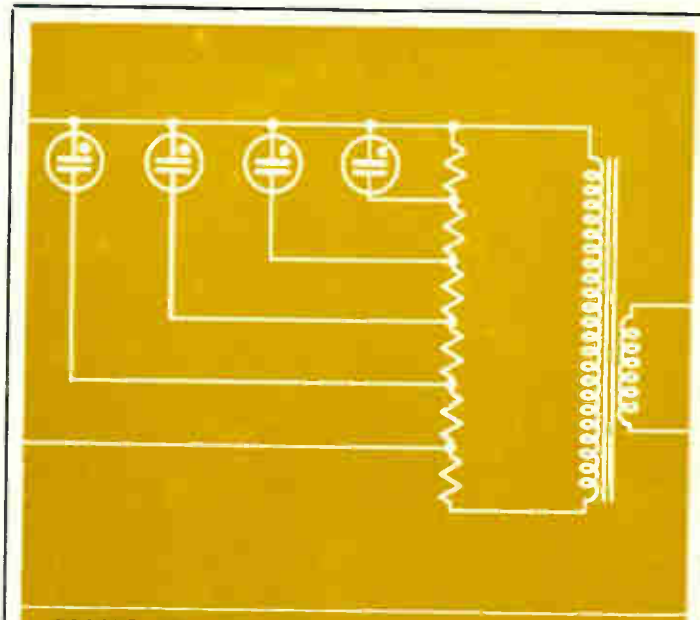
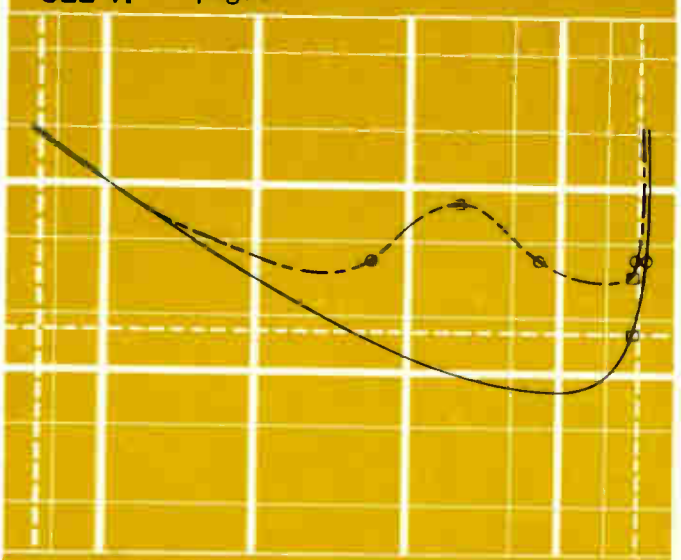
Audiofan

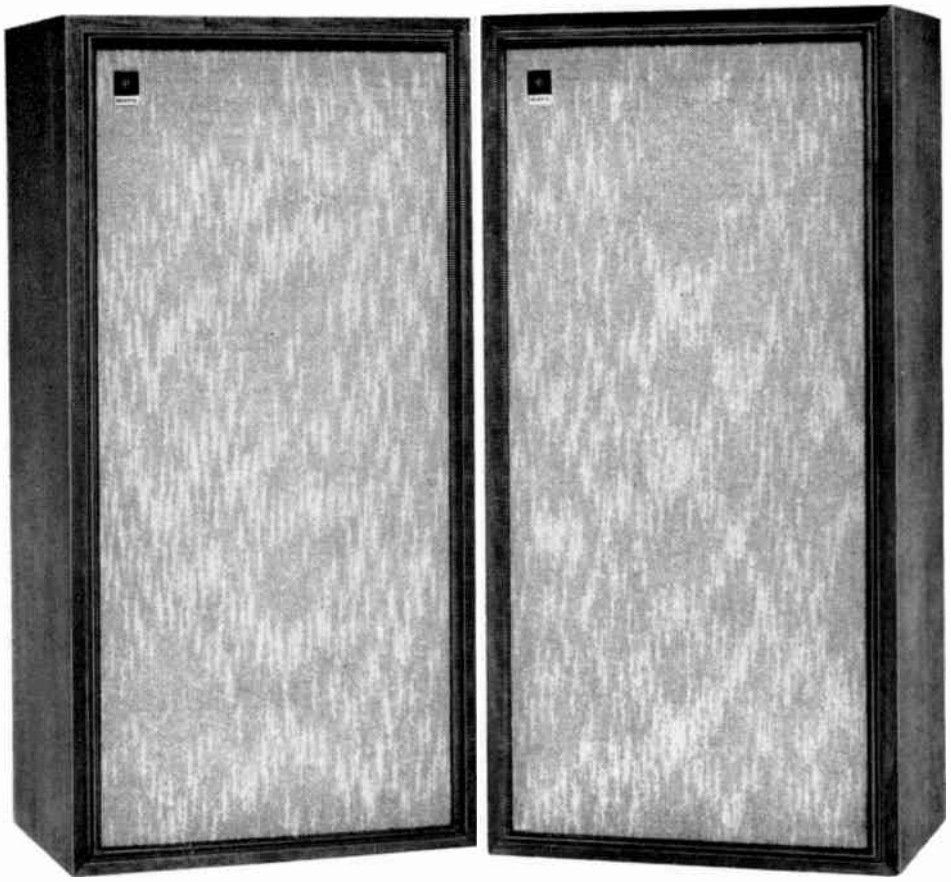
THE MAGAZINE
FOR THE
HI-FI ENTHUSIAST





APRIL 1966 VOL. 2 NO. 4 FIFTY CENTS

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



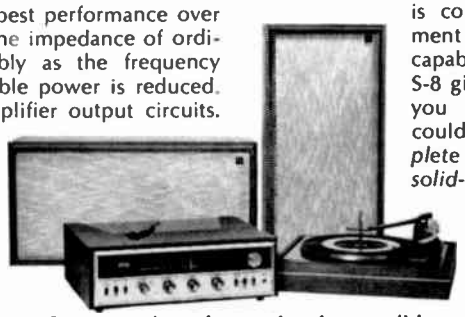
Only the new Scott S-8 is designed with Controlled Impedance!

