signal, 292,500 microvolts. Price—\$34.95 list.

**Model EF-1 FM Signal Booster, Indoor type.** Transistor amplifier with output for 1 300-ohm tuner, provides extra signal required for stereo multiplex reception. Price—\$17.95 list.

All-Directional FM "S" Antennas. Three models: AFM400, with roof mount kit, \$11.95 list; AFM450, with add-on kit for existing TV antennas, \$6.95 list; AFM475, same as AFM450 plus 50 ft. 300-ohm lead-in and standoffs. Price—\$8.95 list.

JERROLD

### FM Antennas

There are three Paralog FM antennas with up to 11.6 dB of gain. They are

excellent for FM stereo; they minimize multipath distortion. For best match they should be used with coaxial cable. Prices range from \$29.95 for the FMP-8, \$39.95 for the FMP-10, and \$59.95 for the FMP-16. In addition Jerrold has a diversified line of other antennas for FM providing needed gain or directivity to suit specific requirements.

## General

### ACOUSTIC RESEARCH

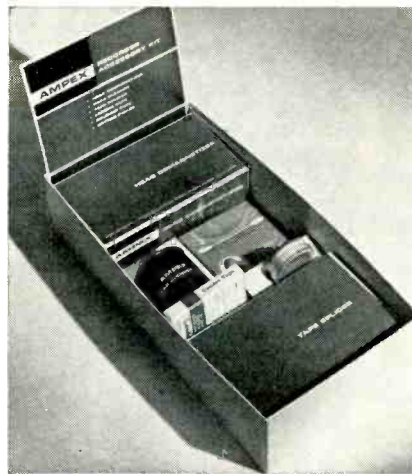
**Speaker Stand**  
2-shelf stand, 29" high x 30 1/2" wide, in mahogany, birch, walnut, cherry. Un-assembled. Price—\$30.00

**Speaker Base**  
11" high, in oiled walnut or unfinished. Price—\$7.50

**Needle Force Gauge**  
Balance-type gauge, with weights to 1/4 gm. Accuracy within ± 5%. Price—\$1.00

### ALTEC

**Bass Energizer**  
Requires no additional power. Effective below 150 Hz. Full efficiency is realized at 60 Hz and below. In effect then, this device increases low frequency response for any high efficiency speaker system.



AMPEX

### Blank Recording Tapes

500 Series: Regular Oxide; 600', 900', 1210', 1800', and 2400' lengths, 0.5 to 1.5-mil Mylar. Prices—\$2.65 to \$9.50.

Slow-speed Recording Oxide; 1200', 1800', 2400' lengths, 0.5 to 0.5 Mylar. Prices—\$4.75 to \$10.75.

900 Series: ranges from 150' 1.5-mil reel at 65¢ to 2400' 0.5-mil reel at \$7.95, in both Mylar and acetate bases. Other lengths are: 225', 300', 600', 900', 1200', and 2400'.

**Recording Accessory Kit.** Includes head demagnetizer, head cleaner, tape splicer, splicing tape, leader tape, and cotton swabs. Price—\$22.50.

**Slide Projector Actuator, Model 100.** Designed for use with Amplex 2000 and 1100 tape recorders and major makes of automatic 35-mm slide projectors. Price \$12.95. Adds music and narration with automatic slide changing for slide shows. AUDIO DEVICES

### New Formula-10 All-Purpose Audiotape

This new-formula Audiotape offers numerous advantages and improvements in magnetic performance. Above all, they are completely compatible, permitting easy interchangeability without making machine adjustments.

### New Formula-15 Low-Noise Audiotape

This new "low-noise" Audiotape is unique in that it not only provides excellent low-noise characteristics, but also does not sacrifice those characteristics necessary for critical professional recording. Prices—on application from dealers and distributors.



AUDIO ORIGINALS

### Component Cabinetry

Large selection of shelf-type and floor-standing equipment and speaker cabinets in many popular styles and finishes. Prices range from \$79.50 to \$329.95. BENJAMIN

### Cover/Base

Model CB-1 is designed for the Miracord 40/50 series turntables. It is an oiled walnut base with plexiglass cover that is hinged directly to the base. The changer may be operated with the cover closed. Price—\$19.95.

**Model TL-1** is a cuing device for the Miracord 40 series turntables. It is easily added and facilitates the lowering of the stylus into any selected groove of a record. Price—\$12.50.

### ELECTRO-VOICE

#### XT-1 Stereo Mixer Transformer

Combines stereo channels to mono for center channel or remote mono loud-speaker. Price—\$60.00.

**KDGA Aristocrat Enclosure Kit.** Walnut exterior, folded-horn kit, for 12-in speakers and "building-block" mid- and high frequency speaker combination. Size—29 1/2" high x 19" wide x 15 1/2" deep. Price—\$60.00.

**KD10 Equipment Enclosure Kit.** 29 1/2" high x 21" wide x 18 1/4" deep, with adjustable shelf for electronics; lift top and front-opening doors. Price—\$75.00.

**BB1 VHP Building Block Kit.** Includes T35 tweeter, X36 crossover network, wiring harness, and AT37 level control. For use with high-quality 16-ohm woofers. Price—\$44.00.

**BB4 Midrange Building Block Kit.** Includes T25A driver, X8 crossover network, wiring harness and AT37 level control. Price—\$108.00.



BARZILAY

### Component Cabinet Kit, Model 1B

Consists of 1 equipment cabinet kit and two speaker enclosure kits in oiled-walnut finish. Assemble in 4-6 hours, using only Phillips-type screwdriver. Prices: \$299.00 complete. Equipment cabinet only, \$179.00; Speaker pair, \$120.00. Other kit and assembled designs available.

CBS LABS

### Test Record—Seven Steps to Better Listening.

Includes L-R identification, speaker phasing and balance, tone-control setting, buzz and rattle identification, and tracking study. Requires no instruments or technical knowledge. Detailed operating booklet by E. T. Canby is included. Price—\$5.00. COMPUTRON

### Basf Tape

Basf tape represents a complete line of magnetic recording tape. 1.5, 1, and 3/4 mil tapes are available in all popular sizes. Backings offered include tensilized polyester and polyvinyl chloride—trade named Luvitherm. During production this material is pre-stressed, giving the tape excellent mechanical properties.





AR-2\* (new model of the AR-2)—\$89 to \$102



AR-2a\* (AR-2\* plus super-tweeter)—\$109 to \$128



AR-3—\$203 to \$225



AR-4\* (new model of the AR-4)—\$51 to \$57 depending on finish

[Speakers are shown with grille cloths removed.]

## why **AR**<sup>INC.</sup> guarantees its speakers for 5 years (covering all repair costs, including freight):

1. *It's fair.*
2. *It's good business.*
3. *It keeps our quality control department on its toes.*
4. *Because of #3, it doesn't cost us very much.\**

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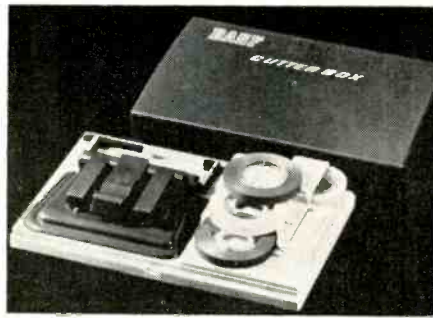
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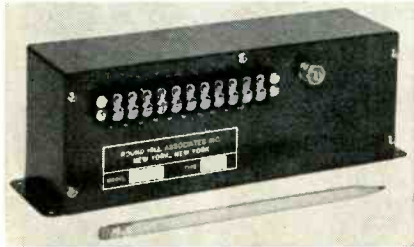
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ROTRON

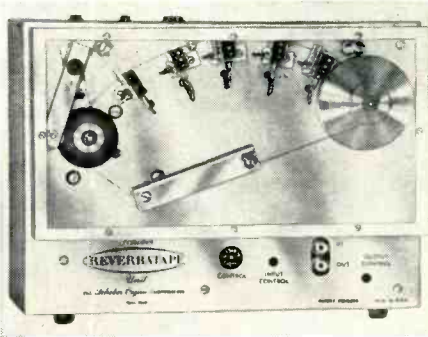
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(Continued on page 98)

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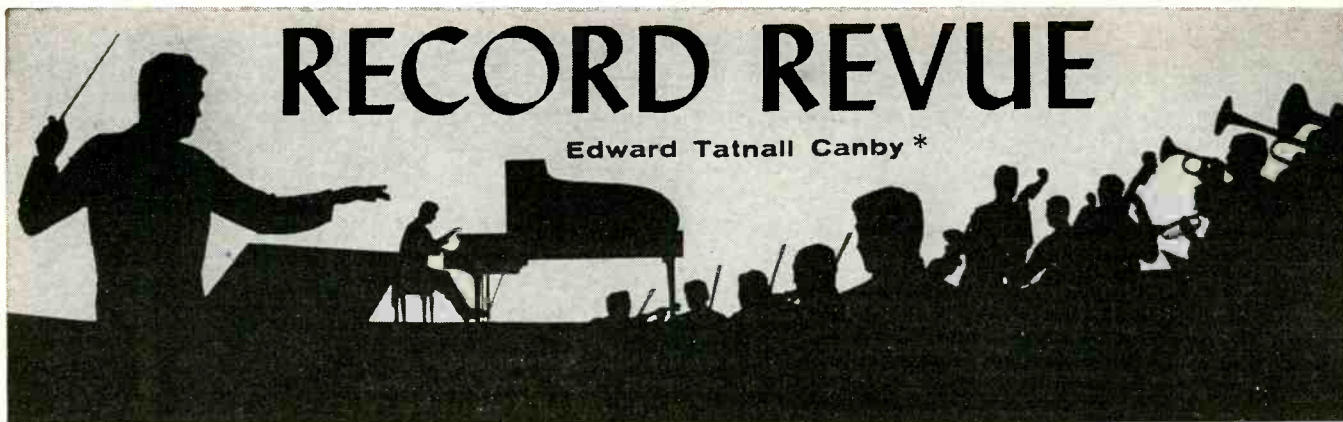
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# RECORD REVUE

Edward Tatnall Canby \*



## MODERN AS THE DAY

Charles Ives: *Symphony No. 1; The Unanswered Question; Variations on "America"* (orch. Wm. Schuman). Chicago Symphony, Morton Gould. RCA Victor LSC 2893 stereo

This is the first recording of Ives' First Symphony and a first hearing for most of us who have heard a good many of those weird orchestral movements such as "The Unanswered Question".

Good reason—this was, at least in part, Ives' "home work," at the tiny Yale Music School, for that indomitable old pioneer of American conservatism, Horatio Parker. Parker didn't much like young Ives' wild ideas (nor did many another—until day before yesterday) and so, perhaps, this symphony is deliberately toned down to near-conventionality for the sake of a passing grade in the course. The time—1898. The music wasn't performed by any well known orchestra until this performance in Chicago, dating from 67 years later.

