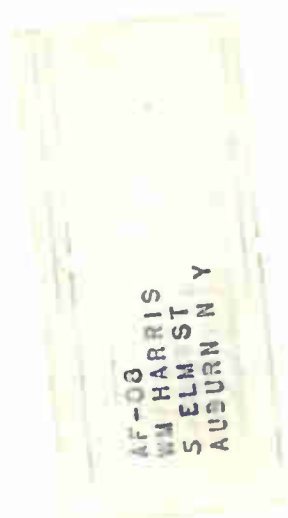


THE MAGAZINE  
FOR THE  
HI-FI ENTHUSIAST



MARCH 1966 VOL. 2 NO. 3 FIFTY CENTS



*Is  
there  
a  
magnetic  
disc  
in  
your  
future?*

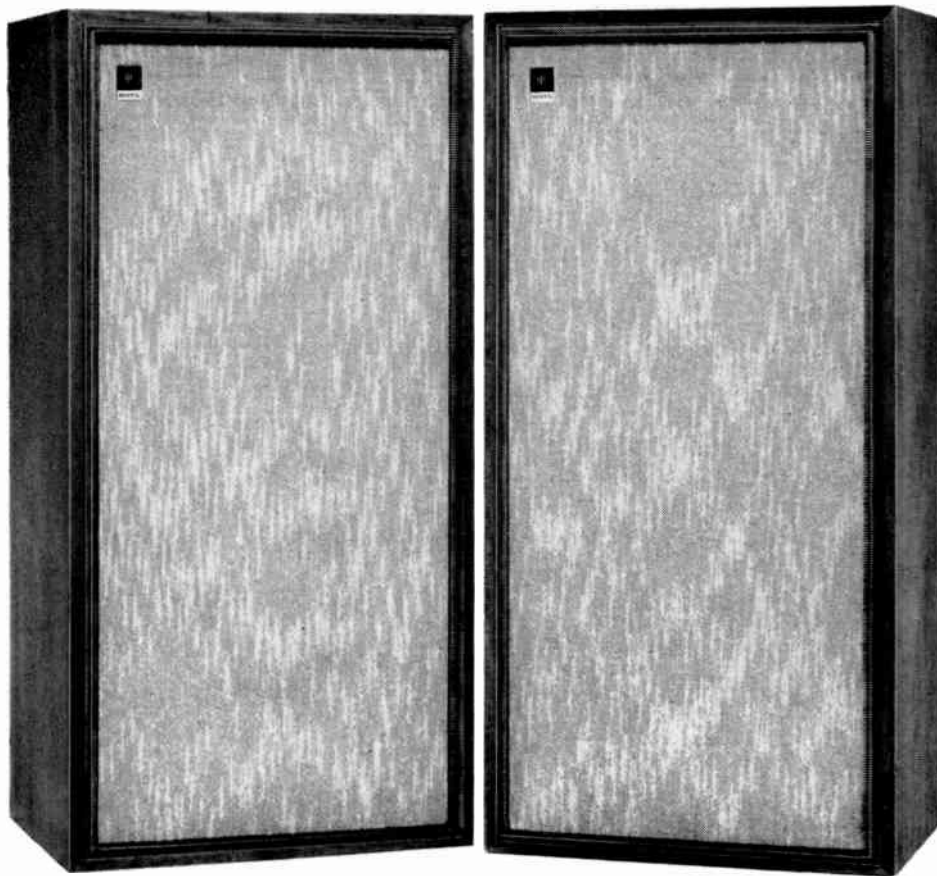
— see page 12

YOUR SUBSCRIPTION IS SPONSORED BY

**BARNETT BROS.**

(PLEASE SEE OUR ADVERTISEMENT INSIDE BACK COVER)

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



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

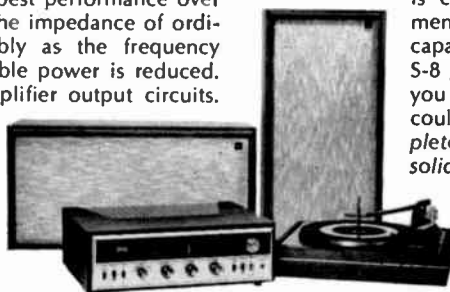
Scott engineers have developed a new kind of speaker system, specially designed for finest performance from solid-state components. Of all speakers now on the market, regardless of price, only the S-8 is completely compatible with new solid-state equipment. Here is why:

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.

Even the most expensive speakers available today were designed for tube equipment where impedance is controlled by output transformers. These speakers do

not offer, for example, 8 ohms impedance to the amplifier at all frequencies. In fact, the impedance can vary from as little as 2 ohms to as much as 20 ohms at different frequencies.

Now, Scott has designed an 8-ohm speaker system specifically for use with transistor components. The impedance range is controlled by integrated engineering development of both speakers and crossover to match the capabilities of today's solid-state equipment. The S-8 gives you the kind of sound you wanted when you bought transistor components. What more could you ask? The price? Only \$69.95, each. Complete system, including S-8 speakers, Scott 342 solid-state FM stereo receiver, and automatic record changer, well under \$500 at most dealers.

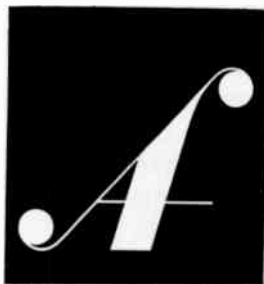


Scott... where innovation is a tradition



For further information and specifications on the new Scott S-8 speaker system, write:

H. H. Scott, Inc., Dept. 226-39-04, 111 Powdermill Road, Maynard, Mass. Export: Scott International, Maynard, Mass.



EDITORIAL

***can  
hi-fi  
be  
wrong-fi?***

Every so often, somebody shouts "Cheat!" because a weak voice is made to sound thunderous on a recording or during a live performance. Or because wrong notes are corrected, coughs and clinking glasses of an audience are added, or you name it.

There's no doubt that a final recording can be very different from an original performance if only because mistakes can be corrected and inadequacies covered up. Now, many people like it this way, just as most people prefer to have photographs taken when at their best, not to mention diffusing blemishes and wrinkles in the process.

On the other hand, some hi-fiers prefer recordings that are more faithful to original performances, clinkers and all. That's what makes horse racing.

But even live performances today are modified. With an increasing number of theatres installing electronic amplifiers to assist performers, you can't hardly tell the Enrico Carusos from the Rex Harrison, say some opponents of the system. New York Times music critic, Harold Schoenberg, calls amplification "cheating." He says, "It passes something off as your own that is not your own."

However, even the severest critics of electronic assistance admit that when it's done well it's very, very good. So fine, in fact, that it's undetectable.

This being the case, we gain Carusos, much to our enjoyment. People in the galleries discover they have excellent seats now. Performers needn't strain their voices as much and can, therefore, concentrate on tone, enunciation, phrasing and other vocal nuances.

By the same token, those twirling knobs and tape splicing assists by recording engineers can give us performers at their best. Is all this wrong? We don't think so. Do you?

THE EDITORS

# Up- grade your sound !

Whatever your receiver or amplifier is capable of doing, EMI loudspeakers have a unique way of making it sound better.

Perhaps it's the ease with which EMI loudspeakers project sound. So smooth and natural, it seems to float on the air in all its concert hall glory. Filling the room.

Or perhaps, it's the deep bass, the incomparable realistic midrange and the full, silky highs.

Or it could be the subtle detailing of their transient perfect response that catches you unawares.

So, for better sound from your receiver or amplifier, come on up to EMI loudspeakers.

There's an EMI loudspeaker to meet any requirement and budget. From \$49.95\* to \$395.00\*

*\*Slightly higher in South and West*

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Scope Electronics Corporation  
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New York, New York 10016  
Also available in Canada.



## **Letters**

Send your audio questions,  
problems, comments and  
suggestions to the  
Editor,  
AUDIOFAN  
25 West 45th St.  
New York, N.Y. 10036

### **no orchids today**

DEAR AUDIOFAN:

I'd wish readers would stop writing letters telling how great your magazine is. This is something we all know! How about some real suggestions and questions?

Fred L. Ackerman  
Brooklyn, N.Y.  
Brooklyn, N.Y.  
*You'll be happy with the March crop.—Ed.*

DEAR AUDIOFAN:

On page 32 of your November issue of AUDIOFAN you mention and show a picture of an automobile record changer (4-speed B & N 809T). Please advise the manufacturer's name and address.

Allan Ross  
St. Louis, Mo.

*B & N Manufacturing Co., 11942  
Regent View Ave., Downey,  
Calif.—Ed.*

### **boo! FM**

DEAR AUDIOFAN:

Your editorial in the December 1965 issue of AUDIOFAN concerning FM being on a higher level, having relatively few blurbs, etc., must have been written by someone on Cloud 9. FM is *worse* than AM today. Blurbs following one another . . . as much as 8 minutes out of a 20 minute run of music. I either listen to SW (short wave) or occasionally to an AM station that has an AOK musical program.

C. Newman  
Bronx, N.Y.

*With success comes more commercials, but you should find many less commercials on FM than on AM nonetheless. There are exceptions, of course, especially when an FM station is tied in with a properous AM station, as some are. Balancing these in-*

*stances, there are FM stations in your area that do not have any commercials whatsoever. Furthermore, a large number of commercials over FM have soft-sell, interesting sales pitches. The same can't be said of AM commercials, which often compound juvenile commercials with juvenile programming. Also, please do not lose sight of the fact that FM broadcasts display a much wider frequency response than AM broadcasts, not to mention lower susceptibility to interference. So fidelity is improved. And FM's stereo broadcast and receive capability puts it into another league entirely. A major one.—Ed.*

### **is the higher-priced spread better?**

DEAR AUDIOFAN:

Replacement tubes for high quality audio equipment are available at prices ranging from about \$1 each to about \$15 for a matched pair of output tubes. My question is, do the more expensive tubes contribute in any significant way to the performance of good components?

Manfred Leiser  
Syracuse, N.Y.

*Higher priced vacuum tubes may or may not contribute to better performance. This isn't a hedging reply. Many vacuum tube power amplifiers will operate with less distortion when output tubes are matched. But a large number of amplifiers will not benefit greatly from matched tubes because bias adjustments are made automatically or there are control provisions that allow adjustments to be made so that each tube draws the same amount of current. There are also some voltage amplifier tubes for which is claimed less noise and more freedom from microphonics than standard tubes. In some instances, the claim is justified.—Ed.*

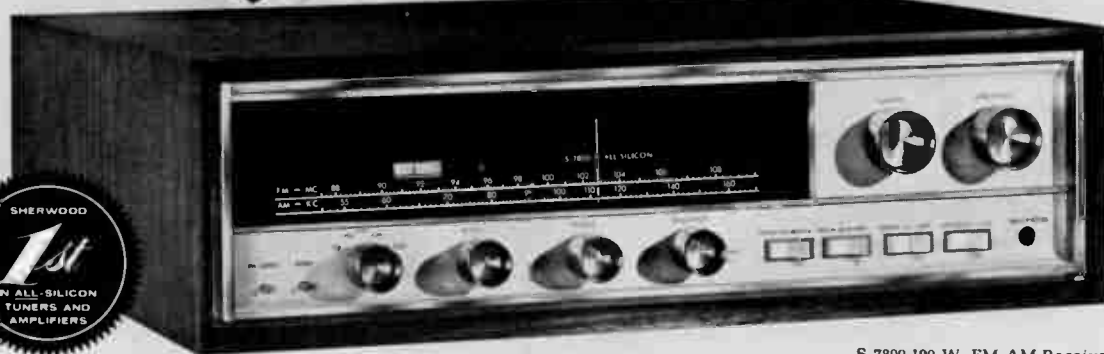
Compare these Sherwood S-7800 features and specs! ALL-SILICON reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, Front-panel mono/stereo switch and stereo headphone jack, Rocker-action switches for tape monitor, noise filter, speakers (A) and (B) disconnect. Music power 100 watts (8 ohms) @ 0.3% harm distortion. IM distortion 0.1% @ 10 watts or less. Power bandwidth 12-45,000 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: 2.4 db. Drift  $\pm$ .01%. AM sens. 2.0  $\mu$ v. AM bandwidth 7.5 kc. 43 Silicon transistors plus 16 Silicon diodes and rectifiers. Size: 16 $\frac{1}{2}$  x 4 $\frac{1}{2}$  x 14 in. dp.

AUDIOFAN  
MARCH  
1966  
PAGE 3

# Did you miss our last ad\*?



\*If you missed our previous ad comparing Sherwood's new S-8000 ALL-SILICON FM receiver with many other receivers, write for your free copy.



S-7800 100-W. FM-AM Receiver  
Chassis: \$399.50  
Wal. Cab. 28.00

Now we've added AM... and the industry's longest warranty  
—3 years—to our ALL-SILICON 100-watt FM receiver.

How can Sherwood offer this long warranty? Only because we said "No!" to both ordinary Germanium Transistors and old-fashioned tube Nuvisitors, insisting on ALL-SILICON reliability. No other receiver has its pacesetter 1.6 $\mu$ v FM sensitivity, its remarkable 0.1% distortion rating, for the most true-to-life sound.

*Sherwood*

Sherwood Electronic Laboratories, Inc., 4300 North California Avenue, Chicago, Illinois 60618 Write Dept. F-3

*This is the Lab 80. Add up the galaxy of innovations which Garrard has developed and engineered into it...including built-in cueing... variable anti-skating compensation...ultra-sensitive magnetic tripping... and you will begin to visualize why this superbly performing automatic has revolutionized the turntable industry.*



Dynamically balanced, counterweight-adjusted tone arm—built of Afrormosia wood for light weight, low resonance.

Full 12" anti-magnetic turntable—heavy and dynamically balanced for perfect speed. Anti-static mat

Anti-skating control—with patented foolproof sliding weight design—does not use springs. The natural side pressure on the stylus which frequently causes distortion and rapid record wear is eliminated.

Calibrated stylus pressure gauge with precision  $\frac{1}{4}$  gram click adjustments for accurate audible/visible settings.

Two spindles—one for manual play, the other for automatic operation. Convenient short spindle interchanges with revolutionary center drop spindle, which handles 8 records fully automatically when desired. Exclusive... spindles remove for safety and convenience when taking records off the turntable.

Built-in cueing control eliminates all danger of accidental damage to records or stylus through manual handling. A great operating feature and a tremendous convenience which permits selecting any band of the record with complete safety

Low mass cut-away shell—with extended finger lift—compatible with the most advanced cartridge designs.

Exclusive super-sensitive magnetic trip, with Dupont Delrin® to offset friction... performs perfectly with highest compliance pickups at correct minimal tracking force

Silent Laboratory Series® 4-pole shaded motor with vibration-proof total isolation suspension.

Important reading: 32-page Comparator Guide detailing all Garrard models. Write for complimentary copy to Garrard, Dept. GB-2096, Westbury, New York 11591.