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

SCOTT®

For further information and specifications on the new Scott S-8 speaker system, write:
H. H. Scott, Inc., Dept. 39-04, 111 Powdermill Road, Maynard, Mass. Export: Scott International, Maynard, Mass.

EDITORIAL

empty holsters in hi-fi land

No man would be caught alive in the "Old West" with an empty holster. He'd be dead.

There's a less punitive parallel in hi-fi when an audiofan is caught with empty preamplifier jacks. That man is uneconomical.

It's a waste of resources simply because an investment in audio amplifiers, with convenient source switching facilities, and speaker systems has already been made. This inborn flexibility is one of the reasons for buying components, isn't it? This means that an audiofan can increase his enjoyment of realistic sound by simply inserting some signal-carrying plugs into existing jacks. What could be easier?

What you use to fill up those empty jacks depends largely on the source equipment you now have. If you own a mono FM tuner, for example, you may well want to upgrade to FM stereo . . . cross off one jack. If you own an FM stereo receiver, you may wish to add an automatic or manual turntable to it . . . there go two more jacks. And what could be a more natural appendage to a receiver than a stereo tape deck to record stereo broadcasts? Chalk off two more jacks.

You can add new dimensions in audio to your systems, too. Maybe a shortwave broadcast set can boost your hi-fi fun, especially if you understand a foreign language. (You don't need a license to *receive*, you know.) And don't overlook using your hi-fi gear for instrument amplification, either. You can play an electric guitar or electronic organ through it.

With summer coming up fast, remember that you can use your hi-fi system as a public address system for back yard calls to dinner—just plug in a microphone, add an outdoor speaker, and you're all set. The extra outdoor speaker also makes for a fine outdoor background music setup, using your indoor system, of course. We can go on and on . . . channel TV sound through the hi-fi system . . . add a second tone arm and cartridge to a manual turntable . . . take advantage of stereo headphone jacks, ad infinitum.

You've got the basic equipment, why not take advantage of it?

THE EDITORS

Letters

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

information please!

DEAR AUDIOFAN:

I am trying to obtain information on records of the following songs: *My Love, My Life*, sung by Marissa Pavan in a 1952 film, *What Price Glory; Two Brothers*, sung by Kay Starr; *Dancing On The Ceiling*, sung by Jeri Southern; *Dark At The Top Of The Stairs*, sound track of film. If you could send me the name of the record albums and serial numbers which include these songs I'll greatly appreciate it.
Paul Gagne
Laconia, N.H.

Sorry, we don't have the information. Libraries sometimes have a voluminous loose-leaf directory, an index to music, which may help you. You might also contact the American Society of Composers, Authors and Publishers (ASCAP), 575 Madison Ave., N.Y.C. And perhaps one of our readers has an answer or two for you.—Ed.

DEAR AUDIOFAN:

At the present time I am contemplating purchasing a tape deck. I would appreciate it if you could tell me what points to look for.
Harvey Bienstock
Bayside, N.Y.

Now that's a mighty tall order without knowing how much you're prepared to spend for a tape deck or what your anticipated tape needs are (largely playback, live recording, dubbing records, heavy editing, or what?). It would take a lengthy article to outline all the if's and but's. We have one in the works, but don't wait for us. Why not see your hi-fi dealer? He can demonstrate how the decks operate, as well as point out various features.—Ed.

Audio Club News

and a roarin' time was had by all

"Sorry I couldn't answer your correspondence sooner," writes Alfred Williams, president of the Stereo Tape Club. "I was away on a *Lion Hunting* trip."

Now that's a new one for us, but it's certainly believable when you realize that the club is situated in Cape Town, South Africa.

"We have received enquiries (sic) from various cities of South Africa and overseas about our club activities," writes STC's president. "These are cultural and general; that is, folk music, descriptions of sports, general information of progress, and so on. This incudes personal messages to voice friends in other countries." He continues, "Our library of 4 track pre-recorded tapes is expanding rapidly and we are always glad to receive tapes of local FM-stereo broadcasts on an exchange basis."

The Stereo Tape Club's activities include work with hospitals and youth institutions. Williams observes that one of the club's ventures—a local recording of juvenile interest, entitled "Meet The Children"—won a special round of applause.

Anyone wishing to contact the club should address correspondence (tape or letter) to: The Stereo Tape Club, 3 Clan Building, 181 Main Road, Diep River, Cape Town, South Africa. If members are a mite tardy in replying, don't fret. Lion hunting is a consuming pastime, you know.

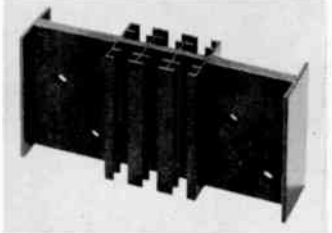
Scott's best solid-state components! Build them yourself and save $160

Now you can enjoy the world's most advanced solid-state engineering, and save up to $160, when you build these Scott solid-state kits. Scott kits give you the same features, performance, quality, and long-lived reliability you've come to expect from their factory-wired counterparts . . . the only difference is, *you* build them.