Well, I've always thought that Charles Ives was the sort of pioneer genius whose music, forecasting so much that came later, (also inextricably *hindcasts*, so to speak, an indigestible quantity of what had come earlier—the whole mixed into an interesting but unresolved mass of sound, in no style whatsoever nor of much consistency. Doesn't matter—we love Ives for what he is, zany or no.

So he turns out to be in this early Symphony. It "steals" from everybody then on earth, hodge-podge, fancy-free, and most of all from such now-conservative Europeans as César Franck, Dvorak, even Mahler. In a few words, the Symphony is outrageously bad in a very original way, preposterously overblown, long-winded and yet sweet as only the honest work of a talented student can be. Sort of fun, if you can stick it out to the end! But, definitely, no Masterwork to bow down before.

As for the Variations on "America," they are a real fright—you don't know whether to laugh or to cry. Was William Schuman serious, or tongue-in-cheek, in this orchestration of the original organ work? Blasphemy is the only word—or so it would be if this, say, were the "Star Spangled Banner" instead of its unofficial sister-anthem. Outrageous, again, and musically just plain dreadful garbage—but in an original and entertaining fashion. (That is, if you don't mind nose-thumbing "My Country 'Tis of Thee".)

Don't please DON'T listen to Ives solemnly, worshipfully—*ever*. Too many people do. He was an old musical curmudgeon, persnickety and yet lovable. If you'll just take him that way, he'll do very nicely as America's First Modern Genius.

Varèse: *Amérique*. Milhaud: *L'homme et son désir*. Honegger: *Pacific 231*. Utah Symphony Orch., Abravanel.

Vanguard VDS 71156 stereo

Terrific modern show-piece, this record! Varèse, who died last fall an elderly man, was another of those pioneer musical curmudgeons like Charles Ives, who combine incredible foresights into the future with a liberal dose of easy-going old-fashionedness. But Varèse was born French (later an American citizen) and instead of flouting the Yale Music School, like young Ives, he got himself more or less tossed out of the august French Conservatoire, after outraging such as Saint-Saëns and Fauré ("the old goats," I think I heard Varèse refer to them affectionately, a few years ago.)

Varèse came to the U.S. in 1922 and this enormous piece, Side 1 on the record, was his "first impression." Phew! Some impression! It surely forecast plenty of the later Varèse, complete with the usual astounding battery of percussion and the inevitable fire siren, here a relatively docile tenor model. If you've heard "Ionisation", from the Twenties, or "Déserts," his big stereo tape work, out of factory noises, done in the '50s, you'll spot the familiar earthquake sounds here too.

But this earlier Varèse music is longer-winded. It has less real concertation and, relatively speaking, somewhat more of the old-fashioned sound to it than the later works. *Relatively*—mind you. If you want 23 minutes of sound and fury for your hi-fi speakers, unbroken, here you have all the noise you ever could ask for! Fabulous.

Milhaud's "Man and His Desire" of 1918 uses a vocal quartet and an exotic array of standard instruments for another of those Brazilian-style extravaganzas that came out of his early visit to South America. The voices mouth wordless yowls; the orchestra purveys the familiar mixture of jungle sounds and Parisian cafe music that was Milhaud's specialty in those heady days right after World War I. Like its musical partner, "La Création du Monde," this piece was for a sort of super-ballet, and performed by an unlikely ballet company—from Sweden! Some mixture.

Honegger's rather tired old steam locomotive is having a sudden antiquarian revival lately (*Pacific 231* is an engine, in case you didn't know). After Milhaud and, especially, Varèse, it sounds awful tame.

Stravinsky: *The Rite of Spring*. Four Etudes for Orch. Orch. Nat. de la T.R.F., Pierre Boulez. Nonesuch H 71093 stereo

It's not often that a major orchestral work finds an outstanding performance on a "small" label—but here's a case in point. This ranks tops, and would on anybody's label.

Not so much because of any orchestral superiority. The French Radio Orch. is just a typical bad-and-good-mixed French orchestra of the upper grade. What matters here is the interpretation, which is by the dynamic young French modernist composer Pierre Boulez—he of the *musique concrète* taped music and much else of a super-advanced sort.

The Boulez touch is simply that the now-familiar "Le Sacre," the Rite of Spring, is shorn of the last of its old-fashioned Romantic qualities—which are often emphasized in recordings by standard symphony orchestras—and comes forth a much more modern piece than usual.

Oddly enough, this seems to make it seem *less* radical, easier to understand. For, here, instead of radical music as of 1913 we have conservative-modern as of the 1960's! Well worth trying in case you have been listening to the piece in somebody else's recording.

Stravinsky: *Agon*

Schuller: *Seven Studies on Themes of Paul Klee*. Boston Symphony, Leinsdorf.

RCA Victor LSC 2879 stereo

Stravinsky's "Agon" is a nicely balanced work—just teetering on the edge of his "last period," having to do with his own individual brand of serial or twelve-tone technique, yet still clearly and easily related to the great corpus of middle works which are now so comfortable for our ever more modern ears. (Time does move on.)

As for Schuller, he is now the most energetic leader of our younger composer-conductors, a man who confidently, even impetuously, wades into any sort of music going, including "third stream" jazz. His ingeniously mechanized little sketches after Paul Klee's decorative pictures are miracles of instrumentation—small-scale yet intricate, ultra-sharp-edged. For many a listener they'll seem pretty cold and calculated—but that is no more than today's way of "talking", so to speak. The program aspect helps, for there is a direct relation between the Klee designs and the Schuller musical patterns. One of the Klees is beautifully reproduced on the album cover, by the way.

Good to have some solid contemporary like this from RCA and Boston. Columbia has had too much of a monopoly on such things, lately.



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Four British Composers. (Bennett, Goehr, Davies, Williamson). Soloists, Members the Melos Ensemble Carewe.

Odeon ASD640 stereo  
(via Capitol)

If you were thinking Great Britain was lost in the fuzzy musical past, this one might bring you around with a sort of a jolt. And yet—it is very traditional in a British way, even so, the music is based mainly on the choral writing which the English love. Alexander Goehr, born 1932, contributes a pair of almost savage choruses, very Viennese—twelve-tone (in a British fashion); Peter Davies (1934) offers a piece for soprano, contralto, and small orchestra; Richard Bennett (1936), the youngest of the group, has an all-instrumental ensemble called a "Calandar," also twelve-tone-like (or maybe twelve-month-like); only the largish "Symphony for Voices" by the ex-Australian Malcolm Williamson, the oldest, is very definitely not serial-based, though it is a heavily serious and complex work, plenty tough to perform.

If you are a choral fan, or if you have liked, say, the works of Benjamin Britten, you will be able to latch onto this younger British generation without too much trouble.

Britten: *Curlew River*. Peter Pears, John Shirley Quirk, et al., Inst. Ensemble directed by B. Britten and Viola Tunnard.

London OSA 1156 stereo

... And here's the old man of British modernism himself in a recent work and a startling one, too—for here he has gone semi-oriental, basing this Christian "Parable" for church performance on an actual Japanese No play. It sounds like No, too, even though nominally there is nothing of the Japanese in the work except the story basis, converted from the Japanese original into an English church play presented by a band of Medieval Monks and their Abbot. Odd effect. Very mysterious, very sacred, very austere and, moving—far removed from the usual sorts of "modern" music, including that by modern Japanese composers of the international school.

Japanese or no, there are familiar Britten landmarks here, such as the opening processional of incoming monks singing Gregorian chant and the recessional of the same monks at the end—see his "Ceremony of Carols" for the same device. Also the inimitable Peter Pears, tenor-baritone of countless other Britten performances. It does sound oriental, but also British-Medieval, and in that respect "Curlew River" lies right in the line of Britten's earlier music for church use.

Medieval English Lyrics. Assorted artists.

Argo ZRG 5443 stereo  
(via London)

If you want to absorb a convincing sound-picture of the reality of Medieval music in England—this is it. Starting with "Sumer is icumen in," around 1240, it goes on through music by Henry VIII himself, composed in 1515 or thereabouts; and the whole is not only done in excellent musical taste but with a modestly quiet scholarship overwhelming in its thoroughness.

One whole section of the big enclosed booklet is given over to the music, another to the old-English texts, and the

skill with which these old poems are presented—down to the last detail of of spelling and sense—is quite breathtaking. There's even a glossary for each separate poem, translating and explaining all the odd words.

You'll need the glossary, and the translations too. Take, for instance, this: "*Edi be thu. heven-quene, folkes frovre and engles blis, maide unwemmed, moder clene, swich in world non other nis. On the hit is ethe sene of alle wimmen thu hast the pris.*" It's that kind of English.

When scholarship of this top sort is combined with a superb musical performance, by assorted instruments and a brace of excellent male singers, you can't go wrong.

Organized Sound by Tod Dockstader: *Quatermass* (1964).

Owl Records ORLP 8 stereo  
(1129 University Ave.,  
Boulder, Colo.)

This huge, many-movement work of tape music, three quarters of an hour long, strikes remarkably close to our own readership—for the composer is a working recording engineer in New York City and does his tape composing in his spare time on conventional studio equipment of the simplest sort, relatively speaking—just a few recorders, a serviceable oscillator and some mikes to take down the brief "live" sounds that are used, together with oscillator-produced electronic sounds, as the basis for the whole structure of this and other Dockstader works. There are three whole records of them, all released tastefully and impeccably by a small Colorado label, Owl.