*Only Garrard could have created the Lab 80. Only Garrard could have produced it to sell for \$99.50. This results from more than 50 years of leadership, supported by the great advantages of substantial international volume, vast manufacturing facilities, and truly exceptional engineering resources.*



**Garrard**<sup>®</sup>  
WORLD'S FINEST

March 1966  
Vol. 2, No. 3



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- page32 ■ Tuning in

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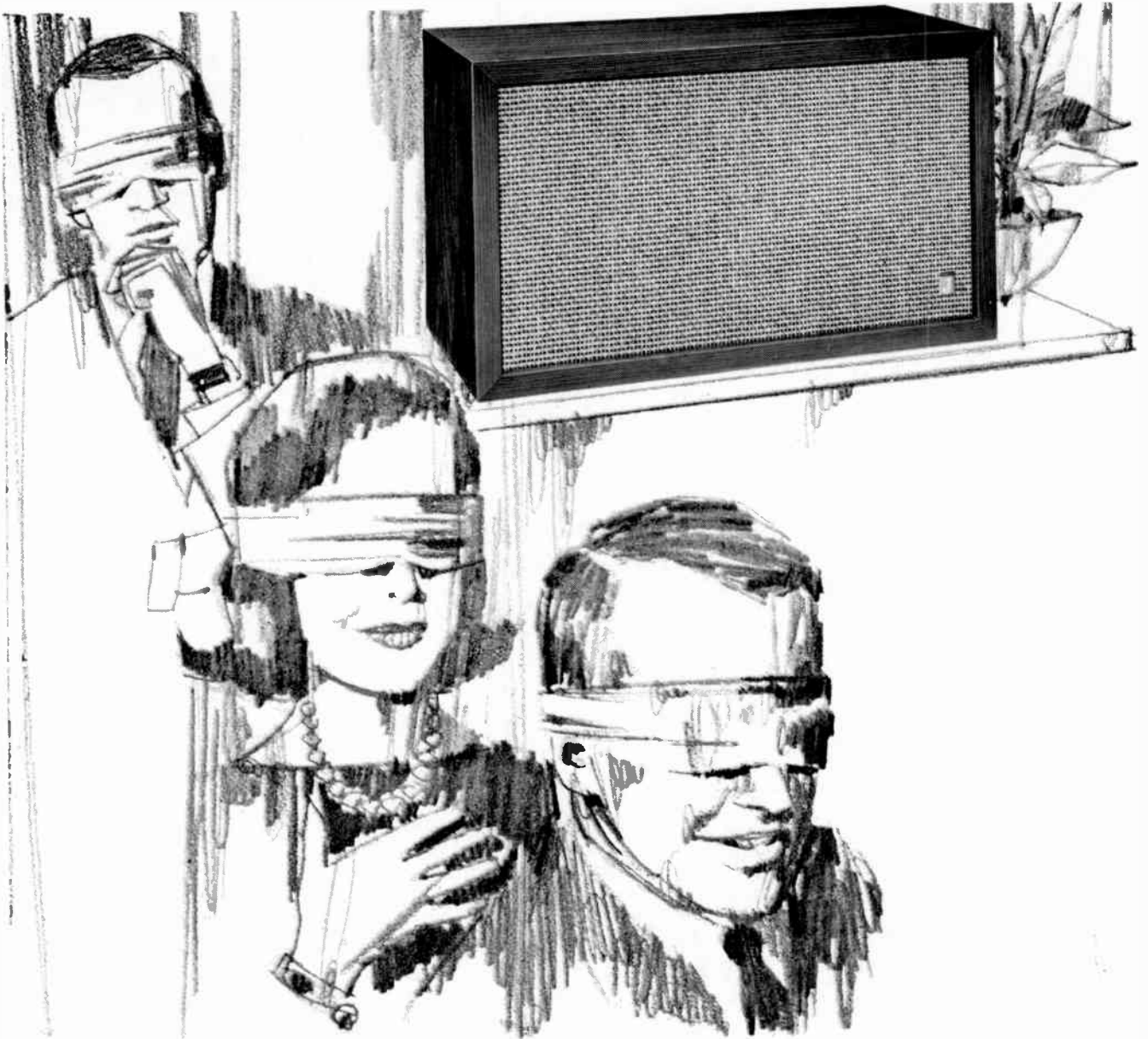
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## *Jensen Loudspeakers Sound Better... Naturally*

A standard of excellence was established when Jensen introduced the famous TF-3 shelf loudspeaker system. In a blindfold test the Jensen TF-3 was overwhelmingly preferred over many of the more expensive systems.

The new Model TF-3A represents another step forward in listening enjoyment. Engineering improvements result in greater efficiency with the same natural sound and high quality of performance in every range from 25 to 20,000 cps. The TF-3A, is a 4-speaker—3 way shelf loudspeaker system and is completely compatible with the TF-3 for superior stereo fidelity.

The new Jensen TF-3A is available in oiled walnut cabinet at \$115.50 or unfinished hardwood at \$99.50.




JENSEN MANUFACTURING DIVISION / THE MUTER COMPANY / 6601 SOUTH LARAMIE AVENUE, CHICAGO, ILLINOIS 60638  
Argentina: Ucoa Radio, S.A., Buenos Aires • Mexico: Fapartel, S.A., Naucalpan, Mex.



# (**COMPACT MUSIC SYSTEMS**)

**Can a hi-fier find contentment with a moderate cost, space-saving music system? Or will giving up higher power and a choice of components cause unhappiness?**

 We know some hi-fi enthusiasts who sneer at the thought of a stereo power amplifier on one chassis. "We'll take two identical mono power amplifiers anytime!" they say. And they do.

But a great many audiofans take a less critical view. They're willing to forego those magnificent extra drops of fidelity, not to mention the delightful operating facilities, to save space in the home, conserve money or to remove some of the technical trappings from hi-fi.

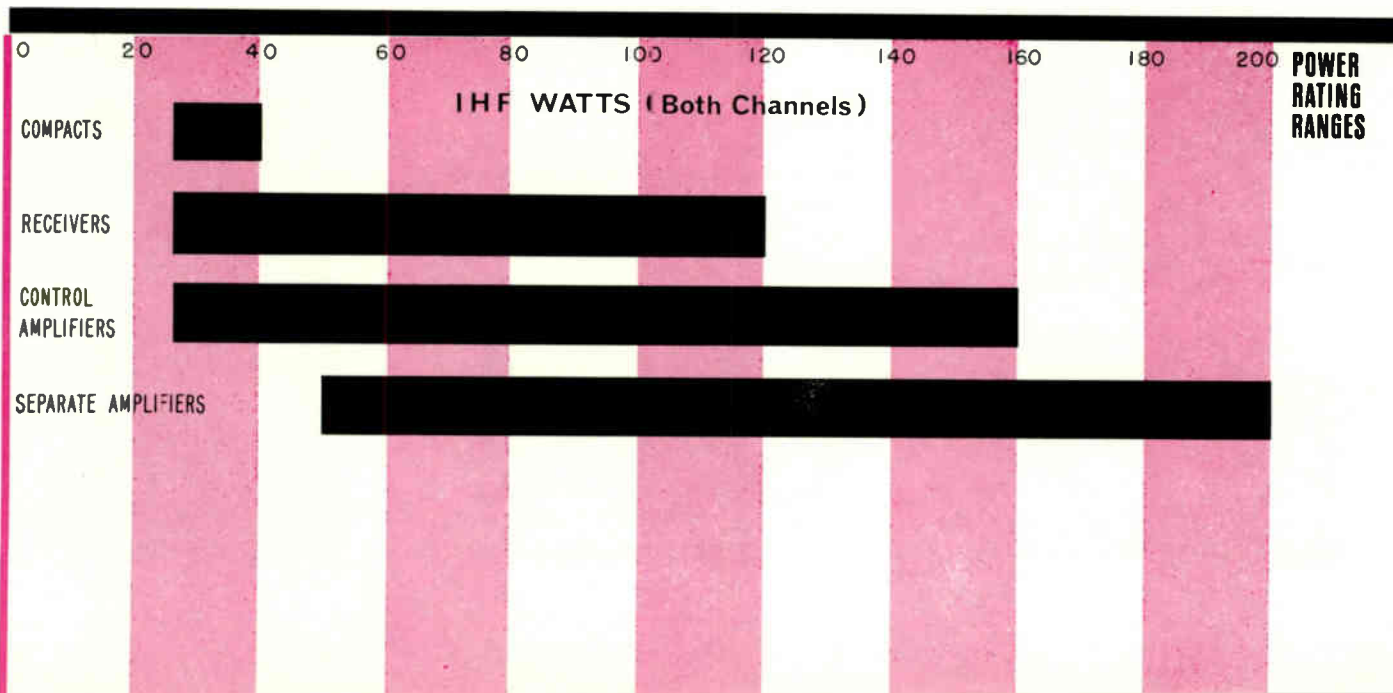
This accounts for the high popularity of control amplifiers, where stereo power amplifiers and stereo preamplifiers are combined on one chassis, and a growing trend toward further integration by adding an FM stereo or FM stereo/AM tuner to create a stereo receiver. Tack on your choice of speaker systems and the system is ready to go. To play other source

material, simply add a manual or automatic turntable with a cartridge and a tape recorder.

Where do compact music systems fit into the picture? They carry the ball of conserving space and money many yards farther, as well as diminishing the "technical" feel a bit more by pre-connecting an automatic turntable.

You get just about everything in one package: a piggyback-riding automatic turntable, a stereo control amplifier (solid-state, natch), separate speaker systems, and many compacts incorporate tuners. All of this is wrapped up in one unit, encased in either a luggage-type case or furniture-style wood cabinet. As a result, more and more serious hi-fiers use compacts as second music systems.

There is very little choice left to the buyer. Oh, yes, H. H. Scott has a unit with or without a tuner and a classy little FM receiver which



**COMPACT MUSIC SYSTEM GUIDE**

(All have automatic turntables and speaker systems unless otherwise noted)

Manufacturer	Model	W/Tuner	Case/Cabinet	Price	Remarks
Benjamin	Stereo 200	—	Wood	\$339.50	Speakers optional @ \$59.50 each (included in price)
	Stereo 200 FM	FM stereo	Wood	448.50	Speakers optional @ \$59.50 each (included in price)
Electro-Voice	Entertainer I	—	Luggage	199.00	
EMI/Scope	201	—	Luggage	199.50	
Fisher	50	—	Luggage	199.50	
	85	—	Wood	269.50	Available with larger speaker systems @ \$299.50.
	95	FM stereo	Wood	369.50	Available with larger speaker systems @ \$399.50.
Harman-Kardon	SC-440	AM-FM stereo	Wood	429.00	Available with smaller speaker systems @ \$399.00.
KLH	11	—	Luggage	199.95	
	11-FM	FM stereo	Luggage	279.95	
	15	—	Wood	229.95	
	19	FM stereo	Wood	299.95	
	20	FM stereo	Wood	399.95	
H. H. Scott	2300	—	Wood	274.95	Available with larger speaker systems @ \$324.95.
	2301	FM stereo	Wood	399.95	Available with larger speaker systems @ \$449.95.
	2400	FM stereo	Wood	299.95	FM stereo receiver only; separate turntable can be added. Available with larger speaker systems @ \$349.95.
Shure	M-100	—	Wood	399.95	Portable, luggage style unit available @ \$349.75.



A



B

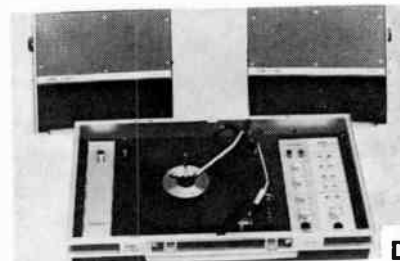


C



D

Representative compacts shown here are, clockwise: (A) Benjamin Stereo 200 FM, (B) Shure M-100L, (C) Fisher 85, (D) EMI/Scope 201, (E) H. H. Scott 2301, (F) Harman-Kardon SC-440, (G) KLH 11-FM, (H) Electro-Voice "Entertainer I".



E



F



G



H



## *inquiring reporter*

PLACE: HI-FI DEALER SHOWROOMS.

QUESTION:

### WHAT IS YOUR OPINION OF COMPACTS?

allows you to attach a manual or automatic turntable of your choice; Benjamin gives you the option of not buying their speakers; etc. But by and large, you must buy the whole system or nothing.

They're like "package" phonos, you say? Yes, in the respect that everything is preselected in the system. But it takes only a casual glance to see the compacts' component bloodline.

For example, the compacts are topped by good quality automatic turntables—Dual, Garrard or Miracord. They include magnetic cartridges with diamond styli and, consequently, you know there's a stage of preamplification. There are enough controls, switches, input and output jacks to satisfy many people, if not the audio buff. And to clinch it all, the compacts are made by manufacturers of fine hi-fi gear which, among other things, means that they shoot at performance standards way beyond that practiced by producers of conventional "package" phonographs.

It's very clear, therefore, that compacts aren't the same breed as package phonos, just as homo sapiens aren't apes. But how close to the hi-fi component genealogical tree's trunk are they?

Some audiofans feel they're a far branch away, though acknowledging they are vastly superior to the units produced by package equipment manufacturers.

Where compact specs talk about "less than 1% distortion," audio buffs point out that many separate components are in the 0.1% and 0.2% class. While compacts have sufficient power to drive medium to high efficiency speaker systems adequately, they don't hold a candle to most raw component amplifiers. As a glance at our power rating chart shows, a compact's power output falls between 12½ watts to 20 watts per channel, depending upon make and model. There's some overlapping here with some relatively low cost control amplifiers and receivers, but generally, separate components exceed compacts' power ratings by far. (It's interesting to observe that Ed Miller, general manager of Sherwood, told a trade source recently that "Components used in compacts will eventually replace the low end items now being sold by component dealers.")

But let's face it, not everyone is as sensitive

#### **G. E. SEEWER**

COMPANY TREASURER, 1-2 YEARS HI-FI INTEREST: I'M ACTUALLY LOOKING FOR SOMETHING PORTABLE BECAUSE I'M MOVING OUT OF THE COUNTRY. I LOOK FOR THREE THINGS: SOUND, LOOKS, PRICE, IN THAT ORDER. I LISTENED TO A FEW COMPACTS. ONE IMPRESSED ME MOST AND THE ONLY DECISION LEFT TO MAKE IS WHETHER TO HAVE IT WITH OR WITHOUT FM. OH YES, I'M SURE YOU GET BETTER SOUND FROM BIG COMPONENT SYSTEMS.



#### **LINCOLN S. PARKER**

SALESMAN, 4 YEARS HI-FI INTEREST: FOR THE PERSON WHO IS NOT SERIOUS ABOUT MUSIC A COMPACT IS SPLENDID. FOR ANYBODY WHO IS INTERESTED IN HI-FI I WOULD NEVER RECOMMEND A COMPACT. I OWNED ONE: IT WAS IMPOSSIBLE TO IMPROVE THE SOUND. BETTER SPEAKERS WERE WASTED BECAUSE IT HADN'T ENOUGH POWER TO DRIVE THEM. WITH SEPARATE COMPONENTS YOU ALWAYS MAKE IMPROVEMENTS.



#### **FRED SARGENT**

ACCOUNTANT, 10-12 YEARS HI-FI INTEREST: FOR MY OWN PERSONAL INTEREST IT'S NOT AT ALL WHAT I WANT. THERE'S NOT ENOUGH OF IT, I WANT IT SO YOU CAN SEE SOMETHING. MY OWN TASTE IS FOR A CONSOLE. I'D PICK THE COMPONENTS AND PUT THEM INTO A CONSOLE, AND MY WIFE WOULD PROBABLY FEEL THE SAME WAY. NO, I'M NOT INTERESTED IN A PORTABLE AT ALL.