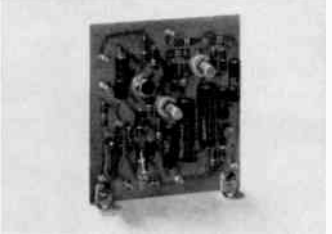
And building them is easy... Scott's exclusive kit construction book with full-size, full-color step-by-step diagrams reduces the possibility of wiring error... cuts construction time to a minimum. All critical circuits are pre-wired, pre-tested, and mounted on heavy-duty printed circuit boards at the Scott factory. All wires are color-coded, pre-cut and pre-stripped to the proper length. Here is a preview of the exclusive Scott features you'll find in your Scott Kit Pak:

Power-Packed LK-60 120-Watt Stereo Amplifier Kit

Rugged silicon output transistors give full audio frequency performance at high power . . . drive even the most inefficient speakers.



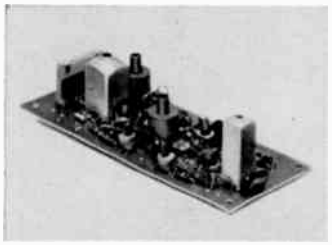
Massive military-type heat sinks keep output transistors running cool . . . assure top performance under high power output conditions.



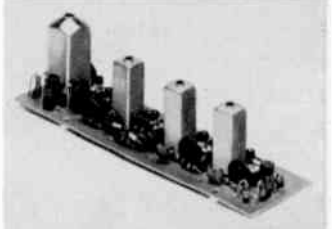
Rugged pre-wired, pre-tested printed circuit boards greatly reduce the possibility of error . . . stand up under years of strenuous use.

Exclusive Circuit Monitor allows you to set output stage bias and balance for absolutely minimum distortion, without external test equipment.

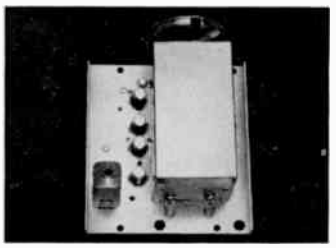
Ultra-sensitive LT-112 FM Stereo Tuner Kit



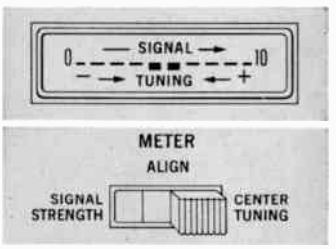
Patented Scott Time-Switching multiplex circuitry insures lowest distortion and best stereo separation. Multiplex section is pre-wired and pre-tested.



Scott silicon transistor IF circuit provides amazing stability, selectivity, and wide bandwidth . . . far superior to germanium transistor performance.



New Scott silver-plated front end gives exceptional sensitivity . . . outperforms and outlasts even the best conventional tube or transistor front ends.



Exclusive "Three-Way" front panel tuning meter serves as a signal-strength indicator, zero-center indicator, or highly accurate alignment meter.

Specifications LK-60: Music Power/Channel @ 4 ohms, 60/60; Frequency Response, 15-30,000 cps ±1 db; Power Bandwidth, 20-20,000 cps. Price, $189.95.
Specifications LT-112: Usable Sensitivity (IHF), 2.2 μv; Selectivity, 4.0 db; Cross Modulation Rejection, 80 db; Price, $179.95.

For complete specifications and features of both Scott solid state stereo kits, fill out this coupon:

Please send me complete information on these great Scott kits:

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

SCOTT®

H. H. Scott, Inc., 111 Powdermill Road, Dept. 39-01, Maynard, Massachusetts

Export: Scott International, Maynard, Mass. Prices and specifications subject to change without notice. Prices slightly higher west of Rockies

RC 80 1949

The Garrard pusher platform record changing principle for automatic play when desired

Consider that over 2 million of the Garrard units sold in this country alone, have featured this exclusive device. It is a smooth, silent, totally reliable mechanism which drops records gently over a polished removable spindle containing no levers or moving parts.

The Type A70...

At $84.50, it is a classic example of the Garrard philosophy... to retain unsurpassed proven features, combining them with the newest advancements, including adjustable anti-skating control and a precision counterbalanced tone arm.

Read below and you will understand why a legion of Garrard owners—many of them still using their original RC 80's— insist upon this magnificent, newest version of the most successful, most satisfactory series of record playing units ever developed.

Adjustable anti-skating control. The natural side pressure on the stylus, which frequently causes distortion or rapid record wear, is eliminated.

Dynamically balanced, counterweight-adjusted tone arm. Needle pivots set into miniaturized ball bearings provide frictionless motion, flawless tracking.

Calibrated stylus pressure gauge with precision ¼ gram click adjustments for accurate audible / visible settings.

2-piece, full size, heavy cast turntable for perfect torque and flywheel action. Noise and vibration damped out by resilient foam barrier.

Low mass, cutaway shell with extended finger lift, compatible with the most advanced cartridge designs.

Super-sensitive trip with Dupont Delrin® to offset friction — performs perfectly with highest compliance pickups at correct minimal tracking force.

TYPE A70 1966

Garrard®
WORLD'S FINEST

Important Reading: Write for 32-page Comparator Guide detailing all Garrard models. Address: Garrard, Dept. GD 2096, Westbury, New York 11590.