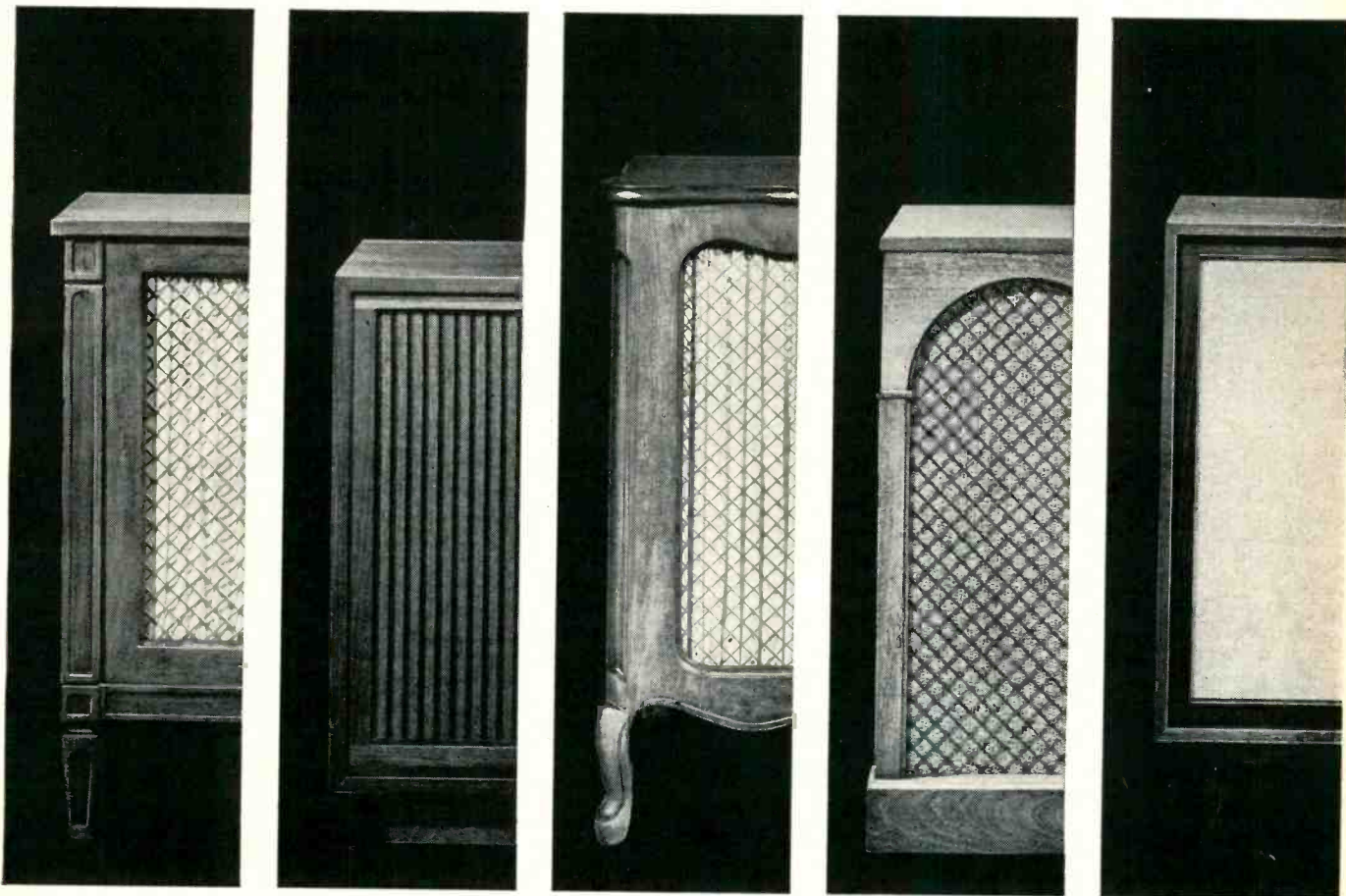
Dockstader, briefly, is strictly an outsider and a loner, as compared with the musical moguls who work via the enormously expensive and elaborate RCA Music Synthesizer, etc., inside University music circles. His background does not include a complete University music course—he is technically "illiterate" from the inside musical viewpoint. But the guy, for my ears, has more sense of music in him than many of the Chosen who do have access to the fancy equipment. An old, old story, this one!

What is good about Dockstader, aside from his superbly clean, systematic engineering technique, is his instinctive economy of means, the basis of any real art. Every one of his works is constructed from two or three tiny basic "ideas"—brief bits of taped sound, treated to a million ingenious transformations and combinations yet always innately recognizable and related. For example, Dockstader says, the sound-source for the whole imposing first movement of "Quatermass", a good ten minutes long, was "just a penny balloon", that is, the squawking sound of air released through its rubber outlet. One of my favorite Dockstadters, on another of these discs, is "Luna Park" (an extinct amusement place once at Coney Island), built mostly out of a little fragment of hysterical human laughter treated to wonderfully humorous transformations.

Like any dedicated, one-track worker, Tod Dockstader is persistent, incredibly so. The first time over, this five-movement monster work will seem pretty heavyweight. But as you begin to hear how he economizes in material, the systematic tie-ins and contrasts—the last movement, for instance, combines motives (i.e. basic sound-bits) from the



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earlier movements—you'll get more and more interested. He is a bit prolix—so was Wagner and even old Bach.

Here we have a genuine "primitive," a very sophisticated one in engineering technique, and he's worth a try even if his stuff isn't the latest in a happening-event, or (oppositely) serio-mathematical numbers structure.

**Ferde Grofé: Atlantic Crossing.** George Mitchell Choir, New Symphony Och. Grofé; Anton Dolin, Ethel LeVane, Narrators.

Everest 3139 stereo

This "completely authoritative and definitive" recording of Grofé conducted by Grofé is no doubt the last word on the particular subject, but I found I could not listen to the stuff. The British might call it treacle; I'd call it monumental corn.

If you like "Manhattan Towers" and such gushful schmalz, or the "Warsaw Concerto," or Muzak in general, this'll go down well with you, complete with crooning choir and reverbed narration, male and female. For my ear, the "Grand Canyon Suite" is 1000 per cent better. And I'm not exactly enthusiastic about *that* one, either, except as an exercise in mood-picture orchestration.

So—if you feel you'll disagree, all you have to do is rush out and buy this. More power to you! Every man to his taste.

**Westminster Abbey's Famous Composers** (Blow, Croft, Gibbons, Purcell, Whyte). Choir of Westminster Abbey, Guest.

Odeon CSD 1603 stereo  
(via Capitol)

In spite of the impressiveness of sheer tradition in Westminster Abbey and the rituals which go on unchanged, century after century, the volatile art of its music keeps changing—even the revivals of the past, like the 16th- and 17th-century music heard here, all works composed and sung in this very same spot. Today's Abbey choir is made up, tradition or no, of today's singers. They aren't necessarily like those who sang in the old days.

Today's singing style, in the big British cathedrals, is curiously out of focus with itself. On the top, there are the typical British boy sopranos, lovely little saint-imps, with their breathy, hooting, piercing sound-production, minus a trace of vibrato. Down below, there are mature basses, well-rounded tenors, and even counter-tenors, who reflect our present-day vocal training for opera—they sing with big, rich, bulbous solo voices, full of a drastic vibrato. The two elements just barely mix, if at all. Odd sound!

If you don't mind this jam-and-peanut-butter sound, you'll enjoy the Westminster music, from the late 16th century onwards, all of its first-rate and veddy British.

**Yaltah Menuhin—Piano Recital.** (Mendelssohn: Vars. Serieuses. Liszt: Two Etudes de Concert. Beethoven: Sonata in B Flat, Op. 22.)

Everest 3146 stereo

Yaltah Menuhin, of the famous Menuhin family, is a skillful, fleet pianist of a (now) slightly old-fashioned sort—that is, she plays with plenty of pedal, poetically, instead of trip-hammer hard, as the young-middle generation pianists,

or self-conscious-droopily, as among the very young who are neo-Romanticists. For most people, Yaltah's sort of piano is good in the listening. Her ear for harmonies and for phrasing, old-fashioned or no, is a good one, which makes the pianistic sense that much easier to understand.

The over-peddalling, though, frankly surprised me; for I did not realize how far we have come away from that once-common sort of piano playing. Maybe it isn't really *over*-pedalling. The effect is abetted by a large reverberation in the hall where the recording was made. In any case—reverb or actual pedal—our piano ears today expect a drier piano sound, out of sheer habit and custom. Maybe Yaltah is a good thing for us.

**Weber: Der Freischütz—highlights.** Streich, Schlemm, Windgassen, Uhde; assorted conductors and orchestras.

M-G-M Heliodor HS 25016 stereo

Strange that this superbly dramatic and musical early-Romantic opera is so sparsely offered in those major hunks that alone can give an idea of its real continuity. Though this album of collected older (D-G) recordings features excellent solo singers, it is mainly a recital of individual numbers, for solo, with virtually no sense of continuity—there is not even an account of the story, to help us place these into the large frame. So it really isn't a true "highlights" album, especially with so many different conductors and recordings. I think better use could have been made of D-G material, even on a single LP.

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## NOSING AROUND . . .

Prokofieff: Stone Flower Ballet. L-Orch. de la Suisse Romande. Varviso.

London CS 6458 stereo

This was one of Prokofieff's last works and it is typical of the later years of his life. Did his powers fail? One feels that his will towards originality and newness did, indeed, fail; he was tired, sick and discouraged, but still prolific.

Oddly, his last music is his most consonant, and most conventional. So—this ballet music is easy enough to hear. But it is also full of Prokofieff clichés, plus a lot too much of the standardized recent-Russian "social-realism" sort of music for my own taste. All in all, it doesn't impress the ear half as much as the violent and dissonant early stuff now being "rediscovered", out of the 1920s.

But don't let me go too far—Prokofieff was a thorough professional and a warm-hearted person. If you've enjoyed any of his music, this is worthwhile listening. Note, by the way, that it includes lovely orchestral versions of several of his little children's Pieces for piano. A marvelous surprise for any child (or adult-child) who has played those little gems.

Purcell: The Fantasias for Viols. Concentus Musicus, Harnoncourt.

Vanguard BGS 70676 stereo

I haven't heard a decent recording of these strange and wonderful short works since the pre-war 78 rpm Purcell Society album of a million years back. Very nice.

The Fantasias are short, contrapuntal-

string pieces for three and four instruments, a few for more, which can be played on the violin family—but shouldn't. Here, they are heard via the proper instruments. It makes a big difference.

Partly, it is a matter of tone. The viols, with flat backs (the violins' are rounded) have a thinner, more nasal tone which is very elegant once you get used to its unusual sound. But much more important is the fact that the viols were played with frets for the fingers, like modern guitars, etc., and so produced little or no vibrato. The violins are played with a non-fretted finger board and the modern fiddler uses plenty of vibrato.

So a "consort" (ensemble) of viols produces a special blend of sound, utterly unlike a string trio or quartet. (Oddly, it sometimes reminds me of an accordion, or a mouth-organ orchestra, for those instruments have no vibrato either.) The gentle, understanding Viennese players do a good job on Purcell, if in a somewhat low-key fashion.

## MORE MISCELLANEOUS

Flagstad-Melchior. Lehmann-Melchior. (Wagner: Kundry-Parsifal duet; Prologue to "Götterdämmerung." Schumann: Five Duets.)

RCA Victor LM 2763 mono

(Treas. of Immortal Performances)

Funny how a record company lives with its past sound. RCA has had to get along with its famed "studio 8H" days of acoustic deadness all through our present times of the Big Liveness.

Here's an even earlier and no less positive RCA era, the great 1930s, when acoustics were quite dead (though not yet "Studio 8H") and soloists were placed "way forward and vastly blown up in volume. (RCA still likes to do that even now—if in a big liveness.) The forward placement, close to the mike, did help project "presence" and personality in a time of lo-fi, lacking highs. Does it here! The singers practically gnash their teeth in your face.