#### **ARTHUR ALBRO**

MEMBER UTILITY TEST GROUP, 10 YEARS HI-FI INTEREST: CAN'T SAY I'VE PAID MUCH ATTENTION TO THEM. THEY MIGHT BE NICE FOR FAMILY ENTERTAINMENT, BUT I DON'T THINK THEY CAN MATCH THE HIGHER PRICED SYSTEMS. YES, I'VE HEARD THEM AND THEY SOUND O.K. IF I HAD THE SPACE I MIGHT CONSIDER GETTING A COMPACT SYSTEM FOR A SECOND SYSTEM. BUT I PREFER TO PICK COMPONENTS.





**RICHARD MAYER**

INVESTMENT ANALYST, 10 YEARS HI-FI INTEREST: I'VE HEARD THAT YOU CAN'T GET THE SAME QUALITY WITH COMPACTS THAT YOU GET WITH SEPARATE COMPONENTS AND I'VE ALSO HEARD THAT YOU CAN. I DON'T KNOW, I CAN'T MAKE UP MY MIND. MY NEXT SYSTEM WILL HAVE COMPONENT PARTS. BUT, OF COURSE, BY THE TIME I GET AROUND TO BUYING IT, I MAY WANT SOMETHING DIFFERENT, THEY'RE MAKING SO MANY IMPROVEMENTS.



**WILLIAM THOMSON**

DESIGN & SELL COMPUTERS, 10 YEARS HI-FI INTEREST: COMPACTS ARE A VERY GOOD IDEA. FOR ME PERSONALLY, IT'S NOT WHAT I WANT. IT DOESN'T GIVE ME WHAT I'M LISTENING FOR. THERE'S SOME LOSS IN SOUND. BESIDES, I'M WILLING TO MAKE THE HIGHER INVESTMENT. I MIGHT CONSIDER A COMPACT IF IT WERE A MATTER OF COST OR SPACE.



**RICHARD KESSLER**

INSURANCE UNDERWRITER, 5-6 YEARS HI-FI INTEREST: OF COURSE, I HAVE A COMPONENT SYSTEM. BUT I FEEL THERE IS A MARKET FOR COMPACTS; THE QUALITY IS IMPROVING ALL THE TIME. THEY'RE GOOD VALUE FOR THE MONEY; ON THE OTHER HAND, THERE IS A BIG SACRIFICE IN SOUND FOR THE DISCERNING LISTENER. NO, I WOULDN'T CONSIDER IT AS A SECOND SYSTEM, MY OWN IS POWERFUL ENOUGH TO ADD SPEAKERS TO IT. IF I WANT SOMETHING PORTABLE I PREFER TO USE A TAPE DECK.

as you are to the delicate, but significant improvements in sound that better systems produce. There's certainly enough good sound quality produced by compacts to elate many people who are now using low fidelity equipment. And a reasonably good hi-fi system may well whet appetites for better systems.

Also, many people who appreciate fine music reproduction cannot obtain the system of their choice for one reason or another. Perhaps space is seriously limited to, say, a small tabletop, if that. Here's where compacts shine! Maybe portability is an especially desirable feature. If so, a compact system, especially if it's in a luggage-style case, can be transported easily from one room to another or to a summer cottage and back.

Cost, too, may be an important consideration. With compacts being moderately priced—\$200 to \$450—many people who couldn't afford "name brand" hi-fi equipment can now enjoy reasonably good sound.

In this light, Harman-Kardon v-p, Walter Goodman, commented recently in *High Fidelity Trade News* that it's a foregone conclusion that compact system customers "will be drawn largely from among those who would otherwise have looked at package units." Other interviews were equally revealing. Altec Lansing's hi-fi sales manager, Don Palmquist, for example, observed that when you get beyond \$300-plus for a compact, "the buyer might well prefer a system of selected components," while Ralph Glover, Mattes Electronics, commented: ". . . People who want what we have to offer wouldn't buy a compact unless they wanted it for a second unit."

First unit or second unit, newcomer or audio-fan, compact music systems promise to expand the fraternity of people who seek realistic sound reproduction.

So though the compact systems may not live up to your concept of hi-fi componentry, don't sneer at them. They can start some friends and relatives off in the right audio direction, as well as supplement a more elaborate system.

**What do YOU think of compacts?**  
Won't you let us know by dropping a note to  
AUDIOFAN MAGAZINE, 25 W. 45th St.,  
New York, N.Y. 10036

**SIMPLE  
CHECK-UPS  
THAT KEEP  
YOUR  
SYSTEM  
TIP-TOP**



**HOLD  
ON TO  
HIGH  
FIDELITY**

### how to live with records

Records and tapes needn't be treated like newborn babies, but some common sense practices should be followed to get the best from source material.

Unfortunately, many of us gravitate to lazy habits. Whereas a spanking new record is almost always handled and stored with great care, older records are generally abused.

As an example, it's so easy and natural to remove records from a turntable, place them aside in a pile, and play other ones. The stack of records often remains in a haphazard pile until the end of an evening of listening to hi-fi; sometimes it isn't stored correctly until the next day.

Get into this habit and you'll find yourself with warped records if your easy-way-out record pile is stacked vertically. And don't think that a horizontal pile is your way out. There's always some dust particles and other abrasives deposited on records. Consequently, the weight of one record on another can cause enough pressure on abrasive particles to scar delicate record grooves.

Everyone knows, too, that records should be exposed as little as possible to the environment, again because of dust and other material in the air. But knowing this and leaving records bare for extended periods are two different matters. Many hi-fiers compound piling records on records in a haphazard manner by leaving them exposed, out of protective jackets. Even worse than allowing dust to gather on grooves is the possibility (and probability) of one record

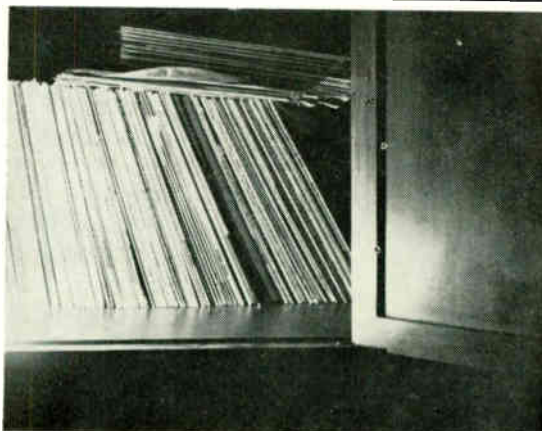
scratching another one, not to mention the occasional c-r-u-n-c-h when a record "gets in your way."

While on the subject of dust, let's not overlook another poor habit: playing records without a dust cover. Plexiglass dust covers are available for most manual and automatic turntables made today, so if you haven't got one, be sure to get one. And if you are equipped with a dust cover, get into the habit of closing it while playing records.

Don't imagine that you're taking good care of your records if you store them in a cabinet. It all depends on *how* you store them. Probably the best way is to store them in an upright position, separated into small groups with cabinet dividers. This will prevent records from leaning over and remove the temptation to throw albums horizontally across the tops of vertically stacked records in an effort to get them out of the way. Keep an alert eye, too, on the protective bags or jackets that you slide records into before inserting them into hard-cover album covers. They often tear after some use and wind up scratching records. Should this occur, you can purchase plastic record coverings separately. They're better in the long run than the original paper jackets anyway.

Sure it takes a bit more time to give your records proper care, but it pays off in higher fidelity. And add up the cost of all your records and you'll quickly realize that you'll be protecting a large investment.

Protect your investment in records by not following the easy-way-out stacking examples shown here.



## *Is there a magnetic disc in your future?*

**a new approach  
to magnetic  
recording and  
playback intro-  
duced recently—  
a flexible  
magnetic mat  
shaped like a  
record—may one  
day change the  
course of tape  
recording  
equipment**



“What, a record shaped like a flat disc?” a friend of Emile Berliner may have whispered to him in disbelief around the year 1880.

“Why not,” the pioneer disc machine inventor might just as well have replied. “There’s no law that says sound can be recorded only on *cylinder* records, is there?”

Similarly, there’s no reason why magnetic recording material cannot take a form other than the magnetic tape in wide use today. The question is, what purpose would it serve? Well, two companies, Ampex and Sony, have answers. Each employs magnetic *discs* which are shaped like phonograph records.

Ampex’ magnetic disc and playback/record equipment is designed for broadcast industry use as an alternative to electrical transcriptions; you know, the records of commercials that pay the station’s bills. Sony, on the other hand, recently developed a magnetic disc the size of a large phonograph record to record images of color TV broadcasts. Playback is on color slides. We hear that the initial price of each disc will be \$410. (Did you say, Wow!)

Of more immediate interest to audiofans is the magnetic disc (about 45¢ each) developed by Ampex, of course. It concerns sound recording and playback, is now used in some broadcast stations, and the concept may well be adopted for consumer use someday.

Why in the world would a person want to use a magnetic disc, anyway?

Ampex says that its “Cue-Matic” system, which uses the magnetic disc we’re discussing, overcomes some inborn problems exhibited when reproducing commercial messages on records. One of the challenges facing a broadcast operator is a need to cue records manually—and if you think it’s easy, let’s see you start a record without riding a noisy lead-in groove. The unfortunate by-

product of such efforts often causes excessive noise in starting grooves. Additionally, much manual handling and effort—centering the discs, placing the stylus in the right groove at the right time—takes time and effort and can also result in inconsistent timing.

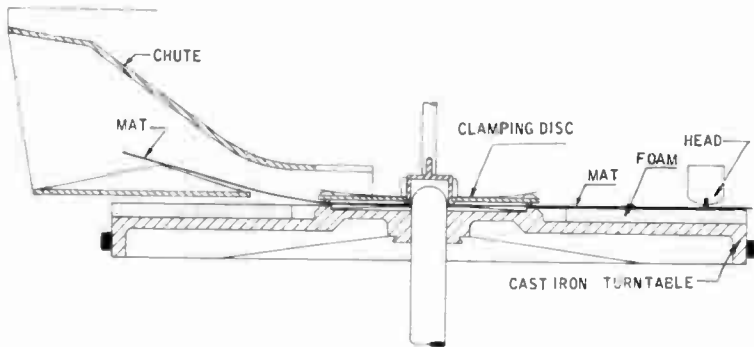
With Cue-Matic equipment, in contrast, an operator simply shoves a flexible magnetic mat into an opening. The disc is centered and cued automatically and ready to play or record at the push of a button, says the manufacturer.

For audiofans, there are many more attractive aspects to magnetic source material in disc form. For example, Ampex’ magnetic disc has a playing time of 3 minutes and 45 seconds—enough to record a complete 45 rpm popular tune or an excerpt from an LP album. Thus, selections on “tape” can be made with the ease now reserved for record discs. (And if this should ever come about for the mass market, you can be sure that some ingenious engineer will devise an automatic magnetic disc player so that more than one disc can be played at a sitting.)

Other advantages quickly come to mind: The 3 mil, 11¾” diameter discs can be slid into a standard 12” envelope for mailing purposes, making tape correspondence mighty simple. There’s no tape stretch (or snap, if you’re using acetate magnetic tape) to worry about. The discs have a long life, with field tests indicating that 20,000 to 30,000 plays produced negligible degradation of quality.

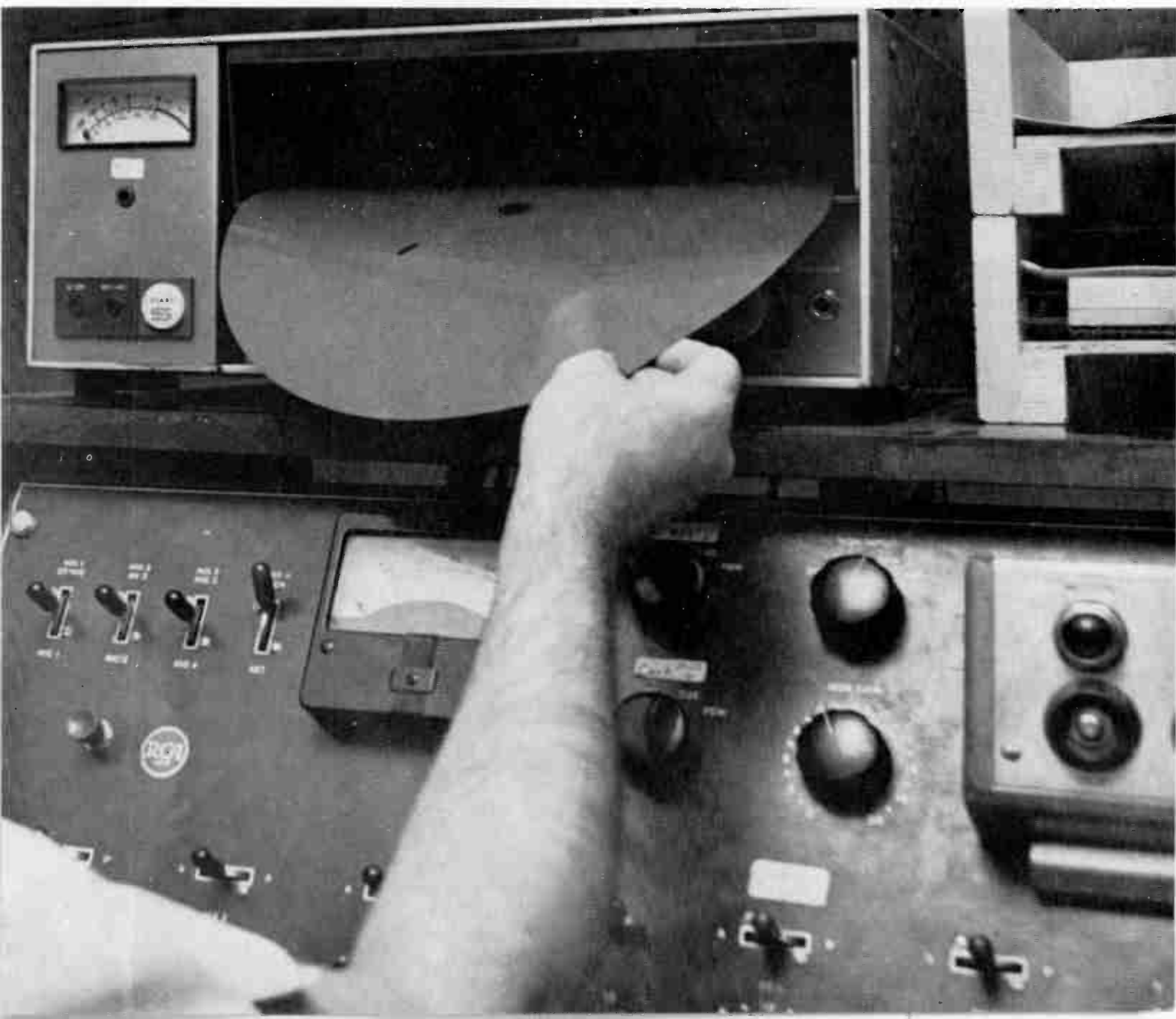
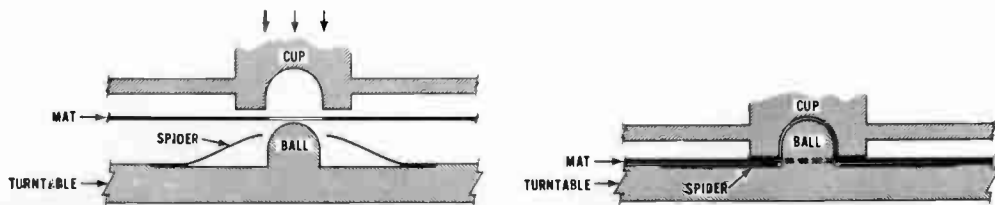
How about fidelity prospects, you ask? The existing magnetic disc has demonstrated a response frequency to 15 kHz, with 50 to 12 kHz considered to be a minimum satisfactory range. Extremely short wavelengths, that is, very high frequencies, should not be recorded along the outer edge of the disc because greasy deposits from hands generally accumulate there. Signal to noise ratio is said to be at least 50 db, the same

A sectional view of Ampex' "Cue-Matic" recorder shows the position of a magnetic mat and a "tape" head in the machine's play mode.