April 1966
Vol. 2, No. 4

Audiofan

A ST. REGIS PUBLICATION

Features

Departments

Audiofan

The first IHF stereo amplifier standards are here!

What are they?

?

Do they give a true picture of performance?

?

". . . It closes test holes which existed before and helps to prevent misleading advertising."

DANIEL VON RECKLINGHAUSEN, Chairman of the IHF Standards Committee; H. H. Scott's Chief Research Engineer

". . . They don't differentiate between 'good' and 'excellent' equipment."

DAVID HAFLER, President of Dynaco, Inc.

New preamplifier and power amplifier standards of measurement were set down recently by the Institute of High Fidelity (IHF), superseding those which existed since 1958.

This is a stirring event for all audiofans. For one, old friends like Music Power Output (MPO) are dead (or soon will be). Long live the new power output rating, Dynamic Power! And as the headline here indicates, stereo amplifiers are covered by test procedures for the first time. (Yes, friends, the IHF specs you've lived by for so long were designed for monophonic equipment only.) Other spec changes will be apparent later in this article.

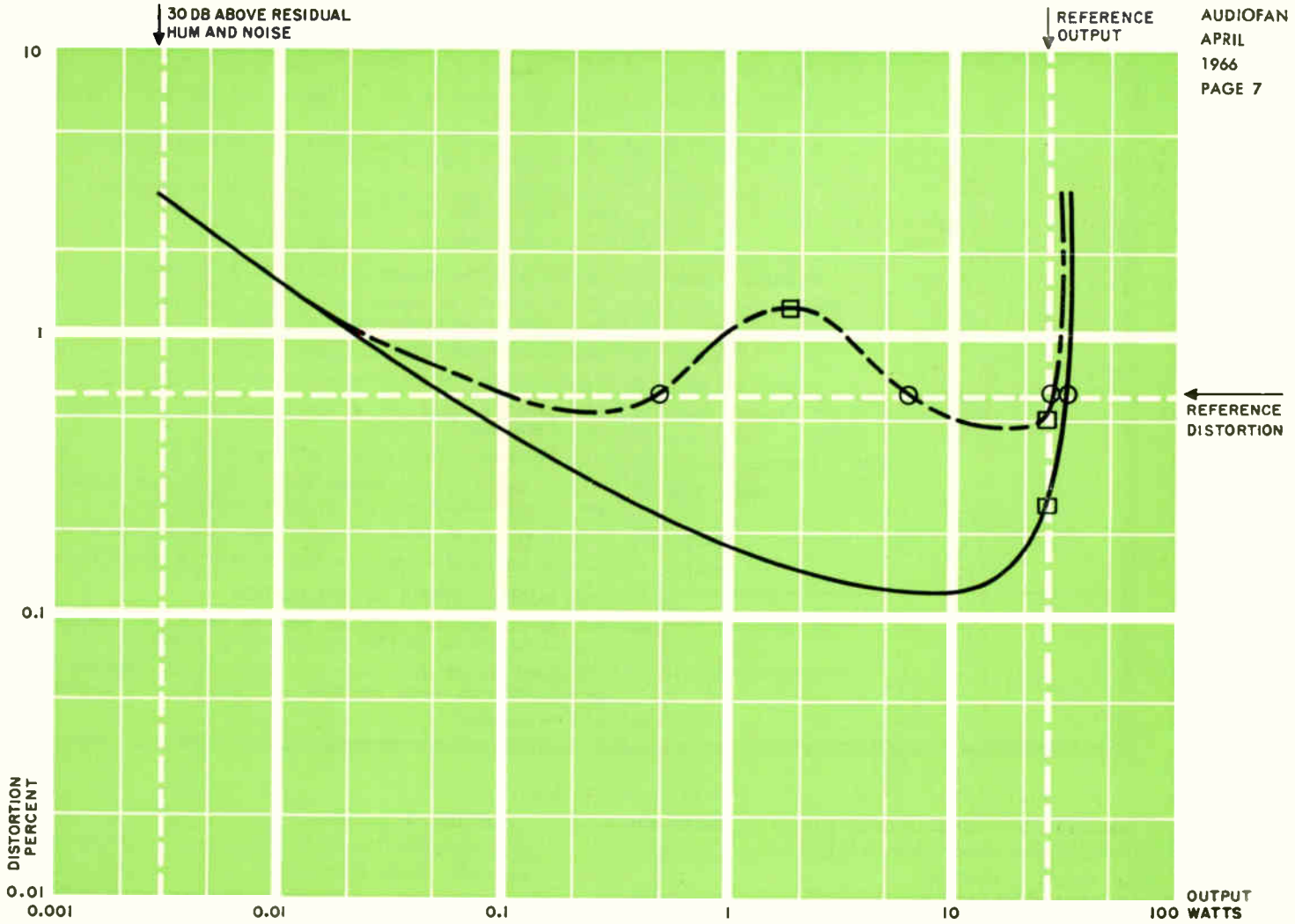
We expect most, but by no means all, hi-fi component manufacturers to use these new specs in time. (Adoption of these tests is a purely voluntary act.)

The hi-fi industry greeted the new standards with emotions that ran the gamut from Hallelujah! to Poppycock! Before we examine the whys and wherefores of these diverse attitudes, and discuss the new specs in some detail, let us take a quick, historical look at ratings.