The first side is part of the famous Flagstad-Melchior series with that dismal Wagner conductor (Flagstad's personal accompanist) Edwin McArthur. His orchestra, far in the background in the volume balance, plays as mechanically as an acoustic-style opera band. But what matters is the team of two voices, and they are incomparably fine. The winningest Wagnerian team ever, and for good reason.

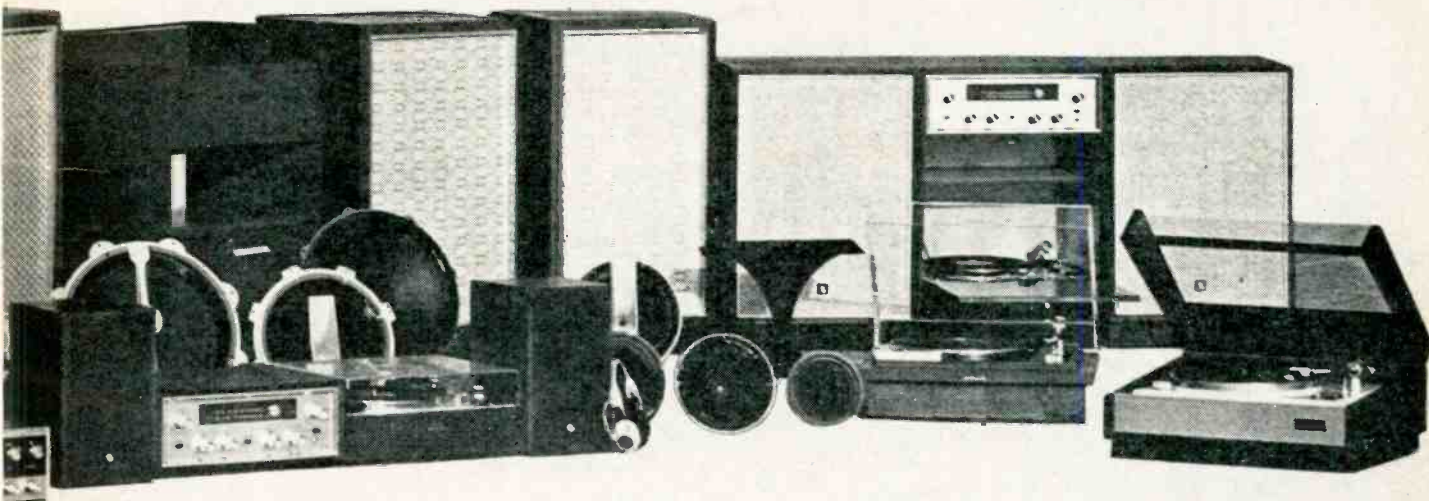
The obverse features the Queen of the German *Lied*, Lotte Lehmann, somewhat incongruously paired here with the big Melchior in what should be a set of rather intimate little Schumann duets to piano accompaniment.

Here, with orchestra, they manage to expand into full-sized operatic duets, rightly or wrongly. Not really very appropriate, though the performances are musical enough, as always with these two singers. The other side of the disc is far more important.

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# The Tape Guide

HERMAN BURSTEIN\*

**I**N THE APRIL ISSUE I invited readers to enlighten us on the use of synchronous motors to drive the supply and takeup reels in tape recorders. To our knowledge, such motors were employed only to drive the capstan. Among several reader replies, there were two extensive letters from Mr. W. D. Tiffany, Stanford Research Institute, Menlo Park, California. Following are extracts from Mr. Tiffany's letters.

*"One manufacturer of high-quality tape recorders, the TEAC Company of Tokyo, has used three hysteresis synchronous motors in its machines for a number of years. TEAC-made recorders that were sold in this country under the Concertone and Concord names. Perhaps the best known is the TEAC 808 (Concertone 505) . . . During the play mode, resistors are placed in series with the takeup and supply reel motors, whose shafts extend through the front panel and drive the reel turntables. During fast forward a relay shorts out the series resistance in the takeup-motor circuit. The resistance in series with the rewind motor remains to provide the proper drag. During rewind the resistance in series with the rewind motor is shorted, while the resistance in series with the makeup motor remains in the circuit . . . While it is true that the torque, (in inch-pounds) varies as the supply and takeup reels go from full to empty, the capstan motor and heavy fly-wheel, together with the 4-pound pressure of the pinch roller against the capstan, prevent discernible speed variation from the beginning to the end of the reels.*

*"During a recent trip to the Far East I visited the TEAC factory . . . I was gratified to note that while a change is being made to solid-state electronic circuitry, the basic deck and mechanical system are, with minor modification and improvement, essentially the same as the older models. . . . It is my opinion that these machines are of semi-professional quality and incorporate simple, straightforward design that is made more attractive by a disinclination of the engineering staff to become preoccupied with complex sub-panel mazes of levers, cams, shafts, and belts. Their adherence to three synchronous motors is . . . well justified by the long trouble-free use that can be obtained from them. . . . I would also think that hum and vibration are greatly lessened by the use of hystere-*

*sis synchronous motors throughout; they are very quiet."*

(I then wrote to Mr. Tiffany: "I must confess that I still don't understand how TEAC manages to use synchronous motors for the purpose in question. A synchronous motor, as I understand, moves at a speed dictated by the a.c. line frequency, or else it doesn't move at all. On the other hand, the supply and takeup motors must be constantly changing speed as the diameter of the tape on the reel changes. How does TEAC get the synchronous motors to move at speeds other than dictated by the line frequency?" Mr. Tiffany replied:)

*"While it is true that industrial or commercial synchronous motors generally cannot run properly unless they can operate at their normal speed, the same is not true of hysteresis synchronous motors. The larger industrial motors usually have d.c. fields, and if they are loaded to the point where they must drop below synchronous speed, the armature begins to slip poles, a very high current surge occurs as each electrical pole slips past the physical poles in the motor, and mechanical protective devices disconnect the motor. Mechanical load capability in these cases is determined by the amount of field excitation and by the current-carrying capacity of the armature and field.*

*"On the other hand, a hysteresis synchronous motor usually has a continuous rotor with no poles of its own in the normal sense, although the rotor does have shallow longitudinal serrations, usually in a long 1/8 to 1/6 turn spiral. Of course, the stator does have the necessary number of poles for the desired rotational speed. These motors might possibly be classed as something between an induction motor and a true synchronous motor. The hysteresis synchronous motors used in turntables and tape recorders can operate at lower than synchronous speed, occasioned simply by a drag load, and they can do this without noticeable 'cogging' as the poles of the electrically rotating field pass the actual poles in the motor. A good example might be found in the telechron motor of electric clocks. These can be lugged down below synchronous speed and will still turn. I have never checked them for the cogging effect, however. My good friend Bob Morrison, in the Test Division of Ampex, suggests that . . . excessive drag (very low*

speed) might cause a 'lunge' if the motor tries to stop altogether. However, I have never experienced this with TEAC motors or with American phono turntables using hysteresis motors. I have frequently tested the inch-ounces of torque in the supply and takeup reels. This is usually done at very low rotational speed, ranging down to no rotation at all, and I have never felt the slightest lunge or cogging at any speed. Moreover, the motors do not become excessively hot. At the same time, the motors used by TEAC in their home and semi-professional models deliver a surprising amount of torque at any speed.

*"I believe the advantage to be gained through use of hysteresis motors is their low inherent cogging and consequent smooth torque at any speed. Thus as the tape moves from supply to takeup reels, a very steady drag is accomplished through a relatively large speed range . . .*

*"A further inherent factor operates in favor of smoothness of torque. You will recall that the supply and take-up motors have resistances in series during the play mode. The resistance in the takeup motor is set for slightly more torque than is the resistance in the supply motor. At this reduced operating voltage and current, any inherent tendency toward cogging is reduced electrically. Finally, the large mechanical impedance wheel of the TEAC with its swinging load arm on the supply reel side of the heads provides a further ironing out of flutter and wow. TEAC claims 0.1 per cent wow and flutter at 7½ ips, and 0.15 per cent at 3½ ips for its Model A-5010. During my visit to the factory I examined the quality check records of one morning's production run, and saw no measured value greater than .08 or 0.13 per cent (at respective speeds of 7½ and 3½ ips) throughout the reel . . ."*

## Cost vs Quality

*Q. I am trying to decide which of two machines to buy. The higher-priced one is specified as having frequency response of 30-15,000 cycles  $\pm 2$ dB, whereas the specs for the other merely state that response is 35-15,000 cycles at 7.5 ips. Does this mean that I should exclude the lower price machine from consideration?*

*A. As you have surmised, the omission of tolerance limits with respect to frequency response suggests that frequency response is not as flat as is desirable. However, this is not the only reason why the higher-priced machine is apt to be preferable. Part of the difference between two grades of tape machine is due to quality control, resulting in conformance to design specifications with respect not only to frequency response but also distortion, signal-to-noise ratio, wow and flutter, etc. The higher-price machine is apt to have better design and materials, giving better performance and protection against the need for repair. On the other hand, the lower-priced machine may be perfectly adequate for your particular needs.*

## Storage

*Q. Should half-track stereo and full-track mono tapes be stored heads out (by rewinding the tape after recording or playing) or tails out (rewinding just before use)? Why?*

\*280 Twin Lane E., Wantagh, N.Y. 11794



A. Tape should be stored with a minimum of stress. If it has been recorded in one direction only, it is undesirable to rewind it at high speed and then store it ready for playing (heads out), because the stresses of high speed rewinding may result in permanent deformation of the tape in the course of storage. Thus tape recorded in one direction should preferably be stored tails out and rewound just before use. On the other hand, tape recorded in both directions may be stored heads out because this does not involve high-speed rewinding prior to storage.

**Deactivating Erase Heads**

*Q. I would like to know how to make the erase head inoperative when I am making recordings on my tape machine (I plan to use a bulk eraser for erasing the tape). Should this be done at the head terminals or at the oscillator within the tape recorder?*

A. The erase heads should be made inoperative at the terminals of the head. However, disconnecting the head will remove part of the load on the tape oscillator, resulting in an increase in bias current to the record head, with consequent treble loss. Therefore you have to arrange a substitute load to replace the erase head. This load should carry the same amount of bias current as the removed erase head.

**VU Meters**

*Q. Can I add a VU meter across the secondary of a microphone transformer?*

A. The signal level would be far too low to drive a VU meter. You require about 1.5 volts to drive the meter, whereas only millivolts are available at the transformer secondary. Two stages of amplification, plus a cathode follower for low-impedance transformation, are needed.

*Q. I am going to install a VU meter in place of the magic-eye tube in my tape recorder. The instructions accompanying the meter state that the input signal which causes the meter to read 0 VU should be 10 dB less than the signal which causes the magic-eye tube to close. Is this correct?*

A. Essentially yes. You definitely want to make allowance for the difference between the level indicated by the meter and the true peak level. Professional tape recorders usually make a 6 to 8 dB allowance for the mechanical lag of the meter. The manufacturer of your meter suggests 10 dB, which is not excessive in view of the fact that the lag can frequently be 10 dB and on occasion can exceed 20 dB.