When a mat is slid into the machine it hits end stops which serve a dual purpose: the mat's center hole is coarsely centered over the turntable's spindle and a trip switch causes a clamping device to center the mat accurately.

Operation of the magnetic disc machine is fully automatic. Simply slide the mat into a chute and depress a play or record button.





ratio to be expected from 4-track, ¼ inch magnetic tape playing in the 3¾ ips and 7½ ips speed range, according to a paper presented at the 17th annual meeting of the Audio Engineering Society.

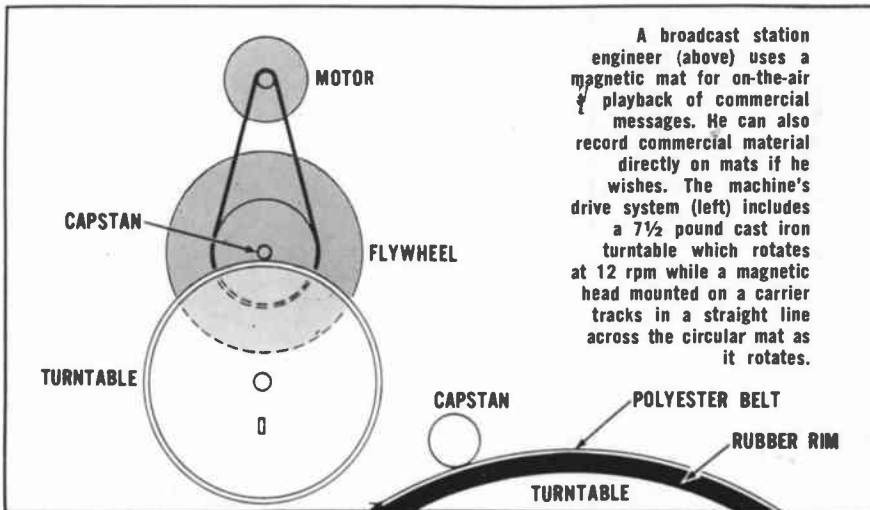
Some of the new system's specifications are truly breath-taking. For instance, wow and flutter values are said to be on the order of 0.03 to 0.06 percent. Repeat; that's 0.03 not 0.3! (Specs read under 0.15%, however.) Modulation noise, such as is caused by scrape flutter, is substantially reduced in the magnetic disc system. Whereas a standard reel-to-reel tape machine such as Ampex' model 354 has a measured modulation noise of -40 db, the Cue-Matic is said to measure -51 db. (If you're wondering how this comes about, remember that a long, unsupported length of tape is absent; the magnetic disc rests on a foam-padded turntable platter.)

The transport used by Ampex resembles a disc-cutting lathe's. It uses a rotating 7½ pound turntable which rotates at 12 rpm and a tape head which moves in a straight line from the rim to the inside of the turntable.

As shown in an illustration here, the turntable is driven by a capstan which is secured to a flywheel which, in turn, is belt-driven from a hysteresis synchronous motor. The 3½ pound flywheel rotates at 480 rpm, compared to the turntable's speed of 12 rpm. A seamless polyester belt is stretched around the turntable rim to give tight coupling between the turntable and the capstan.

The tape head is mounted on a fixed base in a head carrier, which slides along in a straight line on a solid rail. Its motion is slightly damped with silicone grease and, get this, pressure between the tape head and the mat is set to 20 grams. This was found to be the best compromise between head life, reported to be about 1,000 hours, and head-to-disc contact.

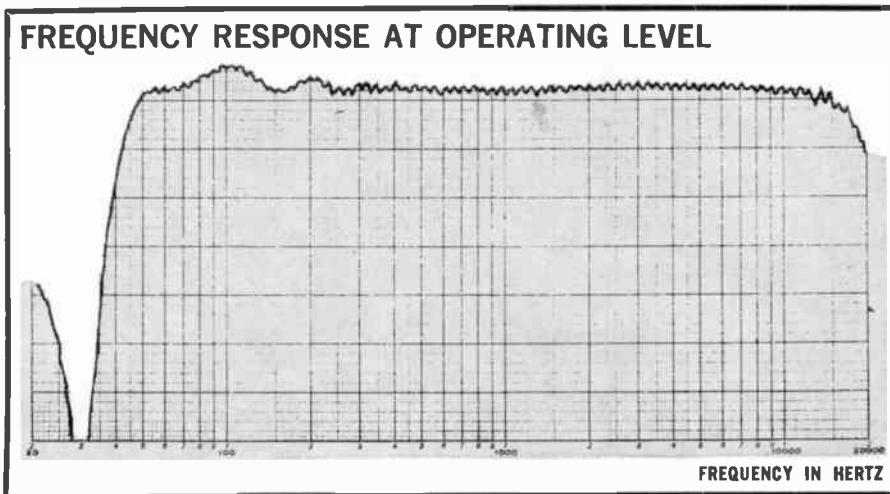
Of special interest here is a re-  
(Continued on page 28)



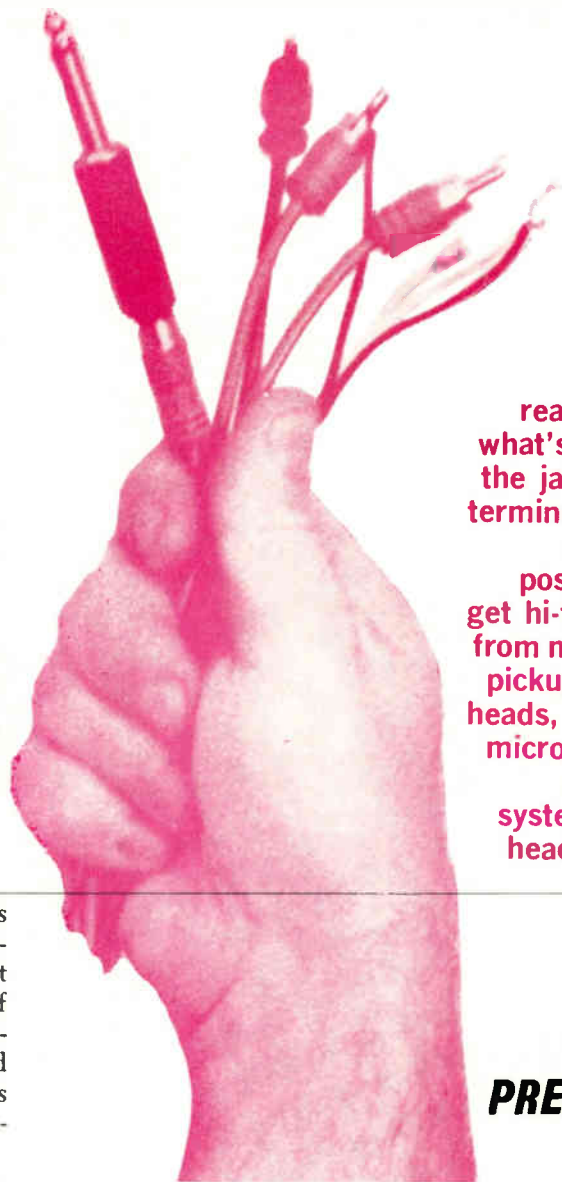
A broadcast station engineer (above) uses a magnetic mat for on-the-air playback of commercial messages. He can also record commercial material directly on mats if he wishes. The machine's drive system (left) includes a 7½ pound cast iron turntable which rotates at 12 rpm while a magnetic head mounted on a carrier tracks in a straight line across the circular mat as it rotates.

The frequency response of the magnetic mat machine at operating level is shown in the curve below. A 50 Hz to 12 kHz response is considered to be a minimum frequency range, according to designers. Signal-to-noise ratio is said to be the same as expected from 4-track audio magnetic tape playing at 3¾ ips

or 7½ ips. Wow and flutter values are almost immeasurable, say company engineers, with values of 0.03% to 0.06% given. Modulation noise of the magnetic disc system shows a significant improvement over a magnetic tape system, too, owing to the absence of scrape flutter.







read about what's behind the jacks and terminals that make it possible to get hi-fi sound from magnetic pickups, tape heads, tuners, microphones, speaker systems and headphones



The inputs of a preamplifier, whether it's a separate one or part of a combined pre-amp-power amplifier, determine what you can plug in. They aren't simply a group of handy jacks that connect internally to some amplifier tubes or transistors, however. Behind these jacks are circuits that meet requirements for sensitivity, impedance matching, and equalization; all highly important for good fidelity.

You need at least three sets of input connectors—actually six separate connectors for stereo. This is the bare minimum, allowing a stereo phono cartridge, FM tuner and tape heads to be plugged in. Most preamps also have a pair of auxiliary inputs which might handle higher output voltages from tape recorder electronics (rather than the very low signals coming directly from tape heads), television audio, etc.

An additional set of phono inputs is not uncommon today; this gives the user an opportunity to use one set for a manual turntable and another for an automatic turntable, for example. Also, some units employ two sets of phono inputs to give the user a choice between a high level magnetic cartridge input and a low level magnetic cartridge input. Both are, in fact, low level inputs, since both output voltages are minute.

Few preamplifiers have provisions today for ceramic or crystal cartridges. And for good reason—with rare exceptions, magnetic cartridges are always used by hi-fiers; each needs different equalization and a different amount of gain. The magnetic pickup has to be boosted heavily in the bass, cut in the highs, and puts out a much lower signal, so there is usually an extra stage or two of amplification behind the magnetic phono input. In a pinch, a high-output ceramic can be

connected to a "high-level" unequalized, high-impedance input like that for a tape machine, or auxiliary inputs. But contrary to some notions, the ceramic needs equalization for fully accurate playback and the top-grade stereo ceramics put out a much smaller signal than a radio tuner or tape machine does.

A further consideration: a number of ceramics can now be bought with small "networks" of resistors and capacitors that change the ceramic output into something like that of a magnetic pickup. Such a network allows you to plug a ceramic into the input designed for a magnetic. This may be the most convenient way for you to hook in your youngster's lo-fi phono into your hi-fi system.

An input must not only have the right gain and frequency characteristic behind it, but must present the right load to the program source, have the right "impedance." Most magnetic pickups today are designed to work into about 50,000 ohms. A much lower load will cut the high frequencies. Too high, and the treble frequencies may be peaky. A moving-coil pickup, of which there are only a few, can take a much lower load, down to a few hundred ohms in

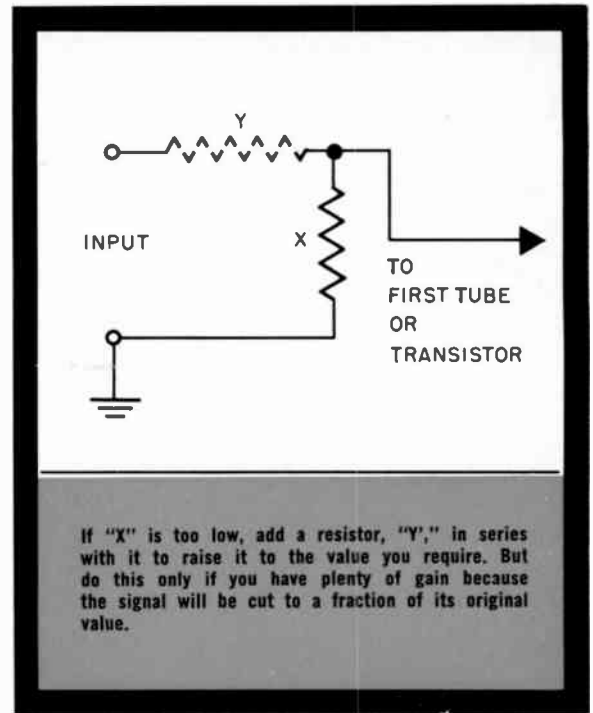
**IN(S)  
&  
OUT(S)  
OF  
PREAMPS**

some cases, but is also usually fine with a higher load. A ceramic needs a much higher load resistance, up to 2 megohms for some, to preserve full bass response. Radio tuner and tape machines are less critical: anything over about 250,000 ohms is usually alright. Too low, and again you lose signal strength. If the input impedance is wrong, it is often possible to correct it in a very simple way, as shown. Generally "high" impedance means 100,000 ohms, or more; "low" 1,000 ohm's or less, medium in between.

The input sensitivity tells you how much signal voltage you must apply to that input to produce full output from the preamp or amplifier.

If sensitivity is too low for any program source, you will not be able to get full volume. But sensitivity can be too high, too, and if the volume control is not right across the input—it rarely is in modern amplifiers—you are likely to overload an input that is too sensitive for the program source, with consequent distortion. (A radio tuner fed into a magnetic phono input would produce hair-raising distortion, for instance.) This happens most frequently in the case of magnetic pickups. If a stereo pickup is rated at, say, 5 millivolts output for 5 cm/sec recorded velocity (a representative value), the output in the loud passages of some recordings may go as high as 30 or 40 millivolts. An input rated for full output at, say, 15 millivolts is likely to be seriously overloaded. So it is necessary to match pickup to amplifier in this respect—have an input that will handle several times the pickup rating at 5 cm/sec without distorting.

Some preamps handle this problem by having *two* magnetic phono inputs, one for low-output pickups, and one for high. Other preamps use an *input level control* for this purpose. It is, in effect, an auxiliary volume control, right across

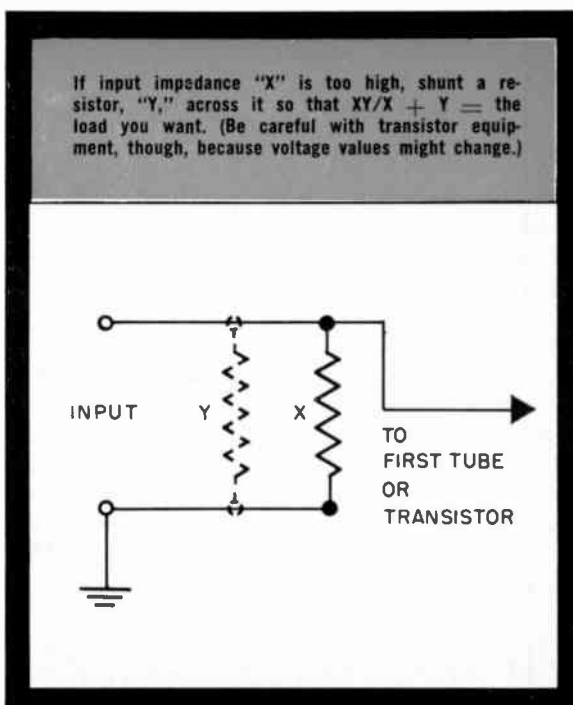


the input, which is set once to establish the overall level at the first stage. To set a phono input level control, put on a very loud recording, turn the input level control well down, then advance the main volume control to about 7/8 full on. Now bring the input level control back up until the volume is about as loud as you will ever want to hear it. From there on, you can control volume with the main volume control! Don't touch the input level control again!