Where manufacturers of high fidelity equipment once rated their amplifiers under different test conditions, making it virtually impossible for audiofans to compare one make's attributes with another's, most amplifiers are now rated under the same test conditions, the IHF ones. Some manufacturers, however, adamantly refuse to employ IHF amplifier ratings because they do not feel they are meaningful in appraising an amplifier's performance.

If you were an audio buff a number of years back, you'll recall the furor that took place over the then new amplifier specs, especially its Music Power Output (MPO) rating. This is the one you see in advertisements as "Music Power 20 watts per channel," "40 watts total IHF power," or words to that effect. The cry of "inflated ratings" that rang out then persists to this day. Some manufacturers used the lower, more respected RMS continuous power ratings.

At this junction, the phono package industry came along with a "standard," too. It was called, Music Power Rating (MPR). This specification



In arriving at new IHF amplifier specifications, manufacturers choose the output power and distortion (total harmonic and residual hum and noise) reference levels at which they wish to rate an amplifier. In the case of the two hypothetical amplifiers above, it's 25 watts output and 0.6% distortion. Distortion at rated reference power (□) and maximum power at rated reference distortion (○) is shown for both. Observe that if an amplifier's curve goes beyond the distortion reference line points at other than high power and low power outputs, additional rating information is required.

inflates power ratings beyond credulity insofar as hi-fiers are concerned. Aside from the fact that measurements are taken at the 5% distortion mark, a figure high enough to make any hi-fier grimace, standard test procedures were never formulated. So package manufacturers test their phonos any which way they see fit, double the figure for both channels, and double it once again for peak readings. Some gimmick, eh!

The old Music Power Output rating has its shortcomings, too, to be sure, though it's picyune compared to MPR's. For example, Dan Von Recklinghausen, Chief Research Engineer at H. H. Scott and, incidently, Chairman of the IHF Standards Committee, observes: "Under the old amplifier standard, MPO tended to be higher than continuous power." An alternate view, in the same track, was expressed by CM Laboratories' Wayne Chou recently, who says, "I never believed in Music Power Output ratings. It measures an unnatural phenomonon."

But what about the *new* power standard? Is it better than the old one? Let's consider both.

Music Power Output, the soon-obsolete spec, means the greatest power at 1000 Hz obtained without exceeding a rated harmonic distortion percentage chosen by the manufacturer. It's anything but a continuous operating procedure since power supply voltages are not allowed to change from no-signal values. (External supplies are used.) This is a bone in the throats of many people who realize that power supply voltages *do* change under normal operating conditions. Additionally, measurements are made with a *single* channel operating.

The new amplifier standard, **Dynamic Power (Music Output)**, is very much different from the previous spec. *Two* test methods are employed, with the worst value chosen as the spec.

One method, the Transient-Distortion test, uses a tone-burst signal to simulate music and/or voice signals. The largest power output using a middle frequency at a reference distortion is measured on an oscilloscope. The amplifier's own power supply is employed and both channels operate at the same time.

The second method is similar to Music Power Output tests, though both channels have signal

IHF-RATED AMPLIFIER STANDARD FOR MULTI-CHANNEL AMPLIFIERS

		MINIMUM SPECIFICATIONS REQUIREMENT
Dynamic Output	1.	*Watts per channel at reference distortion.
Continuous Power Output	2.	*Watts per channel at reference distortion.
Power Bandwidth	3.	*Frequency response in Hertz at reference distortion with ½ reference continuous power.
Sensitivity	4.	Volts or millivolts to develop reference output power for highest gain input and lowest gain input, respectively.
Hum and Noise	5.	Signal-to-noise ratio in decibels for highest gain input and lowest gain input, with weighting network (if any) noted.
		ADD FOR COMPLETE SPECIFICATIONS REQUIREMENT
Frequency Response	6.	Variation in decibels between 20 and 20,000 Hz at reference distortion.
Maximum Input Signal	7.	Volts or millivolts for highest gain and lowest gain inputs, respectively, which amplifier can handle without overloading.
Stability	8.	Rated unconditionally stable if no spurious oscillation occur with tests.
Input Impedance	9.	Measured in ohms for highest gain input and lowest gain input.
Damping Factor	10.	Whole number expresses ratio of output voltage under test conditions to change when load is removed.
Difference of Frequency Response	11.	Decibel difference between channels at 20 to 20,000 Hz.
Tracking Error	12.	Maximum decibel difference between channels' gain controls at 1,000 Hz and between channels' tone controls at 20 to 20,000 Hz.
Separation	13.	Ratio, in decibels, of wanted to unwanted output signals between channels.
Crosstalk	14.	Ratio, in decibels, of wanted output signal to distortion between channels.
		TESTS AND RATINGS DESCRIBED, BUT NOT REQUIRED
Intermodulation Distortion	15.	Ratio of high frequency (7,000 Hz) amplitude variation to amplitude in two-tone test (60 Hz and 7,000 Hz), expressed in percent.
Environmental Conditions	16.	Performance changes due to power line voltage variations, operating temperature variations, power line noise variations, and other conditions.

**All channels operating*

sources connected. Power supply voltages are held to the same values as they would be under no-signal conditions.

After selecting the reference power output and reference distortion figure he wishes to use, the manufacturer is obliged to draw curves of the amplifier's performance, as illustrated here. To arrive at a Dynamic Output rating, he'll need two curves; one for each test method. The *worst* one is to be chosen as the amplifier's Dynamic Output. Additional rating information is mandatory if the curve crosses the rated distortion limits at more than two points (upper and lower power limits).