**CCIR vs. NAB Equalization**

*Q. Can the difference between NAB playback equalization and the CCIR curve used in Europe be compensated through judicious adjustment of bass and treble controls?*

A. NAB equalization begins at 3180 Hz and levels off at 50 Hz, while CCIR equalization begins at 1590 Hz and levels off below the audible bass range. A mild touchup of the tone controls—slight treble cut and slight bass cut—with CCIR equalization to play a tape requiring NAB equalization.

(Continued on page 97)

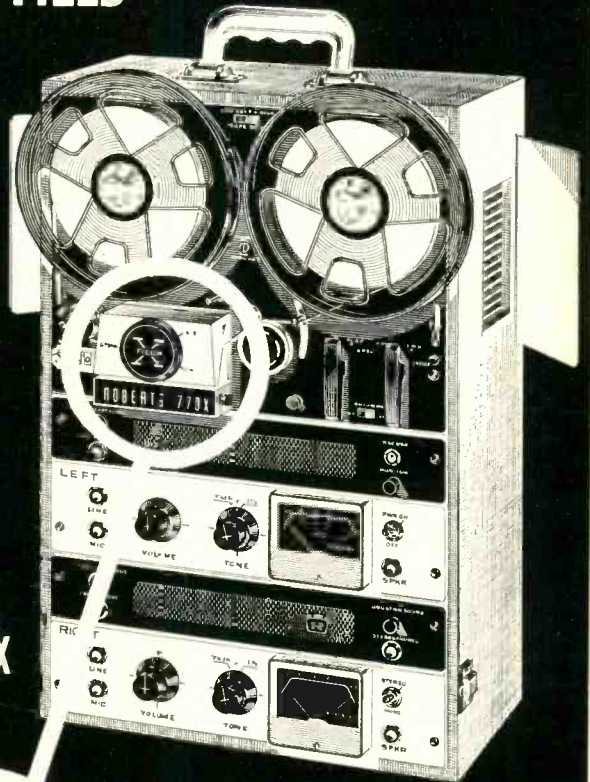
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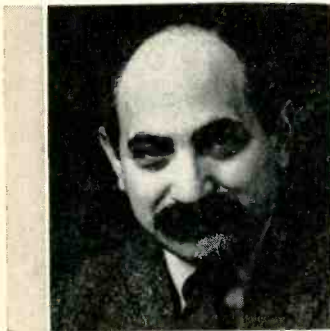


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# JAZZ and all that

Bertram Stanleigh

The Asch Recordings, Volume 1 Blues, Gospel, and Jazz, 1939-1947.

Asch Mono AA1/2

A two-disc collection of material culled from 78's issued on the old Asch and Disc labels. Samuel Charters, who selected the material and contributed the booklet notes, has managed to cover a great deal of ground on the 23 sides that have been brought together on these new platters. The artists include Lead-belly, Champion Jack Dupree, Josh White, Lonnie Johnson, Brownie McGhee, Sonny Terry, The Gospel Keys, Sister Ernestine Washington with the Bunk Johnson Band, Mugsy Spanier, Pee Wee Russell, Omer Simeon, James P. Johnson, Joe Sullivan, Sidney Bechet, Art Tatum, Coleman Hawkins, Stuff Smith, and Mary Lou Williams. And the performances range from excellent to superlative. It's fine to have all of this music back again, particularly on these new transfers that offer a substantial improvement over the old surfaces. A second volume of reissues is announced in the booklet for volume 1. It will be devoted to folk and country releases, an area where Asch was an important pioneer. Let's hope that several additional volumes are in preparation.

Attila Zoller Quartet: The Horizon Beyond.

Emarcy Stereo SRE 66013

Attila Zoller, guitar, Don Friedman, piano, Bruce Phillips, bass, and Daniel Humair, drums, add up to a very serious quartet of questing, deeply introspective experimenters. This is highly intellectual experimentation with deep emotional involvement, but with no commitment to a single performance style. Strict rhythm and precision unison phrases alternate with free improvisation as these young musicians build their highly personal manner of expression. The brilliant recording, crisp transients, and exceptionally fine stereo separation make this release a worthwhile sonic experience.

Louis Bellson: Thunderbird.

Impulse Mono A9107

This album serves to document the exceptional rapport achieved by drummer Bellson and the band with which he played at the Thunderbird in Los Vegas sometime in 1963. The group consisting of Carl Fontana, trombone, Harry Edison, trumpet, Arnold Teich, piano, Jim Cook, bass, Jim Mulidore, baritone, Ed Scarazzo, tenor, and Sam Most, alto, was so pleased with its achievements that they recorded these performances at their own expense. What emerges is some highly polished, keen-edged musicianship. The pace is fast, set by leader Bellson in top form, and it reaches its ultimate in an exciting version of Ellington's *Cottontail*. Is it possible that there

might be more material to come from this recording session?

Franz Jackson and the Original Jazz All-Stars: Good Old Days.

Pinnacle Stereo PLP1095

Here's a group of lively traditional standards performed by a stylish band of real old timers. The collection includes *Snag It*, *Maple Leaf Rag*, *After Hours*, *Asleep in the Deep*, *Lassus Trombone*, and *Under the Double Eagle*, as well as a few less familiar items. The group consists of Franz Jackson, clarinet, Bob Shoffner, trumpet, John Thomas, trombone, Bill Oldham, tuba, Lawrence Dixon, banjo, Richard Curry, drums, and Roselle Claxton, piano. On three numbers, Rostelle Reese, Arthur Reese, and James Herndon take over the trumpet, trombone, and drum assignments. This is real foot tapping, happy New Orleans jazz, recorded in clean, spacious stereo, and it's played by real solid performers.

The Three Sounds: Today's Sounds.

Limelight Stereo LS 86037

Kalil Madi on drums is the new ingredient on the latest offering from this lively trio. His manner is a bit more reserved than that of former member Bill Dowdy, but it must be reported that he fits neatly into the group, and his brushwork is not only a subtle delight, but it has been recorded with particular success. Gene Harris, piano, and Andrew Simpkins, bass, are up to their usual exuberant standard, and the live recording, made in Chicago's London House, has a bright, fresh, well-balanced sound.

The Fugs First Album

ESP Mono 1018

The Fugs

ESP Mono 1028

Down on the lower east side of Manhattan, where the most beat of the country's younger generation congregates, one folk-rock group dominates the scene. They are the Fugs, and their message is one of protest. In most cases they impart their ideas with more fervor than style and taste. But they have a great deal to say, and they manage to project their message with a degree of impact that leaves the rest of the folk-rockers far behind. In addition to releasing a new album that includes the Fugs' big hit, *Kill for Peace*, ESP has reissued the group's earlier platter that was previously out on Broadside. There have been a couple of personnel changes between the first and second waxings, but the sound has the same rough vigor.

Jose Feliciano: A Bag Full of Soul  
RCA Victor Stereo LSP 3503

Folk-rock singer-guitarist José Feliciano combines a rock-blues style with a flashy guitar technique in a collection that is strong in terms of sheer noise and energy, but is rather deficient in variety. Whether Feliciano is singing about love, work, or war, he manages to enunciate the words with clarity, but everything comes out sounding pretty much the same as everything else. The collection includes Bob Dylan's *Masters of War*, Jimmy Rushing's *Going to Chicago Blues*, and the Beatles' *Help!* It is all wrapped up in a brash, juke-box-stereo sound that is tubby in the bass, noisy on both sides, and empty in the center.

Albert Ayler: Spirits Rejoice.

ESP Stereo 1020

"You never heard such sounds in your life," is the new slogan of ESP records, and it's an apt one. ESP is a label that specializes in the far out, and this new release by the Ayler brothers is pretty far ahead of the mainstream. But for all of their highly adventurous experiments, the strained sounds that result from pushing their instruments beyond their natural limits, and the frenzied intensity that the Aylers impart to their performances, their work makes for easy and enjoyable listening. At the core, these compositions are rooted in melodic material that is interesting and easy to follow, and, although they have renounced the concept of strict time, they maintain a rhythm envelope that ties everything together in a unified manner. In addition to Albert Ayler, tenor, and Don Ayler, trumpet, the quintet consists of Charles Tyler, alto, Sonny Murray, drums, and Henry Grimes or Gary Peacock, bass. Call Cobbs' harpsichord is a charming addition to *Angels*. The disc's major composition is its title tune, *Spirits Rejoice*, a hymnlike melody presented in a manner that brings back memories of the old New Orleans marching bands and evokes a mood of childhood nostalgia. The recording, made in Judson Hall by David Hancock, is bright, resonant, and has excellent separation. This is a record that is likely to remain a classic when most of today's *avant garde* has become old hat.

The Marimba from Oaxaca, Mexico.

Folkways Mono FW 8865

A fascinating document that offers two fine groups playing old melodies of this south-eastern Mexican state. Two different instruments and sets of performers are heard. A large instrument, about 12 feet in length, is played by nine musicians, and a 5 foot model is played by a trio. The recordings, made in Oaxaca by Lillian Mendelssohn, were produced under somewhat primitive conditions. The three man band was taped in a hut in the outskirts of Oaxaca, and the sounds of chickens and children may be heard in the background. The larger group was recorded both in a garage and on the local Alameda. All of the performances are lively, clearly the work of superior musicians, and the music itself is delightful.

AE



## IVES

(From page 19)

A. M. material. Because the SCR's now available "over the counter" are designed for use at 60 and 400 Hz, their performance falls off at higher frequencies, and peak limiting is not good above about 8000 Hz. This is not a serious defect with woofers and ordinary speakers, but should be considered with extended-range speakers and tweeters.

SCR's that will respond to much higher frequencies, perhaps as high as 100 kHz, have been announced, and will be available within a few months. These will most certainly protect *any* speaker, using the circuit of Fig. 1.

Life of SCR's, when not overvolted, and when used with the recommended heat sinks, is extremely long, and for speaker protection purposes can be assumed as infinite.

With this speaker protector set at the requisite position for the speaker in use, you can set the volume wherever you please, and listen to any type of material, even the Kesselschmeid waltzes for "Der Höllenlärm," with no worries about speaker damage. Æ

## Audioclinic

(From page 4)

Perhaps your tonearm is not of a high quality. You might be experiencing significant resonances which are excited by the motion of the stylus. These resonances will tend to make the tracking force somewhat unstable during dynamic operation of the system. The variations in tracking force are another way of saying that the stylus motion is influenced, and the result of this must be heard in the final output signal.