Input level controls are handy, though certainly not essential, on most of the other inputs. If your tuner or tape recorder has its own volume control (many do) you have an input level control right there. Adding input level controls to a preamp may be quite simple, if you have room for a miniature variable control close to each input. Drawings here show how it can be done in many cases. One advantage of a full set: You can adjust the input controls so that each program source comes through at about the same volume, so you can switch from one to another without sound blasts.

Another input often provided is called "auxiliary" or something similar, and this is usually like the tuner and tape recorder inputs: high impedance, 250,000 ohms or more, and high-level sensitivity, 1/2 to 1 1/2 volts. One thing you can use it for is TV sound. Or it can be used for a radio, or tape recorder, or any other high-level program source.

A more specialized input is that for "tape head"—and keep this one carefully distinguished from the high-level input marked "tape" which we have already discussed. The latter is for the output of a tape machine and, of course, depends on the preamp in the tape machine to raise the tape signal to the high level and equalize it.



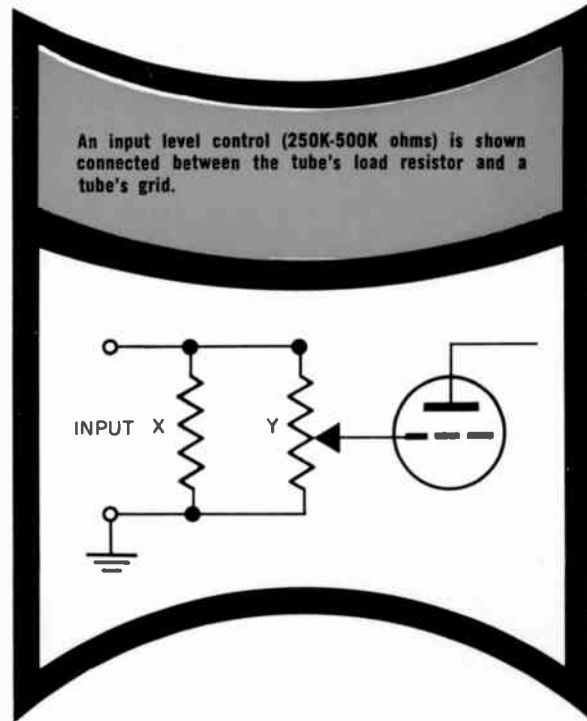
But if you want to save on tape electronics—for instance, if you are using a tape playback deck only in your system—you can use your main preamp as a tape preamp with a “tape head” input, which is very low-level, and equalized. A tape head needs a lot of gain, even a little bit more than most magnetic pickups, and it needs its own equalization, which differs from magnetic phono equalization. Note that in a pinch, if you have a highly sensitive magnetic phono input, you can plug a tape head into it and get reasonably good results by setting the tone controls to correct the frequency balance, as much as they will.

### output section

Now let’s talk about outputs. In addition to the output for connection to the power amplifier (integrated units do not need this output), many preamps now have a “tape output,” which is a way of connecting the preamps to the input of the tape recorder.

The tape output feeds to your tape recorder any signal you select with your preamp, and it usually eliminates from the circuit the tone controls, and sometimes the volume control on the preamp. Check your new preamp with the dealer to make sure what the arrangement is. The theory is that the tape machine will use its own volume controls, and that tone-controlling the signal that goes onto a tape is a bad idea, anyway (not true in every case). Generally speaking, though, it is better not to boost highs or lows going onto tape too much because a tape recording already involves a lot of equalization, especially of highs. More could cause distortion.

The tape output, plus a “tape monitor” switch, allows you to make a recording off the air, for instance, and simultaneously listen to a playback

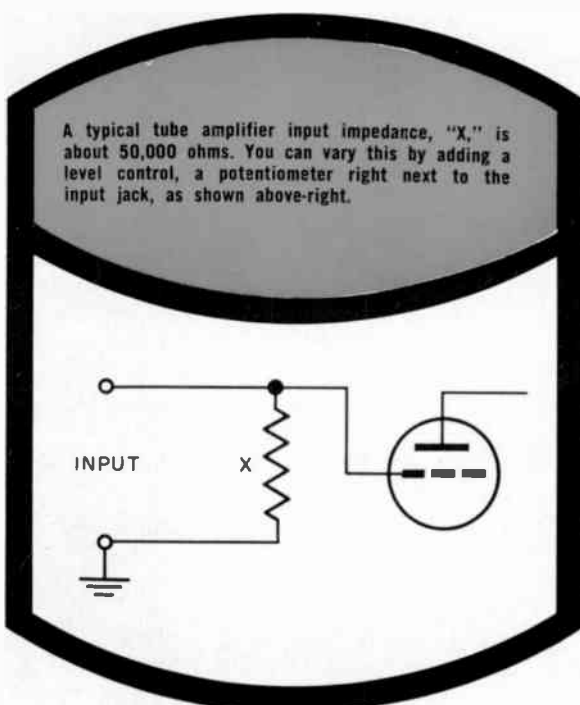


of it if your tape recorder has three heads. This is the best way to monitor a tape recording. You can switch rapidly between the program as it goes to the tape and the recording that results.

An especially useful feature is a front-panel headphone jack, if you ever expect to do any headphone listening (most people do, eventually). Though the jack is part of a power amp section, it’s often thought of as a preamp function. This is generally a low impedance jack with dropping resistors coming off speaker terminals to lower signal strength (the phones don’t need as much signal as speakers do). Speakers are often disconnected automatically when the headphone plug is attached. Another one is a terminal for grounding the whole system to an external ground, always a good idea. You can, of course, simply loosen a chassis screw and tighten it on the ground wire to make such a terminal, but a regular one is less trouble.

Finally, let’s talk about specifications. Since a preamp has no power stage in which most of the distortion of a typical amplifier develops, the preamp can have and should have very low distortion, well under 1% harmonic or intermodulation distortion over the whole frequency band at full output. In this case, “full output” means whatever will drive a power amplifier to top power, and this is usually about ½ to 1 volt. Frequency response should naturally be flat, at least 20 to 20,000, and this is no longer a difficult design requirement. Most good preamps make it with room to spare. Hum and noise level ought to be at least 55 db at the phono input, 75 db at high level inputs.

The differences between tubes and transistors in preamps can’t be stated in any general way. Really top-grade preamps can be made with either (and so can poor ones).





## PROFILE OF AN AUDIOFAN

unorthodox hi-fi system  
sports 6 amplifier  
channels, wall-facing  
woofers, and enclosure-  
less tweeters

**A** During a pre-interview conversation with Hal Mavity he observed that he's no longer a nuts and bolts audiofan.

"Don't let him kid you," advised fellow members of the Stereophonic Club of Southern California, of which he is a charter member. "You may have to pull it out of him, but just look at his speakers, if nothing else." Following this lead, we wound up in a "listening room" located behind a garage.

It's a "warm," square room (18' x 18') with a comfortable den feeling. The austere or clinical "serious sound" feeling attained by some purists was absent. Books on a great variety of subjects—hypnotism, Yoga, painting, for example—share the focal point of interest between the speakers. A pipe rack, too (more for decoration than for utility if you will note the pipes' stem-down positions, Watson!). And above the cheerful fireplace are hung old guns.

But wait a minute! What's with those speakers? (See overleaf page.)

Here's what. Those huge speaker cabinets are, in truth, facing the wall! Those grille cloths you see in the photo are actually false fronts. The two enclosed woofers, booming toward the wall in each cabinet, are 15" JBL 150-4's.

And on top and outside the cab-

inets (see photos) are big JBL 375's for the midrange. They're placed at an angle, a very precise angle chosen after hours of comparison, says Mavity. Same goes for the Kelly Mark II ribbon tweeters right out there, naked as jays.

Bass frequencies are crossed over at 220 Hz; the tweeters go into action at 5000 Hz.

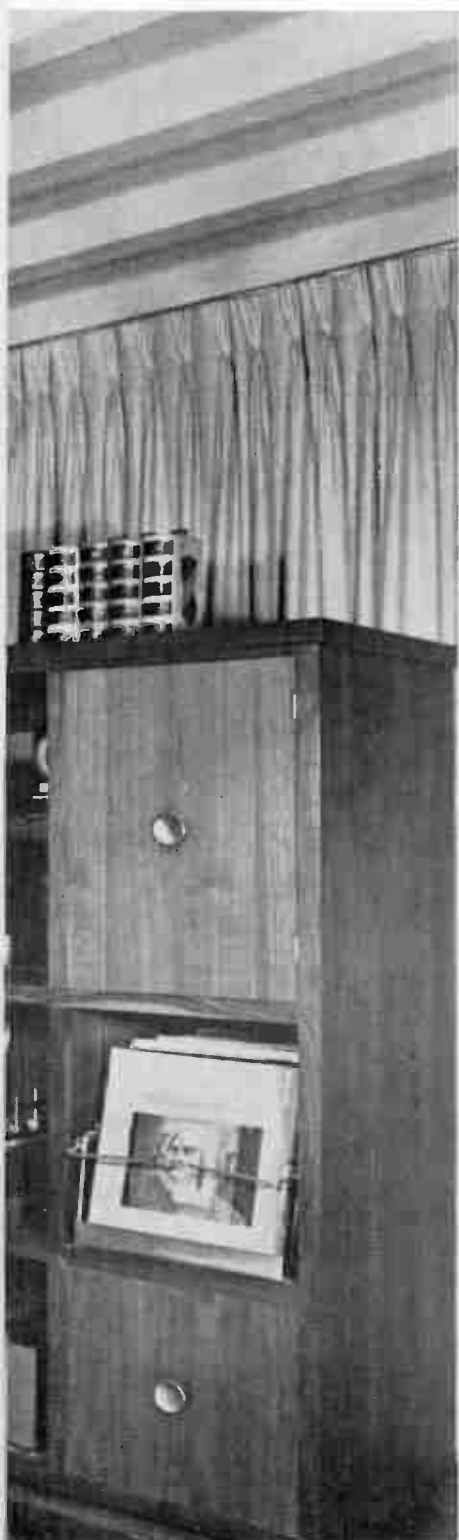
Mavity certainly sounded like the avid audiofan when he explained his unorthodox speaker setup. "I tried all combinations and positions before getting the 'cathedral' quality I wanted," he said. "I found that having the bass speakers face the wall gave me just the right dispersion of sound I wanted."

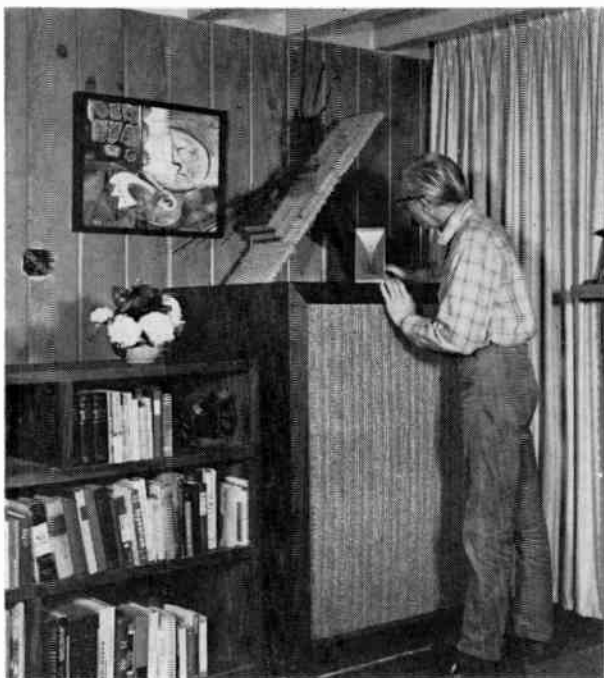
"In this room," he continued, "music sounds as good in one corner as it does in another. And you don't have to sit front-and-center in a particular spot to get the so-called best or perfect sound."

Hal Mavity has many interests. He's a painter, for example—both in an artistic sense and in the housepainting sense: patios to portraits. His own works and those of friends who are rising California artists are hung in the room—and not with music motifs. Mavity's audio approach is strictly aural.

You'll notice four amplifiers with six channels (the extra channels are accounted for by the two stereo amplifiers). Each source has its own amplifiers. In case you're wondering about those *two* manual turntables, Mavity makes use of the Fairchild and ESL tone arm when he wants to change cartridges, whereas the Thorens with integrated arm-cartridge,

Audiofan Hal Mavity installed hi-fi components in cubicles of a large cabinet which is set on casters. Observe that he has two turntables, two mono power amplifiers and two stereo power amplifiers among his impressive array of equipment.





The "fronts" of speaker systems shown here are really enclosure backs. Woofers face walls, while dummy grille cloth gives the illusion of bass speakers facing into the room. ("... gives me just the right dispersion of sound," says Mavity.) Exposed mid-range horns and ribbon tweeters are placed at an angle chosen by our audiofan as the best ones after many hours of comparison.

chosen as an optimum combination, is not designed to accept a variety of other cartridges.

Mavity's interest in music is logical in view of his background—he's a singer. He studied voice more than 10 years and was with an opera company in Pasadena for years. It was in this city that Hal Borek, a founder of the Stereophonic Club, got him interested in good music reproduction via hi-fi components about eight years ago.

Does he use that Electro-Voice 664 mike for recording his trained voice for playback? "No really serious voice recordings," he laughed. "Oh, I tape stuff to play back to myself, but nothing for

professional use such as demonstration tapes."

His sound system—other than the components already mentioned? It's comprised of the following components:

- 2 Marantz Model 9 power amplifiers (70 watt mono)
- 2 Marantz Model 8B power amplifiers (35 watt per channel)
- 4 Marantz Model 3 electronic crossover networks
- 1 Marantz Model 7 stereo preamplifier
- 1 Thorens TD-124 manual turntable with Shure M222 integrated tone arm-stereo cartridge
- 1 Fairchild 312 manual turn-

table with ESL tonearm and Orototon Stereo cartridge

1 Sony 777 four-track tape recorder

1 Marantz 10B FM stereo tuner

1 Finco FM-4 antenna and a CDR rotor.

He has few reception problems, since he is situated on the southern edge of Arcadia—as against some previously profiled audiofans living in foothill areas against the San Gabriel or Sierra Madre Mountains.

Mavity's system is set in a massive cabinet complex of his own design. It is on casters, a most handy feature. Though it's large, it is actually broken up through cubicles for the components, giving it an airy look. (see photo). Cabinet enclosures with doors provide storage space for accessories and glassware, including the wine decanter usually gracing a large catch-all coffee table.

Size and circulation provided by the over-all cabinet make special ventilation provisions unnecessary. In fact, an awesome array of wires can be seen.

Many audiofans take great pains to make certain that all connections are out of sight, even though easily accessible. Not Mavity. He laughed it off as just one more evidence of his current casual approach to the hardware that produces the music. Actually, he said he has a dark colored panel which can be placed behind the wiring, making it unobtrusive. The wiring at the back of some cubicles can be seen against the light-colored drapes that also were selected to achieve the sound Mavity enjoys.

What sort of music does Mavity enjoy? Customarily FM or tapes or records?

"Oh, all three, I guess. Certain jazz. And all classical music. The tuner is on all the time, so if you flip on the preamp you've always got *some* FM station."

Hal Mavity isn't concerned about the cost of his system and cabinet. Pressed for an estimate, he figured it would cost about \$4000 to duplicate. He added: "Of course that doesn't include the outlay along the way to this satisfactory system."