There are other specifications which must be listed when rating amplifiers according to IHF standards. **Continuous power output** must be given, for example. This is the largest single frequency output obtainable with a sine wave signal applied for 30 seconds or more, both channels operating at a reference distortion. Measurements are taken with an RMS calibrated meter. **Power Bandwidth** measurements are made within the frequency range of 20 Hz to 20,000 Hz. Using the amplifier's reference distortion and ½ the continuous power output rating, power bandwidth would be indicated by the high and low frequency points where reference distortion is exceeded.

Other minimum specifications include **Hum and Noise** for highest gain input and lowest gain input, and the **Sensitivity** for the highest gain input and lowest gain input.

Additional specifications are required for complete specifications. Many of these are expressly for multi-channel amplifiers. They include **tracking error, separation and crosstalk,** and **difference of frequency.** See the rating table listed here.

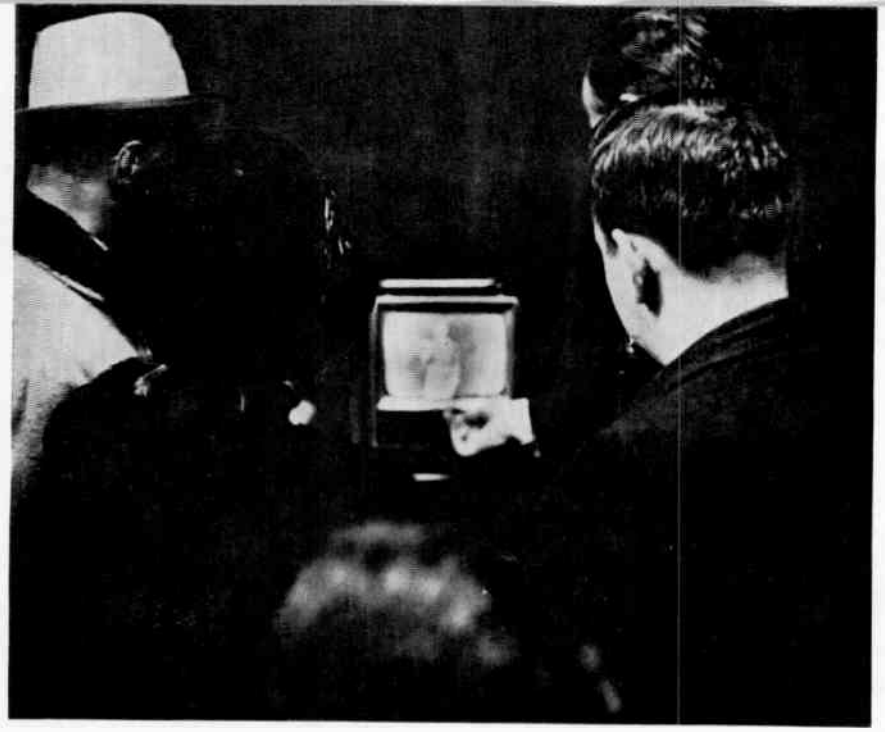
There are barbs thrown at the new amplifier standards, even at this early date. For instance, intermodulation distortion (IM) tests have not been included in either minimum or complete specification requirements of the IHF ratings. Dave Hafler of Dynaco, Inc. says, "This is one of the most serious faults of the ratings."

Many other objections were heard. Some typical comments were as follows: "Continuous power and Dynamic Output should be measured at more than a single frequency"; "Phase shift measurements do not appear in the ratings"; "Weighting factors were introduced in signal-to-noise measurements, allowing high and low ends to roll off"; "No power specification is given for low level distortion figures."

By and large, though, the new standards appear to be a decided improvement over the old standards. It should enable a hi-fier to get a more complete idea of the equipment he's thinking about buying. There are still burning omissions and commissions, of course. But this is not unexpected when a group of leading engineers, with independent views, are called upon to establish a complex standard.

A copy of the new amplifier standard is available for $2.00 from the Institute of High Fidelity, Inc., 516 Fifth Ave., New York, N.Y. 10036.

GLIMPSES OF THE PHILADELPHIA HI-FI SHOW



Sony's home video tape recorder draws crowd of admirers.

Loudspeakers never sounded like this!

AR's Ed Villchur assumes disc jockey role in between answering hi-fiers' audio questions.

Straw walls, vines, live plants, and soft blue lights set the mood for Electro-Voice's program of exotic music.

With sonic appetites whetted by a Ford automobile decked out with a tape cartridge player system smack in the middle of the Benjamin Franklin Hotel's lobby, some 17,000 hi-fi equipment enthusiasts swam upstream (via elevator, of course) to the fourth floor where the 1966 Philadelphia High Fidelity Music Show was being held.

There, audio buffs were treated to exhibitions and demonstrations of hi-fi equipment by more than 50 exhibitors. Before storming exhibition rooms, most visitors took the opportunity to enter a free prize drawing which was held daily. Prize certificates for up to $250 in hi-fi stereo gear made it a worthwhile pause.

Audiofans were treated to a number of full-line displays of equipment, had an opportunity to meet some audio personalities (Rudy Bozak, Avery Fisher, Saul Marantz, and Ed Villchur, to name a few), ask exhibitors any audio questions they wished, and flit from exhibit to exhibit to compare equipment sound qualities.