Perhaps you have the arm tilted in such a way that it is not truly parallel to the surface of the record. Maybe the cartridge itself sometimes comes into direct contact with the surface of the disc. This contact would cause external noise. Check the height adjustment of your arm. It is possible that something in the arm assembly is bent in such a way that the arm is canted to the left or right.

Perhaps the force you are using to track your records is so great that the cartridge proper is hitting the surface of the record. Some cartridge and stylus assemblies are made in such a way that when the tracking force is too great, the stylus retracts into the cartridge. This prevents damage to the stylus.

You should determine the condition of the stylus in terms of wear or whether the stylus has been chipped by dropping it or by some other means. This damage will cause excessive distortion and external, directly radiated sound. Æ

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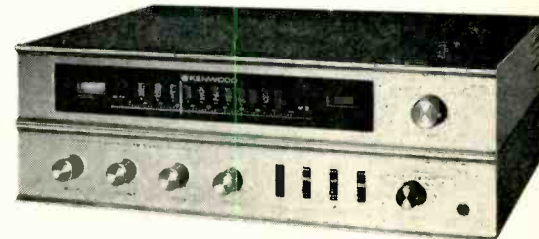
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Ampex Corporation, Midwest Region  
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Elk Grove Village, Illinois 60007

Ampex Professional Products  
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Redwood City, Calif. 94063

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Barzilai Furniture Mfg. Co., Inc.  
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Lear Siegler, Inc.  
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Westbury, N. Y. 11591

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C-T Acoustic Labs.  
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IMC Magnetics  
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Irish Tape (see Morhan National Sales Co.)

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Chicago, Ill. 60638

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JFD Electronics Corp.  
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Wolverine (see Electro-Voice) Æ

*the leader tapes, and I find that the intervals are quite inaccurate. Is leader tape intended for extremely precise measurement of tape recorder speed? What do you consider the best method for determining tape speed accuracy?*

A. The most accurate way I know of checking tape speed is to use a stroboscopic wheel held against the moving tape, such as the Tape Strobe of Scott Instrument Labs or the Stroboscope Tape Disc of Orr Industries. One counts the stroboscopic bars apparently moving past a fixed point, with 72 bars corresponding to a speed error of 1 per cent. Bars apparently moving in the same direction as the tape denote that speed is fast; in the opposite direction, slow.

#### 4 Pole Motors

*Q. I am interested in buying a tape recorder with a 4-pole motor instead of a synchronous one. Will the use of a 4-pole motor adversely affect performance in terms of wow and flutter?*

A. I don't think so. Very good results in terms of wow and flutter have been achieved with 4-pole motors. The factors in wow and flutter are dynamic balancing of the motor and capstan, inertia achieved through a flywheel mounted on the capstan or elsewhere, accurate machining of the capstan system of belts, type of belts, tape path, method of achieving tape-to-head contact, etc. The basic reason for use of a synchronous motor is to achieve accurate timing. Æ

## Tape Guide

(From page 91)

### Wide Hub Reels

*Q. After purchasing recorded tapes on the Dot, RCA, and Bel Canto labels, I find that the reels used are of the type with the large center hub. I am interested in purchasing this type of reel but have been unable to find anyone who sells them. Can you help me?*

A. I understand that large-hub reels are a manufacturer's item and not available at retail stores. It would be necessary to order such reels from a tape manufacturer. I suggest that you query several such manufacturers.

### Low Output from Tape Head

*Q. I have a \*\*\*\* tape playback deck (no electronics included). I have the tape head connected to the tape-head input of my preamplifier. The output of the tape head is so low that I must advance the volume control almost 180 deg. to get fair room volume. With the gain turned up so far, the soft passages still get lost and the hum level becomes objectionable. Is it possible to obtain commercially built electronics to correct the problem?*

A. Possibly the tape head is defective, accounting for inadequate volume. Or the fault may be in your preamplifier. If the fault is not in the head, you might try one of the phonotape preamplifiers sold in audio stores and costing as little as \$20. Because such a preamp provides equalization as well as amplification, its output must be fed into a high-level input of your preamplifier.

### Measuring Speed Accuracy

*Q. I have been attempting to find a method of making precise measurements of speed accuracy on my tape recorders. I have used several different methods with widely varying results. These methods include: (1) Audio leader tape; (2) Audio alignment tape; (3) home recorder test tape; (4) strobe light. The head-alignment tape is supposed to be recorded with signals and intervals totaling 400 seconds at 7.5 ips. However, these timings do not seem to be sufficiently accurate. . . I have measured the length between markings of*



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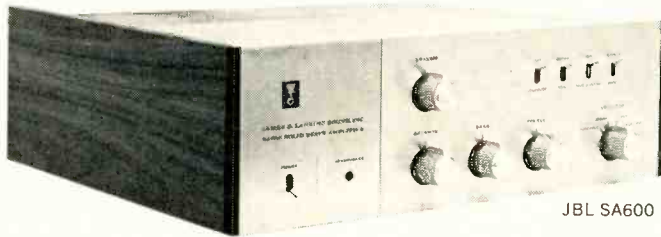


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JBL SA600

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And we'll aim even lower. To stay on top.

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by Harold Burriss-Meyer and Vincent Mallory

Nothing like SOUND in the THEATRE has ever been published. It is the first book to set forth in authoritative detail what you can do with sound by electronic control, and how to do it whenever the source (singer, musician, speaker, etc.) and the audience are present together. The book develops the requirements for electronic sound control from the necessities of the performance, the characteristics of the audience (hearing and psychoacoustics), and the way sound is modified by environment, hall, and scenery. Sound sources are considered for their susceptibility of control and need for it, and the many techniques for applying electronic sound control are described and illustrated in thirty-two specific problems. From these problems are de-

rived systems and equipment specifications. Complete procedures are given for: Planning, assembling, and testing sound control installations—Articulating sound control with other elements of production—Rehearsals and performances—Operation and maintenance of sound control equipment.

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**SOUND in the THEATRE**

## 15—MISCELLANEOUS

(From page 83)

**Model HE-2 Head Demagnetizer.** Provides high flux density for rapid demagnetization of recording and playback heads. Pole pieces allow access to heads without removing head cover; are covered with soft vinyl to avoid damaging head surfaces. \$12.95.

### "SCOTCH" TAPE

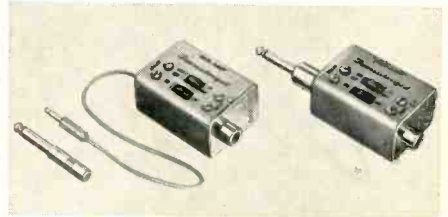
**Three New Series "Dynamrange" Series tape.** Provides brilliant recordings at half the normal recording speed. Use only half as much tape with no less in fidelity. Type 201, 600 ft. on 5" reel, \$2.80; 1200 ft. on 7" reel, \$4.40. Type 202, in same lengths and reel sizes, \$2.85 and \$5.10, respectively. Type 203, 900 ft. on 5" reel, \$4.25; 1800 ft. on 7" reel, \$7.35.

**"Living Letters" Tapes.** Three tape lengths available for a variety of uses, including business and personal correspondence. Plastic container provides excellent re-useable mailer or dust-free storage unit. Extra address labels also available. 3" reels, standard 111 tape, 150 ft., 90¢; Double length, 300 ft., (200 tape), \$1.85; Triple length, 600 ft., (290 tape), \$2.95.

**No. 290 Triple Length tape.** Maximum playing time for each reel size. Especially suitable for continuous recording of lengthy conferences, meetings, conventions. On 1/2-mil tensilized polyester backing, 1800 ft. on 5" reel, \$6.95; 3600 ft. on 7" reel, \$11.95.

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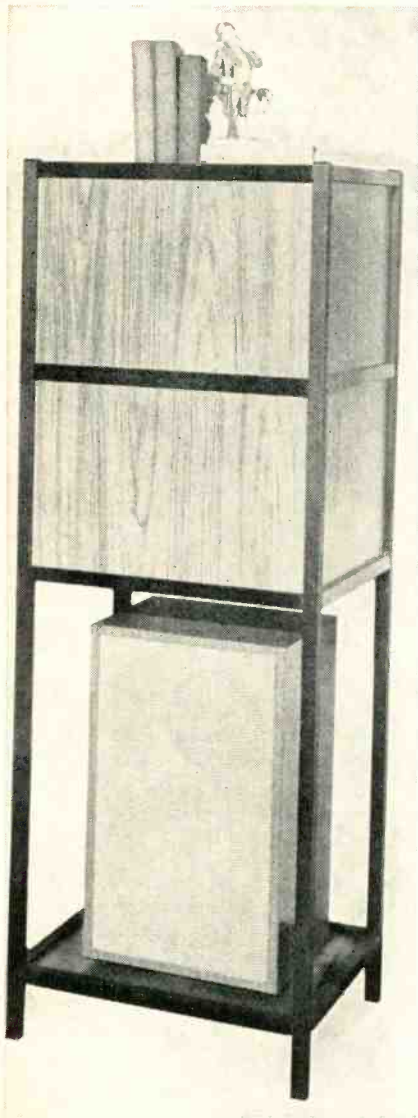
### THE TALL CO.

**Tape Splicers**  
Precision machined tape splicing blocks—Model KP-2, plastic, for 1/4" tape, \$3.50; Model KS-2, metal, \$7.50; Model KS-3, deluxe version, metal, \$9.00. Model KS-3.5, similar, but for 1/2" tape, metal \$25.00.

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A self-powered automatic-volume control amplifier for any sound system. Installed between microphone and amplifier, this unit controls level, reduces feedback, prevents overloading. High or low impedance, with response within  $\pm 1$  db from 20 to 20K cps, and with less than 0.1% distortion; attack time, less than 1 millisecond; release time, 2 seconds nominal, compression range, 50 dB. Dimensions: 4 1/2" wide, 2 1/2" high, and 6 1/2" deep. Price. \$125.00.

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"Preener"—a simple off-turntable record cleaner for pre-play record care. Price—\$3.00.

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"Parastat"—the ideal record cleaner for records which have an accumulation of "gunk" and grime and dust. Parastat is designed to rejuvenate them. Price—\$15.00. **AE**



With just a flip of a switch, the new Uher 8000E tape recorder offers you 4 track stereo, monaural recording and playback, 4 speeds, 4 heads, synchronous sound on sound, multiplay sound with sound, echo effects, exclusive built-in automatic slide synchronizer (Dia-pilot), optional sound activator, (whew) and a host of other fantastic features. (You'll also flip over its all new solid state circuitry.)

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For a demo visit your hi-fi dealer or write for literature, Martel Electronics, Los Angeles, 2356 South Cotner, New York City, 1199 Broadway, Chicago, 5445 North Lincoln Avenue. End wasted tape. Send for the new Martel "Tape Tabulator" for the timing of classical repertoires (\$2.75 value). Dept. B, California office. Enclose 25 cents for postage and handling. Sound begins and ends with a Uher Tape Recorder.