# FM LISTINGS IN YOUR STATE



## part 2 Southern California

In response to many reader requests for FM broadcast listings beyond local reception areas, **AUDIOFAN** presents such information from time to time. If you'd like to have your state covered (a New York FM listing was printed last September), let us know.

An asterisk next to a broadcast frequency indicates some FM stereo. The fast-changing pace set by FM stations—installing multiplex, new stations, etc.—makes it impossible to present an absolutely accurate list. Should you note any omissions, commissions or typographical errors, please let us know and we will alert readers to these changes in future issues.

### SOUTHERN CITIES

- Apple Valley**  
102.3 KAVB-FM
- Anaheim**  
95.9 KEZR
- Avalon**  
104.3 KBIG
- Bakersfield**  
\* 92.7 KIFM      96.5 KGEE-FM  
94.1 KERN-FM    101.5 KOXR
- Carlsbad**  
\* 95.9 KARL-FM
- Ciaramont**  
88.7 KSPC
- Coachella**  
\* 93.7 KCHQ-FM
- El Cajon**  
93.3 KECR
- Escondido**  
92.1 KOWN
- Fresno**  
93.7 KFRE-FM    101.9 KARM-FM  
\* 94.5 KCIB-FM   \*102.7 KXQR  
97.9 KMJ-FM
- Garden Grove**  
\* 94.3 KGGK
- Glendale**  
101.9 KUTE
- Hemet**  
105.5 KHSJ-FM
- Inglewood**  
103.9 KTYM-FM
- Loma Linda**  
88.3 KEMR
- Lompoc**  
92.7 KLOM-FM
- Long Beach**  
88.1 KLON      102.3 KJLH  
\* 97.9 KNOB    105.5 KLFM
- Los Angeles**  
89.1 KXLU      \* 93.9 KPOL-FM  
91.5 KUSC      \* 94.7 KRHM  
\* 92.3 KFAC-FM   95.5 KABC-FM  
93.1 KNX-FM    96.3 KRRD-FM

- \* 97.1 KFMU
- \* 98.7 KCBH
- 99.5 KHOF
- \*100.3 KFOX-FM
- 100.7 KPFK
- 101.1 KHJ-FM
- 102.7 KLAC-FM
- 103.5 KGLA
- 105.1 KBCA
- 105.9 KBMS
- 107.5 KBBI
- Monterey**  
\* 96.9 KHFR
- Newport Beach**  
103.1 KNBB
- Oceanside**  
102.1 KUDE-FM
- Ontario**  
93.5 KOYA
- Oxnard**  
104.7 KAAR
- Palm Springs**  
\*104.7 KDES-FM
- Pasadena**  
89.3 KPCC  
106.7 KPCC-FM
- Redlands**  
96.7 KCAL-FM
- Redondo Beach**  
93.5 KKOP
- Riverside**  
92.7 KACE-FM  
\* 97.5 KDUO  
99.1 KPLI
- Salinas**  
102.5 KSBW-FM  
103.9 KEER
- San Bernardino**  
91.9 KVCR  
95.1 KRCS  
99.9 KFMW
- San Diego**  
88.3 KSDS  
89.5 KEBS  
94.1 KOGO-FM  
\* 94.9 KLRO

- \* 96.5 KFMX
- 97.3 KSEA
- 98.1 KJIM
- 100.7 KFMB-FM
- \*101.5 KGB-FM
- \*102.5 KBBW
- 103.7 KTSB
- 105.3 KITT
- \*106.5 KPBI
- San Fernando**  
94.3 KVFM  
106.3 KSFV
- San Luis Obispo**  
\* 93.3 KVEC-FM  
96.1 KATY-FM
- Santa Ana**  
96.7 KWIZ-FM  
106.3 KFIL
- Santa Barbara**  
\* 93.7 KDB-FM  
97.5 KTMS-FM  
\* 99.9 KGUD-FM  
\*103.3 KMUZ
- Santa Maria**  
\* 99.1 KEYM  
102.5 KSMA-FM
- Santa Monica**  
89.9 KCRW  
103.1 KSRF
- Sierra Madre**  
107.1 KMAX
- Thousand Oaks**  
92.7 KNJO
- Tulare**  
94.9 KGEN-FM
- Ventura**  
100.7 KVFN-FM
- Ventura-Oxnard**  
\* 95.1 KUDU-FM
- Visalia**  
\* 92.9 KONG-FM
- West Covina**  
98.3 KDWC

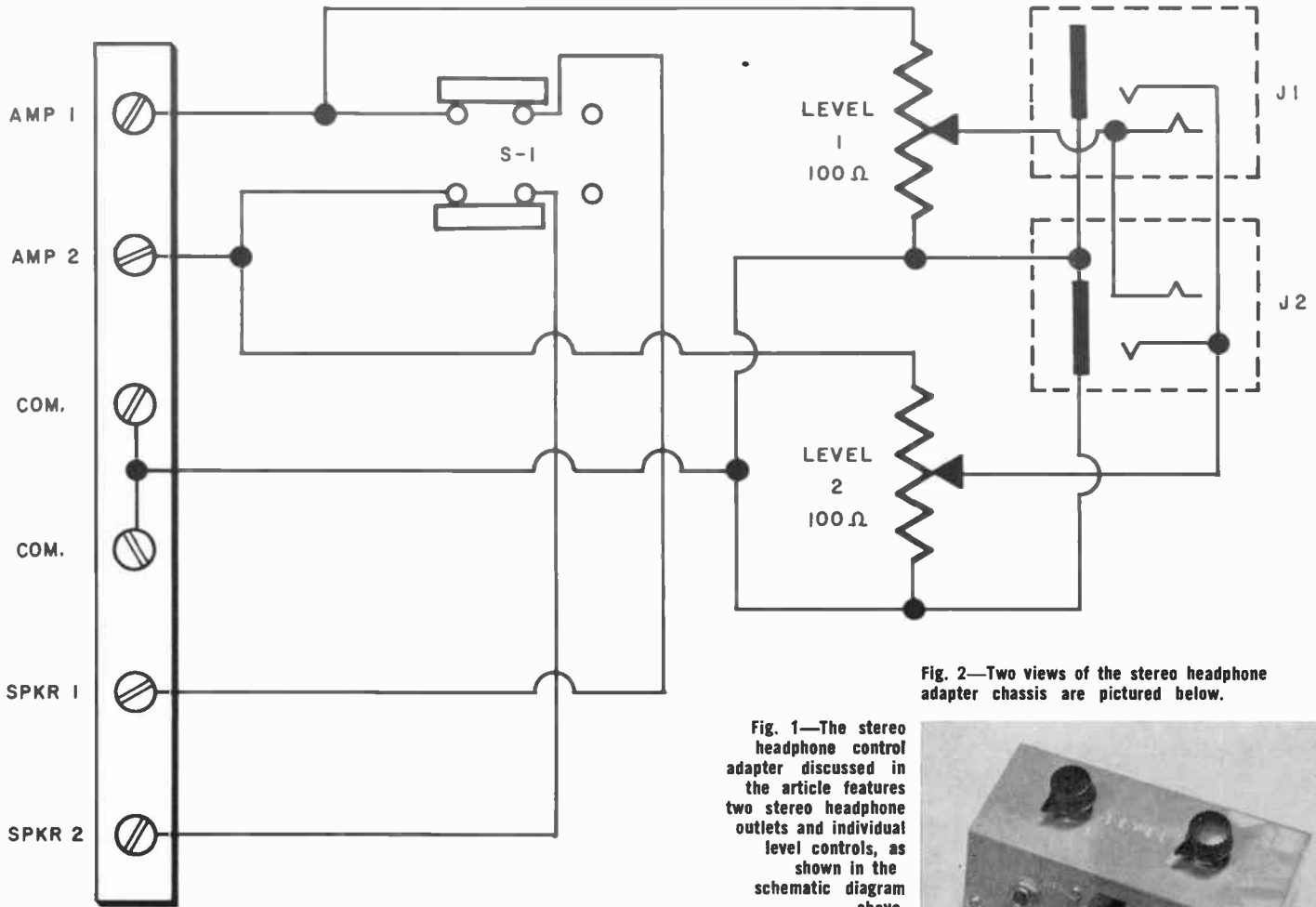
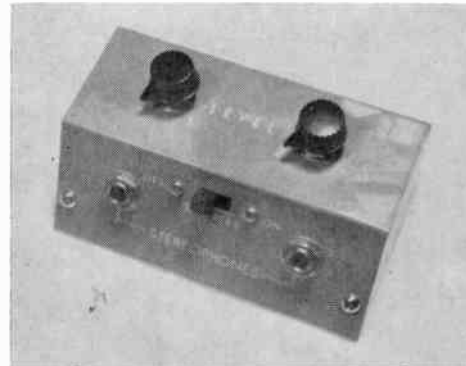


Fig. 2—Two views of the stereo headphone adapter chassis are pictured below.

Fig. 1—The stereo headphone control adapter discussed in the article features two stereo headphone outlets and individual level controls, as shown in the schematic diagram above.



### construct a stereo headphone(s) adapter

Not since the days of crystal-sets and "cat's whiskers" have so many people been found wearing what, at first glance, seem to be oversized ear-muffs. Actually, these popular earcoverings are intended for indoor use (though they can and have been used outdoors). They are stereo-headphones, naturally.

Unlike their predecessors of the early 1900's, they are comfortable to wear, capable of amazingly good tonal response and, in the case of stereo, they offer a sensation of separation and "hearing all around you" that just can't be equalled with twin loudspeakers.

From a practical point of view, they offer a simple means of listening to your stereo system at any hour of the day or night without distributing other members of the family (not to mention the neighbors).

If you bought your stereo amplifier in the last couple of years, read no further, because in all probability your amplifier is already equipped with a headphone jack and a means for shutting off the speaker system while listening through headphones. Many amplifiers automatically shut off the speakers when the plug of the stereo headphone is

connected into the jack. Others have a separate switch for shutting off the speakers while using the headphones. If, on the other hand, you bought your stereo amplifier before this convenience was added to the front panel, don't despair. For a total outlay of under \$4.00 and about an hour



# CONSTRUCTION PROJECTS

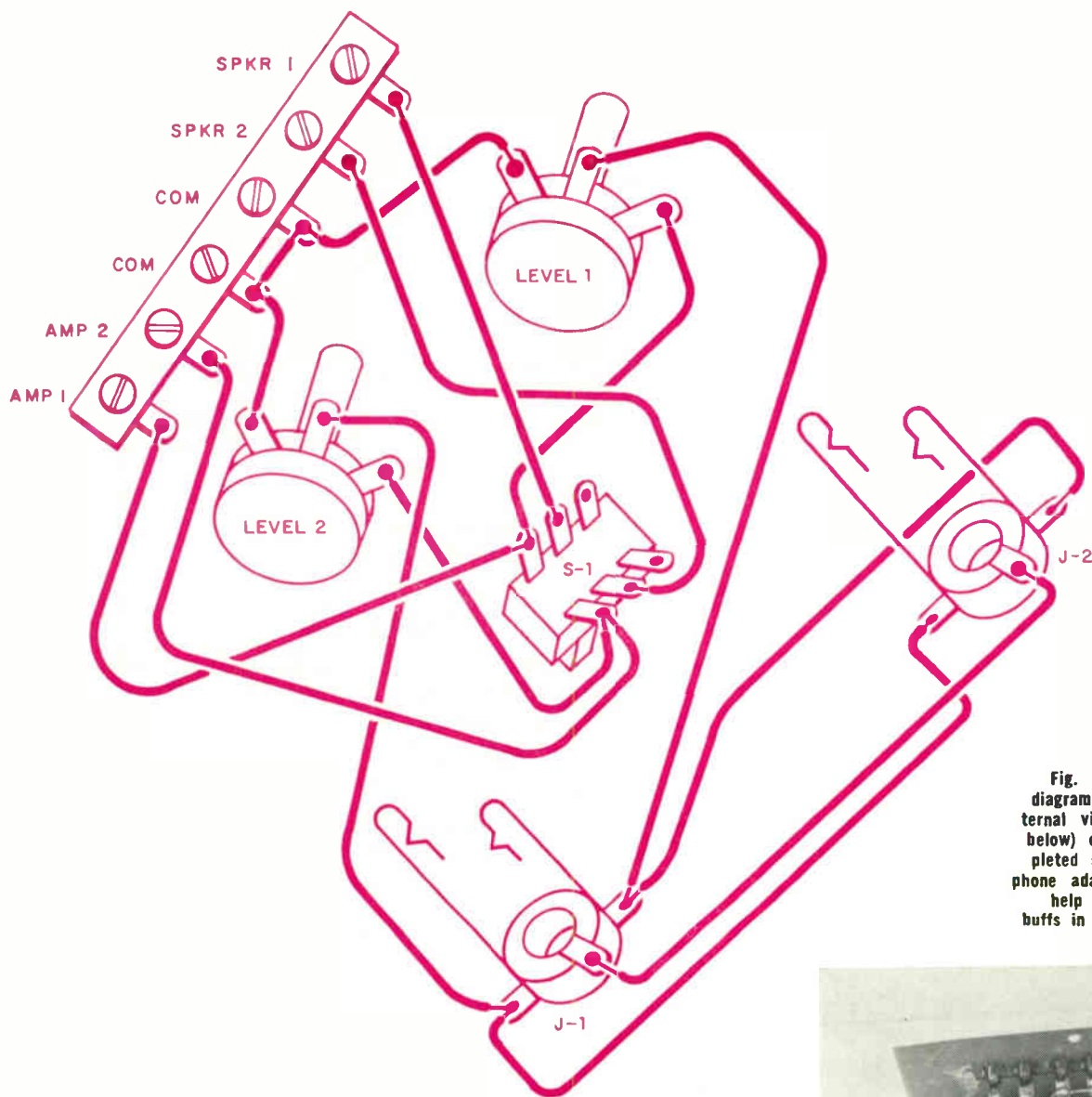


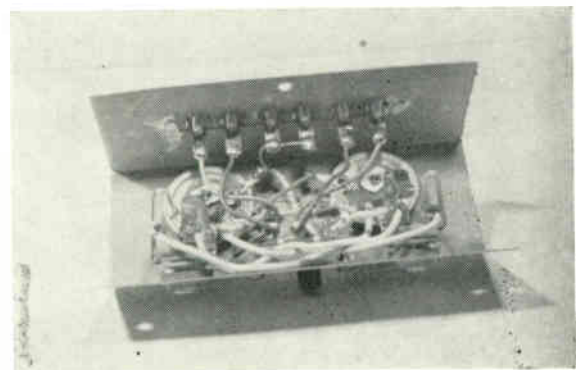
Fig. 3—A wiring diagram and an internal view (Fig. 4, below) of the completed stereo headphone adapter should help construction buffs in building the device.

of time, you can do the professionals one better. The little headphone adapter to be described here features *two* headphone jacks (a sort of "his" and "hers" arrangement) as well as individual level controls for left and right channel and a shut-off switch for your existing speakers. The nice thing about it is that you don't have to take off the bottom cover of your amplifier or do any other modifications to your existing electronics. The adapter is a completely "outboard" device.

Fig. 1 is a schematic diagram of the adapter and, for those who have some difficulty following a

schematic, Fig 3 is a pictorial diagram of the actual connections to be made. The small metal chassis shown in the photograph of Fig. 2 serves as a housing for the parts, though almost any chassis or even a flat metal plate can be used. Jacks J1 and J2 (see parts list) have been chosen to accept the stereo headphone plugs which are standards on nearly all commercially available stereo headsets.