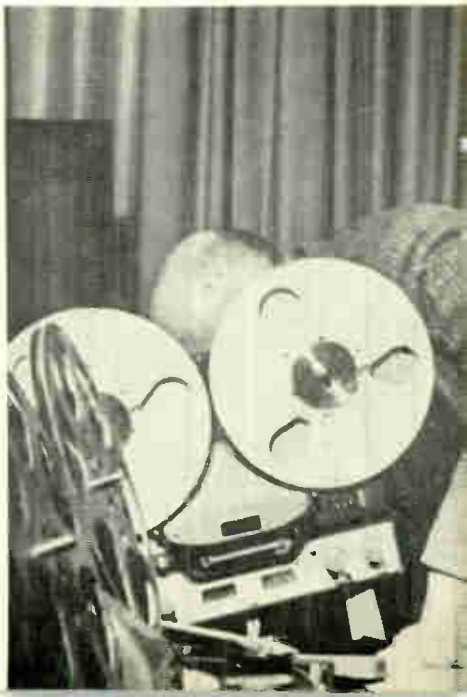
The consensus of opinion among audiofans and manufacturers was that a swingin' time was had by all. Some highlights are pictured here.

Hi-Fi SHOW

Audiofan examines a Pickering cartridge which is set on a rotating shaft.

Charles Fisher and dad greet
Philly audiofans visiting their exhibit.

Step up and fill out a form!
Everyone's a winner (almost) in Philly Hi-Fi Show's daily door prize program.



inquiring reporter

(IF YOU HAVE A QUESTION YOU WOULD LIKE OUR INQUIRING PHOTOGRAPHER TO ASK, WRITE US YOUR SUGGESTIONS.)

PLACE: PHILADELPHIA HI-FI SHOW.

QUESTION:

HOW ARE YOU ENJOYING THE SHOW?

In H. H. Scott's room, it's "Please do touch the equipment!"

"So that's what's behind a motion picture theatre's screen."

It's not always what's up front that counts.

MARTIN KAJKOWSKI

More than 20 years hi-fi interest: I only got here about 15 minutes ago, but shows are generally good. They give me a chance to look around for something to improve my system. I went to the Philadelphia hi-fi show when it was here about two years ago, too. I now have a Rek-O-kut manual turntable. Use a Shure M-44 cartridge, the second cartridge I've had recently, but I'm always searching for better ones if I can find them. My system consists of a Fisher control amplifier and Leak speakers, housed in a Rockford cabinet. No tuner, no tape, though I'm just about ready to get them. I turned to hi-fi components after spending over $400 at Sears for a console that couldn't reproduce 10 kilocycles and had a real cheap cartridge. I wouldn't settle on compacts either, but they have pretty good sound.

HORST STEIN

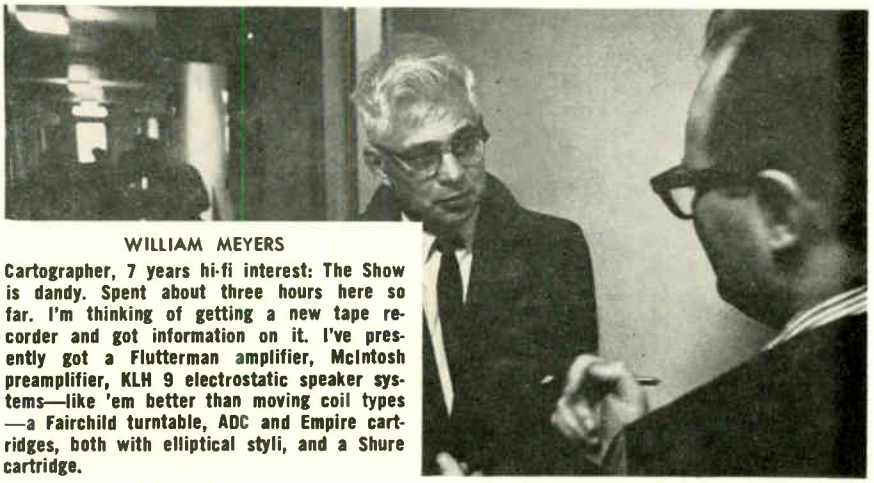
Office Manager, 10 years hi-fi interest: The show keeps me up to date on hi-fi equipment. I have no intention to buy anything right now, but you never know after looking around. I have two full hi-fi systems at home: The main one includes a Fisher amplifier, Harman-Kardon AM-FM Stereo tuner, a Garrard automatic turntable, and a Sony 600 tape recorder and KLH speakers. The second system includes a Harman-Kardon amplifier and a Garrard changer. I have about 70 pre-recorded tapes and records now. It won't surprise you to know that I'm a camera buff, too, as so many audio buffs are. It seems to go hand in hand.

TED CROMPTON

Aircraft mechanic, 8 years hi-fi interest: I come early to hi-fi shows and stay all day, checking into the latest equipment. I want a manual turntable like AR or Thorens. Now have tape, the Tandberg 4-track recorder, together with a Mac tuner, Marantz 7 amps and preamp.

GUSTAVE VAN NYNATTEN

Electrical Engineer, hi-fi interest started before it was called hi-fi: The show is interesting, but I don't like the conflict between the many sounds in rooms. Now have a Scott amplifier, 72 watts, Regency FM tuner, Empire manual turntable, an Ampex 960 tape recorder and JBL D130 speakers.



WILLIAM MEYERS

Cartographer, 7 years hi-fi interest: The Show is dandy. Spent about three hours here so far. I'm thinking of getting a new tape recorder and got information on it. I've presently got a Flutterman amplifier, McIntosh preamplifier, KLH 9 electrostatic speaker systems—like 'em better than moving coil types—a Fairchild turntable, ADC and Empire cartridges, both with elliptical styli, and a Shure cartridge.