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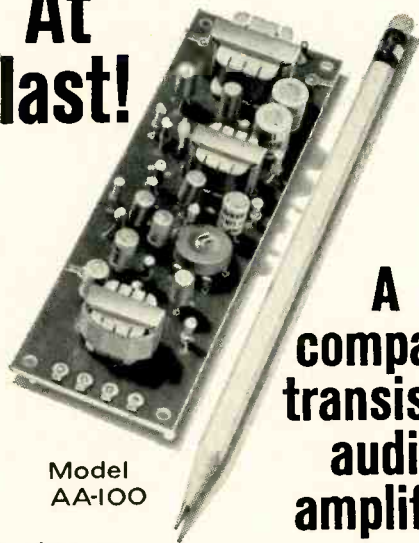
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**About Music**

(From page 10)

done? He would have used every confounded instrument there was that he could lay his hands on and a few he couldn't."

Beecham's Handel is probably the most flamboyant example of the "contemporary" approach to older music. Nowadays it's going out of fashion, even though many conductors still agree privately with the late maestro's opinions. What is taking its place is the belief that a restored *Messiah* can generate far more excitement and color than any streamlined symphonic version.

This week Philips begins its recording of an 18th-century Handel *Messiah*. Colin Davis will conduct soloists and members of the London Symphony Orchestra and chorus. A report on the sessions will follow. Æ

**Audio Etc**

(From page 14)

the manufacturers' lower-grade labeling, under O, for plain "Orchestra." It isn't Schwann's fault that some very fine anonymous music-making, on many a major label, goes under this undistinguished heading.)

Then, oppositely, there are those very real artist organizations whose membership does stay firm and solid—but the name changes. Sometimes expediently, from time to time, according to circumstance. Sometimes for real, and forever. True, the Boston Symphony still remains the Boston and the Philadelphia stays the Philly. But the famed Philharmonia Orchestra, of England, recently heaved up and came down again more or less on the same spot, re-named the New Philharmonia. Now it already has eight recordings listed under the new name—and under N. Via its old name—and listed under P—it has so many I can't even count 'em.

Toscanini's NBC Symphony, still very much alive on records, became (more or less) the Symphony of the Air, also well documented on records, before it departed into real-life limbo. Dozens of other "real" orchestras have done this name-changing act, for various reasons, and then are listed under all their various names, if they have made records. Most have.

So it goes in other areas—opera companies, string quartets, choruses and choirs, even maybe a few solo artists here and there. (But most individuals prefer to hang onto their own identities, contracts or no.) There's surely some deliberate falsifying, some measure of very shady dealing and maybe even a bit of straight piracy here and there. But the odd thing is that most of this complex of pseudonymery is quite proper and businesslike, as things stand today. And so, inevitably, Schwann is right to accept it all, just as it is, for its Artist Issue. The LP fantasy world is plenty real enough for us folks who buy the stuff itself, the sound of music actually being



performed before our ears. What's in a name? In a location? If the sound is OK, of course.

### Old Vienna

Nevertheless it is confusing. You take Old Vienna, again. Who knows how many Columbia Symphonies and such reside in that famous town right now! Who knows anything?

Just under the Viennese name itself, and just counting orchestral ensembles, I found well over two dozen different Viennese recording orchestras listed as separate "artists" in Schwann's Artist Issue, and these quite aside from small chamber groups out of the larger outfits, like the Vienna State Opera Orchestra Wind Players. In fact—looking at Schwann's heady list of Viennese LP-makers, you might really think Vienna was still the greatest musical capital of the world, as indeed it was once—before records came along. Indubitably, it is now the record capital of the world! Just look at the Viennese orchestras. Phew! I hardly have the strength to list 'em all.

There's the Vienna Broadcasting Orch., the Vienna Cathedral Orch., The Vienna Chamber Orch., the Vienna Collegium Musicum, the Vienna Consentus Musicus, the Vienna Concert Orch., the Vienna Festival Orch., the Vienna Konzerthaus Chamber Orch., the Vienna Konzerthaus Orch., the Vienna Mozart Ensemble, the Vienna Musica Antiqua, the Vienna Musikgesellschaft Orch., the Vienna Musikverein Orch., the Vienna Orchestra (*phew—32 entries for this one*), the Vienna Philharmonic Orch. (*that's for real, with 104 items listed!*), the Vienna Philharmonica Orch., the Vienna Pro Musica, the Vienna Radio Orch., the Vienna State Academy of Music Chamber Orch., the Vienna State Opera Chamber Orch., the Vienna State Opera Orch., (*literally thousands of LP's!*) the Vienna State Orchestra, The Vienna State Philharmonia, Vienna Symphony Orch. (*pages of LP's here!*) Vienna Theatre-Konzert Orch., Vienna Volksooper Orch., Viennese Chamber Concert Ensemble.

Now isn't that a lovely Viennese fantasy world on LP? And every single piece, thousands, played by real, live musicians right there in Vienna. Fact!

Of course if you actually visit Vienna you'll find that there are only a few regular orchestras around town (after all, New York has even fewer) and a rather large floating population of excellent musicians, both free-lance and members of one or more of the "real" outfits. But how real is real?

To most of us Vienna itself isn't real at all. Nor is it for Schwann. To most listeners, Vienna is just a name in a catalogue, with an enormous amount of LP music attached.

What really matters is that every one of the records listed in the whole Schwann Artist Issue, in all their many thousands, is a genuine, audible, playable LP disc with music on it. By any other name, wouldn't old Vienna sound just as good, on one of these discs? Like, say, the Columbia Symphony Orchestra, maybe? That's the true reality, as far as Schwann is concerned. Me too. Æ

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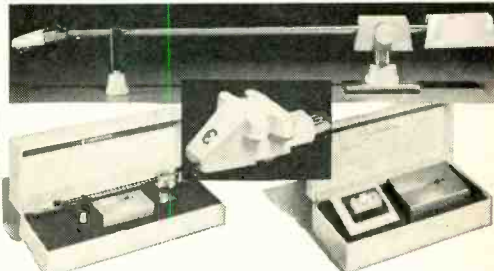
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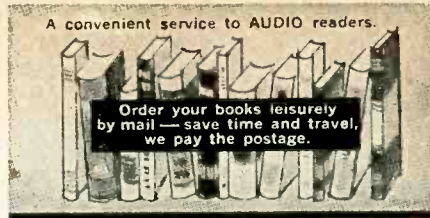
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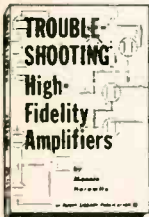
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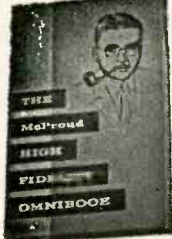
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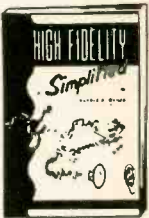
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## Patent Infringement Protection

(from page 24)

In the early years of this century, suit was brought for patent infringement against the Victor Talking Machine Company in which that company was charged with the infringement of the patent of a phonograph horn issued in 1904.

Two years later the manufacture of this horn had been assumed by the Victor Company and no infringement action brought for more than ten years. When suit was brought this defense of laches or delay was set up by the Victor Company. There again the court refused to sustain the argument of that company in its defense.

Of the absence of grounds on which this defense could be sustained, the court said. "It has not been shown that the company was actually misled by any act or statement or even relied upon any of such acts of the patent owner or its assignees, to its disadvantage.

"Neither has it been shown that the failure of the patent owner or its assignees to begin litigation against the Victor Company in any way resulted to the disadvantage of that company. That company sold the infringing horns during a period of their popularity and until cabinet machines were introduced.

"It now claims, in effect, that because it was not prevented from reaping the harvest when it was ripe it should not be called upon to account for those profits or any part thereof. Under all the facts in the case this contention cannot prevail."

In contrast to these incidents where good fortune attended the efforts of the patent owner to sustain his monopoly are those where the patent owner ran amuck of a principle laid down long ago by the Supreme Court of the United States.

"The vital principle," said that court in a decision rendered in the latter half of the last century, "is that he who by his language or conduct leads another to do what he would not otherwise have done, shall not subject such person to loss or injury by disappointing the expectations upon which he acted.

"Such a change of position is sternly forbidden. It involves fraud and falsehood and the law abhors both. This remedy is always so applied as to promote the ends of justice. It is available only for protection and cannot be used as a weapon of assault. It accomplishes that which ought to be done between man and man and is not permitted to go beyond that limit."

Request was made of a steel company by an engine manufacturer that it pre-

pare for use of the manufacturer, certain equipment which had been described in detail. This was done and the parts designed for use in the engine construction furnished as requested but nothing was said by the steel company of an intervening incident in which application had been made for a patent on these parts.

The purchaser proceeded to manufacture these items on its own account, irrespective of the patent and with a full knowledge of this activity by the inventor. Five years and more had passed with the expenditure of more than half a million dollars by the infringer in expanding its plant facilities for the production of these parts, when the patent owner at this late date sued for the infringement of its patent.

Refusal of the federal court to sustain the charge of infringement so long delayed, was with the statement, "It is true that only some five years elapsed between the time the patent owner learned of the infringement and the time it took affirmative action, while the period in most of the outstanding cases is longer.

"But in the usual case the patentee merely delays bringing suit for an unreasonable time after he learns of the infringement. Here the assignee of the patent presented a design embodying the patent to the infringer, knowing he would use it to manufacture the equipment himself and then stood idly by while the infringer embarked on a costly expansion program. In these circumstances the five-year delay was unreasonable and the defense of laches is available to bar both the accounting and the injunction."

Another and recent incident involving this rule that condemns deception by silence and an implied consent, occurred when, after an unbroken period of approximately twenty years, the owner of a patent for the pictorial recording of a background scene in the production of moving pictures, sued a famous producer for an infringement of this patent.

This particular patent had been issued in the spring of 1937. Within the succeeding year or two the patent owner saw the motion picture, "Snow White and the Seven Dwarfs," and determined that the process used in this production was an infringement of his patent. When nearly fifteen years later this suit was filed the federal court said in dismissing the action,

"During these many years the patent owner has not exploited his invention. This producer, on the other hand, has invested millions of dollars of effort, time, and capital in establishing Walt Disney movies as an American institution.

"This venture has paid handsome rewards not only in profit to this producer but in entertainment to millions of children and adults the world over. Whatever claim the inventor may have had for originating or perfecting this new form of art, this producer alone was responsible for making it a commercial success.

"The inventor failed for over a decade to assert his alleged claim. At this late hour he now demands that the producer account to him for the profits of the venture. This plea is not one calculated to find sympathetic reception in a court. It is the judgment of this court that this inventor's unreasonable delay constitutes laches barring the maintenance of this action."