A word about the level controls. These controls serve two purposes. Many people have differing hearing sensitivities in their left and right ears. By means of these controls, the stereo program can be



"centered" in much the same way that you would use a balance control when seated "off-center" with respect to your loudspeakers. In addition, it takes very little power to drive most sets of headphones. Thus, if you didn't have a means for controlling the level on the adapter you'd find that your amplifier volume control would have

to be turned almost fully down to minimum, a setting which does not yield the best signal-to-hum ratio for most amplifiers. With the level controls present on the adapter, it is possible to leave your amplifier volume control set just about where you would want it when using loudspeakers. You need only set the adapter level controls for convenient and comfortable stereo headphone listening.

A word of caution is in order at this point. While most amplifiers have "common" or "ground" terminals for one side of the twin speaker wires, a few do not. That is, certain amplifiers do not share a common connection between chassis ground and the return leg of each speaker. If you happen to own one of these types of amplifiers, the simple circuit shown here will not work for you. If, however, your speaker terminal strips are now labeled with a "ground" terminal or a terminal for each speaker marked "common," you're all set to hook in to the finished adapter.

Simply disconnect the speaker wires from the amplifier's terminals. Connect them to the adapter as shown in Fig. 5. Then connect wires from the amplifier's now unused speaker terminals to the adapter, illustrated in the diagram. The only thing left for you to do now is to plug in one or two sets of stereo headphones in J1 and/or J2 and prepare for the thrill of headphone listening.

Operate your stereo amplifier just as you would with normal loudspeakers. With S1 set in one of its positions, the speakers will operate normally. In the alternate setting of S1, the speakers will remain silent and sound will come only from the headphones.

As for the choice of stereo headphones, more than a dozen makes and models are available. Your high fidelity dealer will no doubt be able to let you audition some, both with respect to fidelity, of reproduction and comfort for the wearer.

The only restrictions from the point of view of this adapter is that the phones selected must be "low impedance" types, either 4, 8, or 16 ohms. Most of them are.

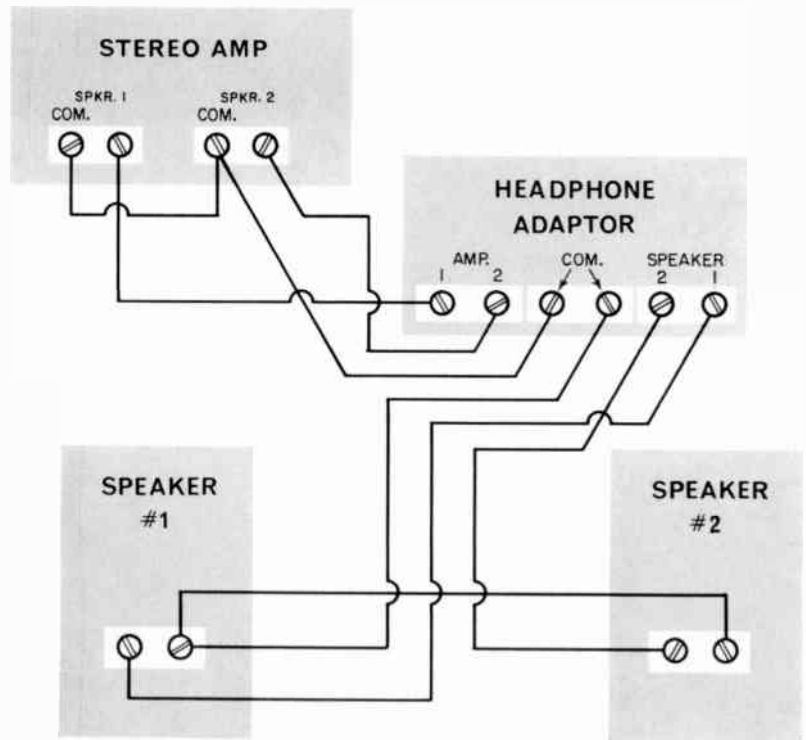
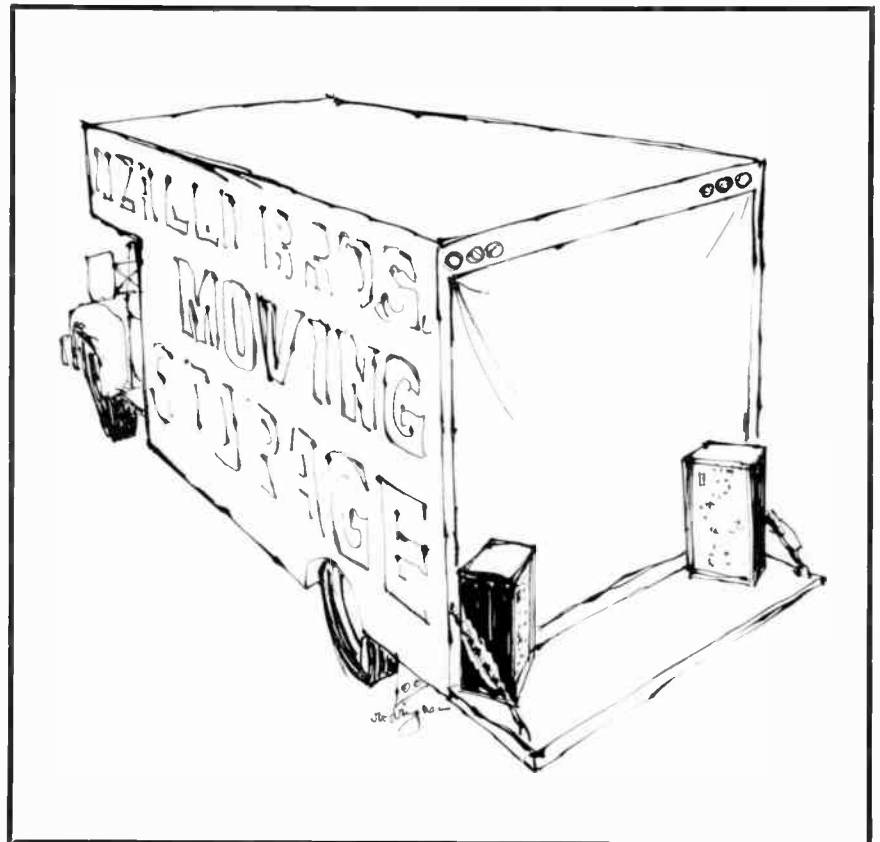


Fig. 5—Here's how to connect the headphone adapter between stereo amplifiers and stereo speaker systems.

## PARTS LIST

Part	Description	6-Terminal Strip Miscellaneous	Screw Terminal Strip Hook-up wire, solder, control knobs (2), Hardware, etc.
J1, J2	Jacks, 3-conductor, Switchcraft type 12B		
Level 1, Level 2	Potentiometers, 100 ohms, IRC type WPK-100		
S1	Slide switch, DPST or DPDT	Chassis	3" x 2" x 2", fully enclosed.



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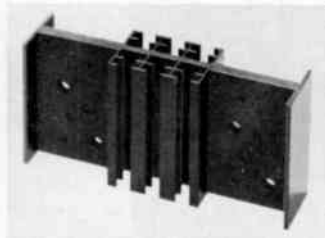
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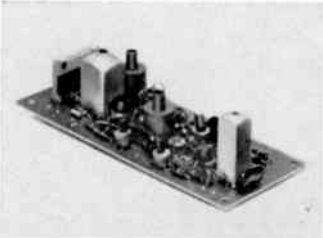


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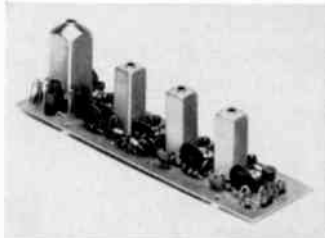


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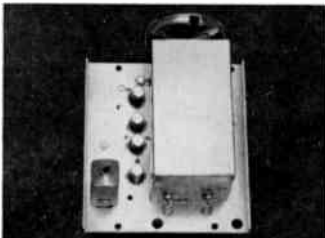
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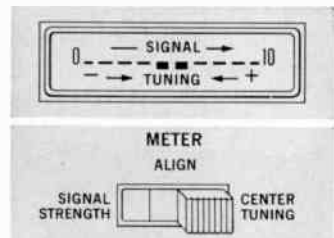
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Specifications LT-112: Usable Sensitivity (IHF), 2.2  $\mu$ v; Selectivity, 4.0 db; Cross Modulation Rejection, 80 db; Price, \$179.95.

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# WHAT'S GOING ON

## AMPLIFIERS/TUNERS/RECEIVERS

There's nothing stagnant about the electronics side of hi-fi stereo gear. Price breakthroughs, new designs, an additional entertainment source, and a manufacturer's first-time entry into this product field mark recent hi-fi electronics equipment. And though we have come to expect all new developments to encompass solid-state design, there's one that's sticking to vacuum tubes.

AUDIO DYNAMICS ADC, known for magnetic cartridges and speaker systems, tosses its hat into the electronics end of things with a 60 watt (total IHF power at 8

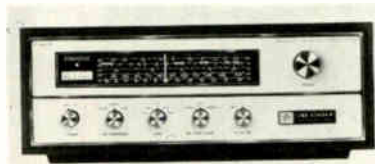


ohms) solid-state control amplifier, the ADC Sixty. The compact—8½" deep x 3¼" high x 15¼" wide features two sets of speaker terminals which are controlled individually, tape recording and playback facilities, separately fused output circuits. Some specs are: THD at rated power, 0.5%; frequency response, 10 to 100,000 Hz ± 2 db. Its price of \$149.50 includes a brushed control panel; an optional walnut cabinet is available.

FISHER Fisher's new Model R-200B FM/AM/Multi-Band Short Wave tuner introduces a reception concept that has long been absent in the hi-fi field—picking up broadcasts around the world. Browning, you old timers might recall, had



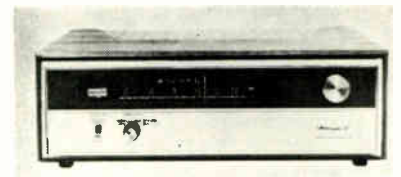
an AM-Short Wave tuner when they were active in hi-fi. But just about that time, AM became a hi-fi outcast, not to mention short wave. AM was resurrected last year, it seems, and short wave now comes to the fore. For audiofans unfamiliar with short wave broadcasts, it's AM on a different frequency band. In general, SW reception quality is kinda lo-fi due to atmospheric conditions, alas, though some broadcasts can be picked up with amazingly good fidelity. The important point here is that many gems, from a performance view, can be received (and therefore taped), whereas without a short wave unit you get zero. The R-200B has 4 AM



broadcast bands: standard broadcast, marine weather-navigation, short wave and expanded scale short wave. There's a three-stage agc to reduce broadcast fade, as well as a three-position AM bandwidth selector, whistle filter, AM

ferrite antenna and an integrated logging scale. The tuner uses a tuned r-f and three-gang AM tuning variable condenser. Oh, yes, there's FM and FM stereo, too. IHF sensitivity is 1.8 microvolt. \$349.50.

H. H. SCOTT Scott's low-cost (under \$200) solid state FM stereo tuner, Model 315, features an all-silicon intermediate frequency section, automatic switching from mono to stereo when a stereo broadcast is received, and a silver-plated all-transistor front end. The unit's Series Gate multiplex circuitry makes possible a stereo channel separation of 35 db, says the manufacturer. Specs include the fol-



lowing: usable sensitivity, 2.7 microvolts; distortion, under 0.8%; drift, under 0.02%; capture ratio, 6 db; selectivity, 40 db; cross modulation rejection, 75 db. Among the tuner's other features are a sub-channel filter, noise filter, signal strength meter, and an FM stereo indicator.

DYNACO The reknowned PAS-3 Dyna preamp has been superseded by the new PAS-X, which is also available in kit and factory-assembled versions. The new basic preamplifier features a different tone control design, says the manufacturer, in which phase and frequency controlling elements are removed from the circuit when the control is in the mechanical

center of its rotation. Controls are effectively out of the circuit when in the flat position. Har-



monic and IM distortion are below 0.05% at 3 volts in the range of 20 to 20,000 Hz. Other specs are equally impressive, including less than 2 millivolts of noise through the equalized magnetic phono input with 60 db gain. A Dyna blend switch includes a partial blend position for the 6 db of blending needed to use Dyna's 3-speaker stereo arrangement which is said to provide accurate source location from most room listening positions. The PAX-3X kit goes for only \$69.95; the assembled version, \$109.95.

**SHERWOOD** The latest Sherwood FM stereo tuner, Model S-3300, features all-silicon solid-state design. The tuner is a highly sensitive 1.6 microvolt (IHF) with circuitry that is immune to overloading, says the manufacturer.



A stereo noise filter which reduces "unpleasant high-frequency background noise without affecting frequency response of the program being received" is incorporated into the S-3300. Other features of the S-3300 include noise-threshold-gated automatic FM

stereo-mono switching, a D'Arsonval zero center tuning meter, front panel level control, and rocket-action switches that control the noise filter, interchannel muting, and other switching functions. \$167.50; a walnut grain case is available at \$7.50.

### RECORD PLAYERS

**GARRARD** Remember the old Garrard Model T manual player and others of its kind back in '58? They were a boon to audio buffs who admired the features of manual turntables but either couldn't afford them or didn't have the space. Now Garrard introduces a kissin' cousin to the Model T, the Model SP20. Though a completely new device, it, too, features 4-

speeds, automatic trip at the end of a record, and an interchangeable plug-in head which will accept any pickup. After a record is played, the tone arm returns to a rest position and the machine shuts off automatically. The low cost (\$37.50) manual player is compact, too, measuring only 14 $\frac{3}{8}$ " left to right, 12 $\frac{1}{2}$ " front to rear, 3 $\frac{1}{2}$ " above and 2 $\frac{3}{8}$ " below the motor board.



---

## 1966 coming events

MARCH 30 to APRIL 3 (Wednesday to Sunday)

### Los Angeles High Fidelity Show

HOTEL AMBASSADOR, LOS ANGELES, CALIF.

APRIL 21 to APRIL 24 (Thursday to Sunday)

### San Francisco High Fidelity Show

CIVIC CENTER, SAN FRANCISCO, CALIF.

APRIL 25 to APRIL 28 (Monday to Thursday)

### Audio Engineering Society Convention

HOLLYWOOD ROOSEVELT HOTEL, LOS ANGELES, CALIF.

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## MAGNETIC DISCS IN YOUR FUTURE

(Continued from page 14)

port that indicates that high frequency response *improves* after some use due to the "polishing" effect of the tape head. (A somewhat similar effect occurs while playing records. There's always some new pressing shavings in the grooves which are removed after a play or two. The important point to remember here when you dub a spanking new record onto tape is to play the record a few times before recording it. You'll get better fidelity by following this practice.)

As mentioned earlier, the whole system is automatic. When you insert a magnetic disc into the unit's chute, it hits end stops and actuates a microswitch when the disc's center hole is aligned with the turntable's center. When the microswitch is activated, a clamping disc centers the disc accurately.

With excellent foresight, the microswitch circuit was designed with a slight time delay to take

into account operators who toss the disc into the chute so violently that it might take a slight bounce before it settles on the turntable platter.