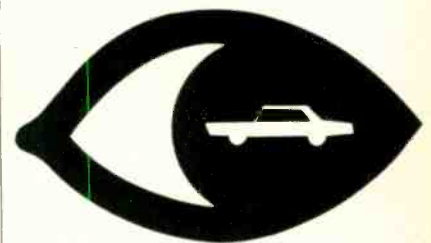
*Searchlight Horn Co. v. Victor Talking Machine Co.*, 261 Fed. 395, N.J. Oct. 22, 1919

*Dickerson v. Colgrove*, 100 U.S. 578. Mich., Oct. 1879

*Lukens Steel Co. v. Am. Locomotive Co.*, 197 Fed. 2d 939 N.Y., July 1, 1952

*Whitman v. Walt Disney Productions*, 148 F.S. 37, Cal., Jan. 16, 1957     Æ

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# CROWHURST Audio Measurements Course

(From page 22)

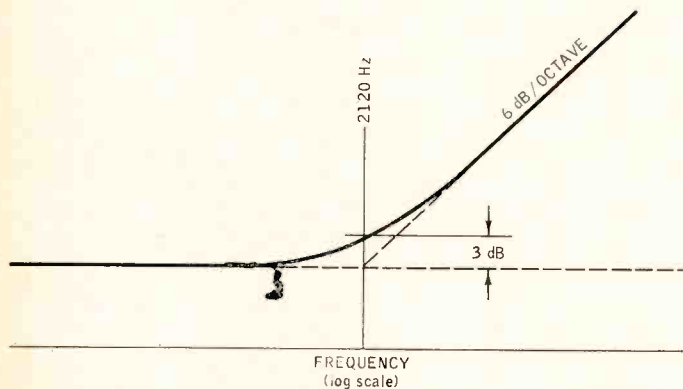


Fig. 7-5. Basic pre-emphasis used on FM transmissions.

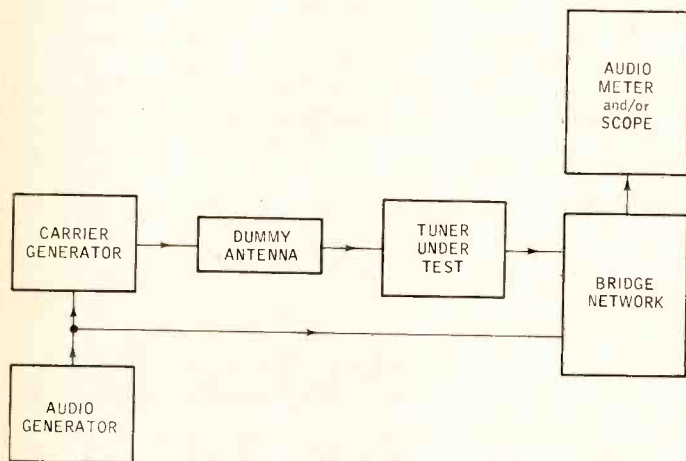


Fig. 7-6. Adapting the bridge method of distortion measurement to tuner testing.

Measurements could be made on both these quantities, but the IHF test is concerned only with acceptable quality reception, so it has reduced the criterion to one, called the pull-in range. This is the frequency change in carrier input that causes the tuner (at IF frequency) to become detuned by only 22.5 kHz.

All tests, such as capture ratio, frequency response, distortion, etc, should be made with automatic frequency control inoperative and operative, and both results recorded.

Most of the foregoing has related to FM tuners, because these are the ones predominantly associated with audio these days. Tests on AM tuners are similar and usually simpler, so they do not need discussion at length here.

## Stereo

Tuners for stereo take two forms. The older type were AM/FM, which virtually were two tuners, one of each kind,

mounted on the same chassis and sharing a common power supply. Tests for this type were made very much like testing two separate tuners. But since the introduction of stereo multiplex, this has become virtually the only type used.

The multiplex operation, while using an ultrasonic switching, or subcarrier frequency (according to which way you view the operation), is virtually an audio function. The action is more within the province of audio than it is radio. In our next installment we will extend consideration of tuner testing to multiplex in detail.

Some of the tests will relate to the basic multiplex function, others to the end result: two-channel reception of stereo, with proper separation and quality as measured in terms of frequency response, distortion, etc. While waiting for it, try to see whether you can formulate the properties that need checking in such a unit. Æ

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# WOHLEKING

(from page 32)

this type of antenna is known as a turnstile. It is the most common of the omnidirectional radiators, though by no means the only method of obtaining this type of pattern. A single dipole bent into the shape of an "S" or "Ram's Horn" as shown in Fig. 11 will also provide omnidirectional coverage. The "S" shaped antennas are readily available, but the "U" shaped ram's horn can probably only be found on aircraft.

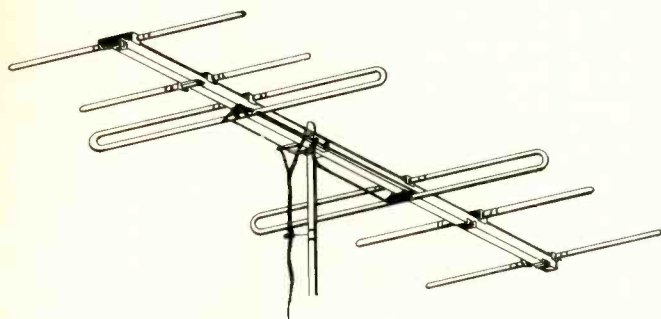
If we were to place approximately a quarter-wavelength behind the dipole another single conductor slightly longer than the combined length of both halves of the fed dipole, as at (A) of Fig. 12, a pattern such as that shown at (B) would be formed. This parasitic element is a reflector and acts in combination with the fed dipole to produce an antenna pattern with the prominence of radiated signal in the direction of the dipole. The same effect can be obtained to some degree by placing a parasitic element somewhat shorter than the dipole in front of the it, spaced about 0.15 wavelength away, as in (C). When utilized in this manner, the parasitic element is called a director, and as the name implies, radiation is from the side on which the director is located. Characteristics of a practical design of this type are given in Fig. 13.

Now by combining the two, we may reap both their benefits. An antenna with both a director and a reflector has higher gain, lower front-to-back ratio, and a narrower beamwidth than either

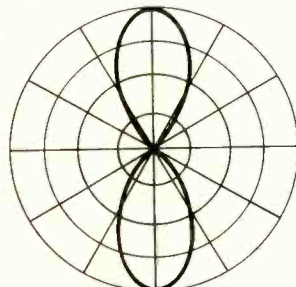
of the single-parasitic-element models. Furthermore additional directors will increase gain and reduce beamwidth even more. This combination of elements is the familiar Yagi-Uda array, more commonly called the Yagi, a fact which probably makes Mr. Uda a bit miffed. Twin fed Yagi-Uda arrays of six and ten elements apiece are pictured with their characteristics in Figs. 14 and 15. Twin-feeding refers to the fact that two dipoles are fed per antenna rather than one. The result is a broader bandwidth. Fig. 16 gives similar characteristics for a typical four-element array.

By combining Yagi-Uda array principles with a pair of back-to-back dipoles, an interesting modification of the bidirectional antenna is formed. The antenna and its associated data are shown in Fig. 17.

Another type of high-gain antenna has recently entered the picture, predominantly in the television field. It is the log periodic dipole array developed by the University of Illinois under an Air Force Contract. The chief advantage of the LPDA is its high gain-bandwidth product. A properly designed LPDA maintains high gain and good pattern and impedance consistency over a much greater bandwidth than will a Yagi. LPDA's are available for example for laboratory use which cover bandwidths of 10 to 1. Until recently none has been made available for FM use, chiefly because the FM band is so narrow it can be covered efficiently by a broadbanded Yagi, and the LPDA just wouldn't show to advantage. For television or combined television-FM use, the LPDA has strong possibilities if it is designed



FREQ. MHz	GAIN IN either direction (dB above isotropic)	SWR (to 300-Ω line)
88	6.5	2.8
92	8.0	2.0
96	7.7	1.5
100	7.4	1.5
104	6.8	2.0
108	8.0	2.8



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IS BETWEEN 50° and 60°

Fig. 17. Bi-directional antenna, suitable for receiving signals from stations in opposite directions from the listener.

## LEVELING AMPLIFIERS

Typical gain-reduction plot

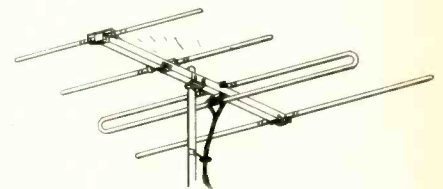
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FREQ. MHz	FWD GAIN (dB above isotropic)	FRONT-TO-BACK RATIO (dB)	SWR (to 300-Ω line)	NOMINAL BEAM WIDTH
88	6.9	9.9	1.35	65°-70°
90	7.4	11.4	1.3	
95	7.8	9.9	1.4	
100	8.0	9.4	1.6	
105	9.3	10.4	1.9	
108	9.1	11.4	3.3	

Fig. 16. Four-element Yagi-Uda array and its pertinent characteristics.

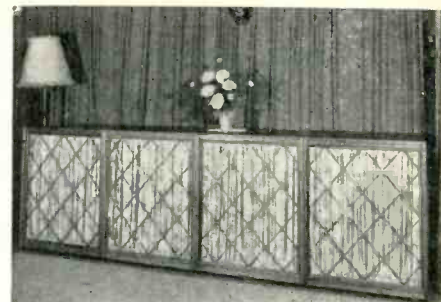
specifically for this purpose. We'll delve further into the use of LPDA's and all types of TV antennas for FM a little later.

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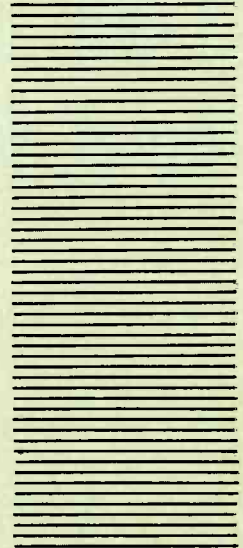
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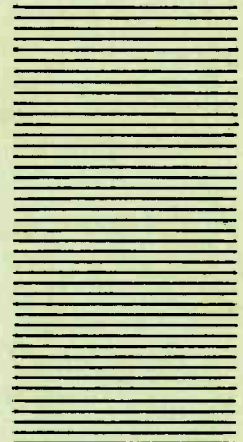
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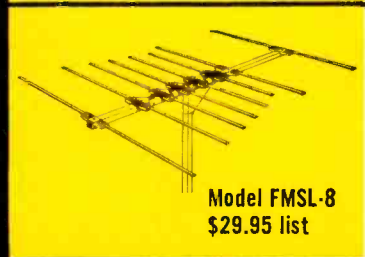
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