The broadcast unit features an automatic stop in the play position. This is accomplished through a 30 Hz pilot tone which is automatically impressed on a magnetic disc when the stop button is depressed while in the record mode. Cueing, too, is automatic (within one revolution of the turntable).

So you see, a working system with magnetic discs is already here. Though it's not a consumer item (for one, the equipment costs almost \$1,400), magnetic discs and equipment such as this may one day be practicable. It wasn't too many years ago, perhaps 20 years, when a phonograph system used the single play pop-a-record-in-a-slot system, as some readers will recall. So the operation itself isn't that radical. *Information credit: Audio Engineering Society.*



**the  
technical  
quality  
of  
records  
and  
tapes**

**Reviews are concerned with audio reproduction qualities, not musical performances**

by Alex Rosner

Latin American dance music does not weigh heavily in most audiofans' record collections. But as more and more hi-fiers discover, a few South-Of-The-Border discs lend musical and audio spice to any collection.

The Latin American "sound" is different. For example, consider the *Charanga* (Charanga is the sound; Pachanga is the dance). The type of musical organization that produces its distinctive sound substitutes violins for the saxophones and brasses of usual Latin American dance bands, and also makes important use of vocals and a flute soloist.

From an audio view, the dance music is like combo jazz but with a broader frequency and dynamic range. This comes about because a greater variety of percussion instruments and vocalists is used. The smallest complement of musicians in a Latin American dance combo might be five and the largest band, sixteen. At least half comprise the rhythm section whose instruments include conga and bongo drums, timbales, gourd, cowbell, and a string bass. Other instruments such as piano, vibraphone and guitar contribute to the rhythm, as do the Spanish-singing vocalists who become integrated with the rhythm as well as melody. Some of the percussionists may also sing while they're playing and a good deal of instrument switching is done, giving the impression of more people than there really are.

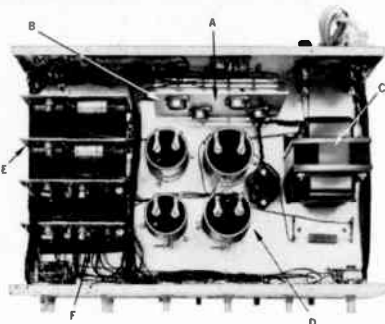
The total effect is one of a swinging rhythm machine whose sound, when well recorded, should tax the capabilities of the finest audio rig.

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capture the frequency and dynamic range, to balance the orchestra and singers for the desired sound, and to create a reverberant condition which will simulate movement in a live performance.

To get back to the Charanga, the following eight discs are representative of what is available from the more popular U.S.-based Latin American orchestras in the way of Pachanga dance music in stereo:

**CHARANGA & PACHANGA**—Hector Rivera and his Orchestra—Epic BN599

**SABROSO!**—Mongo Santamaria and his Orchestra—FANTASY 8058

**PACHANGA CON PUENTE**—Tito Puente and his Orchestra—Tico SLP 1083

**PACHANGA IN PERCUSSION**—Ray Barretto and his Orchestra—Riverside XK8007

**LA PACHANGA SE BAILA ASI**—Joe Quijano and his Orchestra—Columbia CS8544

**PACHANGA CON CHA CHA CHA**—Randy Carlos and his Orchestra—Fiesta FLPS 1313

**PACHANGA CHARANGA**—Tito Rodriguez and his Orchestra—United Artists UAS 6140

**LA PACHANGA**—Rene and his Orchestra—Capitol ST 1530

Of the eight, only the *Tito Rodriguez*, *Mongo Santamaria* and *Ray Barretto* orchestras use violins to simulate the genuine Charanga sound. The *Rodriguez* disc features three centrally located vocalists who emerge clearly but somewhat too prominently. The rhythm section, merged at left, lacks definition and sounds like one complicated instrument except for the gourd, whose scratching sound remains in relief. In some selections the piano sounds muffled because of the piano-bass unison style where the bass masks the piano sound. Occasionally the flute shrieks and even the very musical voices break up.

The vocalists on the *Mongo Santamaria* disc, while in good balance with the orchestra, also sound distorted in spots and lack body in general. The rest of the band sounds clean and well spread. Trumpets are used on some selections in place of violins.

*Ray Barretto's* album, cut on Riverside's "Fortissimo" series, gets played from inside out; that is, the lead-in groove is located near the record's center. The disc offers a 400 cycle test tone of one minute's duration (with a locked groove following) before beginning the first selection near the center of the record. The tone is intended for "balancing the speakers." It clearly reveals wow (caused by off-center pressing). Surfaces are very clean, violins are beautifully recorded and the band is well spread out, offering good definition. There is lots of reverb thrown in, highs seem to be accentuated and the overall recording level is on the high side. The only time break-up could be detected was on a few flute peaks. This disc will put a pickup through its paces. There was no apparent change in audio quality as the cartridge traced from inside to outside tracks. Bar-

(Continued on Page 30)

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**TECHNICAL  
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*(Continued from previous page)*

retto's monotonous style, in unappealing arrangements, fails to demonstrate the advantages of cutting records from the inside out. (Cutting records in this manner, however, is advantageous when music starts pianissimo and concludes fortissimo, as many classical recordings do.)

The remaining five albums, which modify the Charanga idiom by substituting jazz-like brass sections for violins, vary in sound quality. The *Hector Rivera-Epic* release is recorded at a high level with lots of presence, but has too much reverb in most numbers. Bass seems deficient and the conga drums must be imagined except in "Tumba Que Tumba," which is the set's jam session number in which instruments have been rearranged. The record bristles with shouting brass that is

distorted on occasional peaks, and contains other rhythms besides the Pachanga.

*Tito Puente's* album has good bass and balance between vocalists and orchestra with not too much reverb added. The usual crackling power of Puente's trumpet section is reduced because the brasses are set distant. His trumpets, which cannot be rivaled in intonation and precision of attack, occasionally sound distorted on this disc. The vibraphone, a difficult instrument to record and reproduce, is used on a few selections of other rhythms and emerges cleanly. Each of the following two selections from Puente's are exceptionally fine: "Un Telegrama" and "Carmelos."

Columbia's *Joe Quijano* offers swinging, clean sound. The disc has clean surfaces, solid bass and good separation, while the piano maintains its rightful role and level throughout. The excessive reverb projects the enthusiastic vocalists too strongly, however, and the lack of variety emphasizes the singers.

*Randy Carlos*, in his album, uses electric guitar instead of piano, plus two trumpets and a rhythm section. His relaxed style gives a bright sound with clear brass that is only occasionally on the verge of distortion. Voices are just right in relation to the rest of the band. As the title suggests, Cha Cha Cha's are also included.

The best of the lot from a sonic standpoint is Capitol's set by the *René Orchestra*, which features soft-edged flutes on one side and smooth trumpets on the other. The rhythm section (including gourd) is near the flutes, excepting the timbales which are between the trumpets and the centrally placed singers. Despite its relatively high recording level, the sound is as clean as can be, setting an example for the other companies to follow if they can.

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## ASK THE AUDIOFAN ANSWERMAN

FROM J. H. D., LAKE PLACID, N.Y.:

I have read that a horn greatly increases the efficiency of a loudspeaker. Could I improve the performance of my bookshelf system by constructing a short horn, say a foot and a half long, for the front of the bass speaker? What should its dimensions be for good response to 30 cps?

ANSWER:

A horn of the kind you envisage would not improve your bass. Instead, it would seriously impair it. The horn will make the speaker peaky somewhere in the mid-range, and make the bass rough. To work well down to even 40 or 50 cps the horn would have to be 8 or 10 feet long, at a minimum. Even a folded horn for good 40 cps response is a big device. For full-bass horns, there is no real short-cut on size.

FROM J. J. D., BROOKLYN, N.Y.:

I have bought 4 very small tweeters—1½-inch diameter, which I intend to add to my (mono) speaker system, which now consists of one 12-inch wide range speaker in a bass-reflex enclosure. I was not satisfied with the high-frequency response; after considerable study of the literature I decided that adding a tweeter, with a cross-over network, would be the quickest and most direct way to get what I wanted. I found the small tweeters on sale and liked their characteristics. They will take over at about 3,000 cps; the network will keep lower frequencies out of them. I plan to mount them across the top of my bass reflex cabinet. Can you see any problems in this?

ANSWER:

Yes! If you put the tweeters in a straight horizontal row, you will get a fierce beaming of the highs straight ahead of your speaker. This makes the sound rough in the highs if you sit directly in front of the speaker, and robs you of the effect of the tweeters if you sit at the side. The principle is simple, if surprising at first glance: a wide, horizontal extension of vibrating surface and narrow vertical area concentrates the highs in the horizontal plane, spreads them vertically, and a long vertical extension, narrow horizontally, spreads them horizontally. This

principle is used in the "column" speakers now very popular in public address installations, where the sound must be concentrated in the direction of the listeners, and not allowed to go high or low where reflections could add to the feedback problem without contributing to coverage.

One way you could avoid this problem would be to mount the tweeters in two groups, each one with two speakers one above the other, this should give much better dispersion of highs in the room. Ideal, from the point of view of sound distribution, would be a single

vertical column of the four tweeters, but this would obviously be difficult to integrate with your present cabinet. It would be possible, if you don't mind a separate "column" standing on top. The tweeters, of course, don't need large enclosed cabinet volume in back of them. In fact, if you mount them directly in your present cabinet, it's a good idea to enclose their backs tightly with small sub-boxes within the cabinet. This would separate them from the back wave of the woofer, which develops very high pressure that may affect sound, if not damage the tweeters.

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Advertisement

## \$500 OFFERED FOR PREAMPLIFIER



BOB TUCKER

\$500 in cash awaits the first person who can supply Bob Tucker (Dynakit's Sales Director) with a stereo preamplifier which can outperform Tucker's present

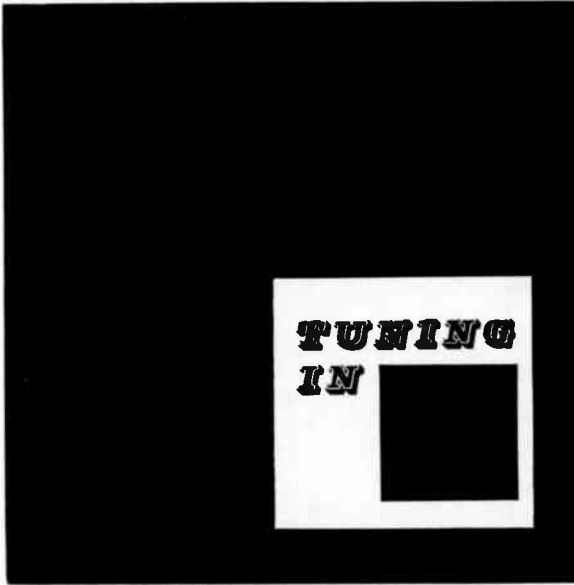
unit, a Dyna PAS-3X.

When asked about his offer, Tucker explained: "Like most hi fi fans, I have always wanted to have the best equipment available. Over the years, as a hobbyist, a dealer, and now as a manufacturer, I've owned or had access to virtually all of the high-priced name brands; and on comparative listening tests as well as laboratory checks, the Dyna still comes out on top. Over 6 years ago I first made a personal offer of \$300 on the same basis, and while I met a few "bounty hunters," none of the units submitted could outperform my Dynakit. Now, with inflation sending the cost of audio equipment up, and with the latest improvement to the PAS-3X, I've upped the ante to \$500." Queried on the criteria for choosing a preamp, Tucker gave the following:

- Harmonic distortion and spectrum analysis
- Intermodulation distortion
- Flatness of frequency response

- Accuracy of equalization
  - Gain
  - Signal-to-noise ratio, both audible and inaudible
  - Transient performance, including square waves and tone bursts
  - Thermal stability
  - Channel separation
  - Ability to maintain performance specs at any setting of the volume control.
- Freedom from switching transients  
Convenience and flexibility of controls  
Freedom from interaction of controls  
Service accessibility  
Conservative operation of components  
Listening comparison

He further explained, "I'll be glad to supply more details to anyone who wishes to pursue this, but to save needless correspondence, I suggest that some preliminary test results be submitted so that those units which obviously do not measure up can be eliminated. An offer like this is feasible only because a preamplifier is the only audio component whose performance can be effectively defined by such established, easily reproducible criteria as the (●) items above. The last one is the simplest and most significant test, though—a listening test which anyone can perform: reproducing a "live" tape, using a first-class recorder, power amplifiers, and speakers; first through the preamplifier, and then by-passing it, going directly from the recorder to the power amplifiers. A truly fine preamplifier, like the PAS-3X, will be undetectable."



- Some readers might have thought Audiofan's January 1966 feature on future hi-fi developments to be a bit far-fetched, especially the prediction that tiny silicon chips will eventually displace transistors. But shortly after publication, RCA announced that upcoming TV sets will employ such circuits, one of which will perform functions of 26 components used in present receivers. Solid-state devices and vacuum tubes are still being used side-by-side with the new integrated circuitry, however.
- Stereo FM stations continue to grow in number, says the National Association of Broadcasters. By January 1966, the total had risen to 396 stations broadcasting stereo FM; up from 370 stations last October. Every state has at least one stereo FM station now, with California leading with 44 stereo stations.
- Video tape recorders continue to grab the spotlight. Concord Electronics unveiled a \$1,500 HVTR which uses two rotary heads in helical-scan style. Half-inch tape on 7 inch reels operate at 12 ips. Audio frequency response is said to be 50 to 12,000 Hz. Sony demonstrated a home color VTR, which is expected to be available in late 1967. The color VTR can record color telecasts and immediately play them back on any standard color television set, as well as recording and playing back black and white pictures. A color vidicon camera is said to be in the final stages of development. Unlike Sony's B&W VTR, which can be adapted for color for about \$1000, a monitor TV set is not included nor required. A color converter, however, has been added. Ampex advises that they don't expect to market a color HVTR for another two years.

Playback of Sony's prototype color HVTR was demonstrated recently. A recording of the demonstration was made and immediately played back on a black and white HVTR (a color vidicon camera has not yet been fully developed.)

- There's a wealth of recorded material on those early phono cylinders and discs. Performances from another era—great singers, musicians, and actors, among others—have been preserved by collectors, archivists, and curators. But these sound recording enthusiasts have been more or less going it alone all these years. Now there's a movement to draw them together into a professional society. A meeting to this end was held at Syracuse University recently, where the purpose of such a group was said to be mutual exchange of ideas and materials and to create a directory to collections so that all members will know who has what. Also discussed was the possibility of a newsletter to keep members up to date on recording collections, trading recordings with archivists and collectors overseas, and copyright laws. In the event you think we're talking about a piddling number of sound recordings made on Edison discs and cylinders, Bettini cylinders, et al, Syracuse University's Audio Archives and Re-Recording Library alone have some 200,000 recordings.
- Ever wonder what's behind those airline cockpit voice recorders that you read about when an air tragedy occurs? Well, they're not too unlike the tape recorders we're familiar with. For example, Fairchild Camera & Instrument Corp.'s cockpit voice recorders are sophisticated, rugged machines that feature a tape speed of 1 7/8 ips, and a minimum continuous operation of 4,000 hours on a four-track system. Now that's a lot of talking time! The rugged, 20.6 pound transistorized recorder has a frequency response of 300 to 5000 Hz. The system is encased in an orange-colored package; the better to spot if the worst should happen.



## ***Dear Audiophan:***

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