HOW FM STEREO DECODERS WORK

two basic methods to net left and right signals from composite FM stereo signals are described in detail

by *Leonard Feldman*

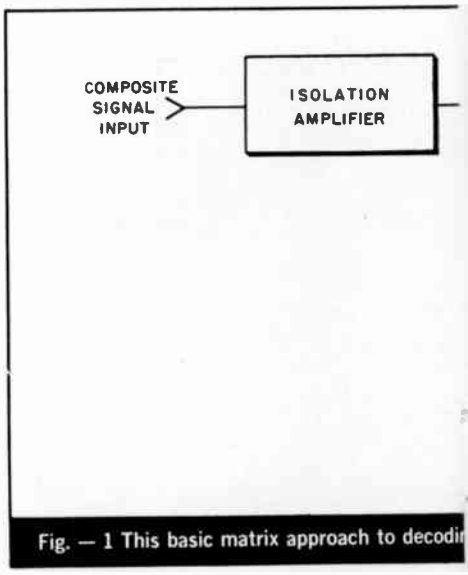


Fig. — 1 This basic matrix approach to decodi

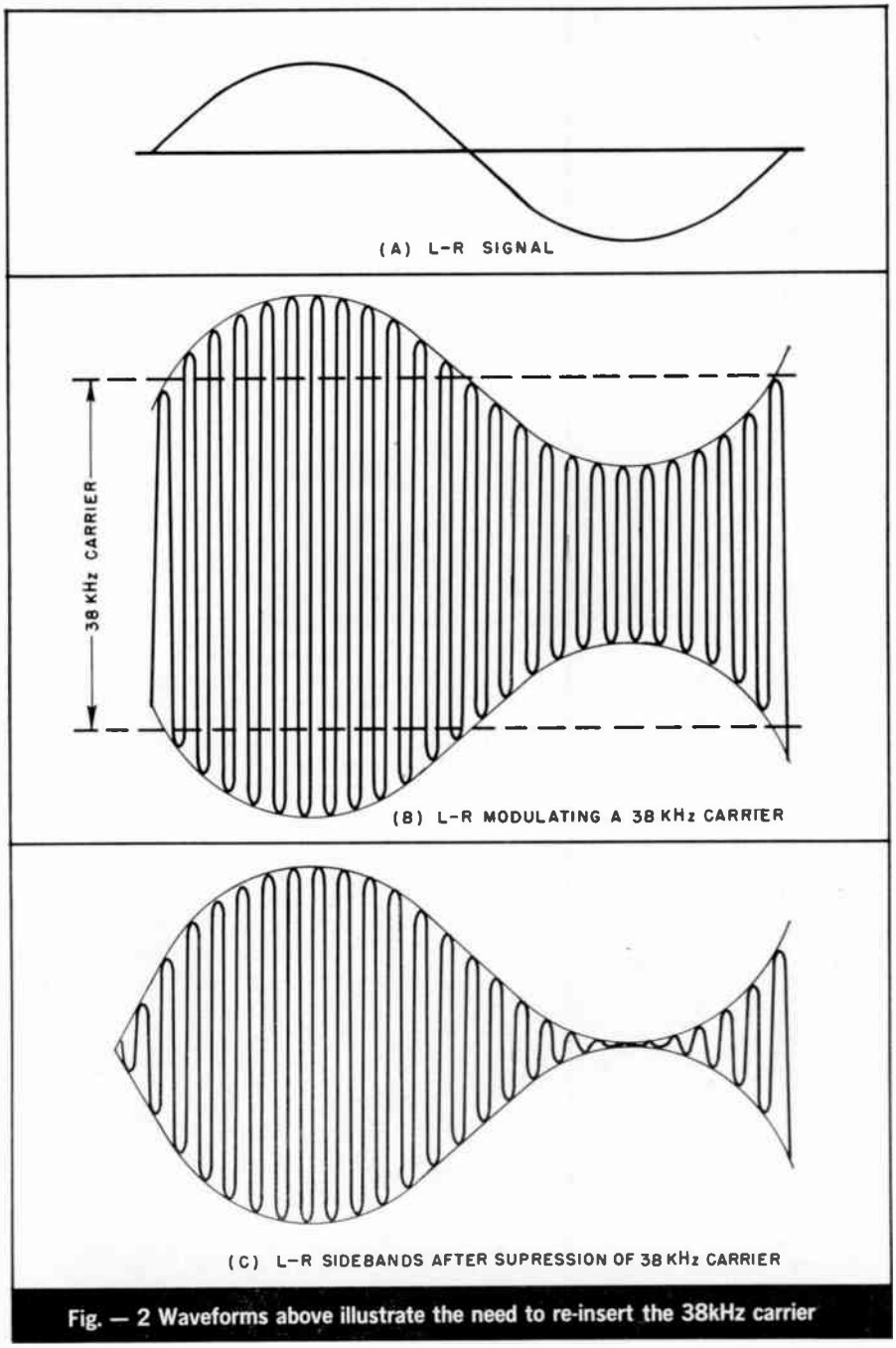


Fig. — 2 Waveforms above illustrate the need to re-insert the 38kHz carrier

In the February 1966 issue of AUDIOFAN we examined the make-up of a stereo composite signal. Here we saw how the left plus right (L+R) information is transmitted by conventional FM, while the "difference" information (L—R) is transmitted via an AM modulated, supressed carrier which simultaneously FM modulates the total RF carrier.

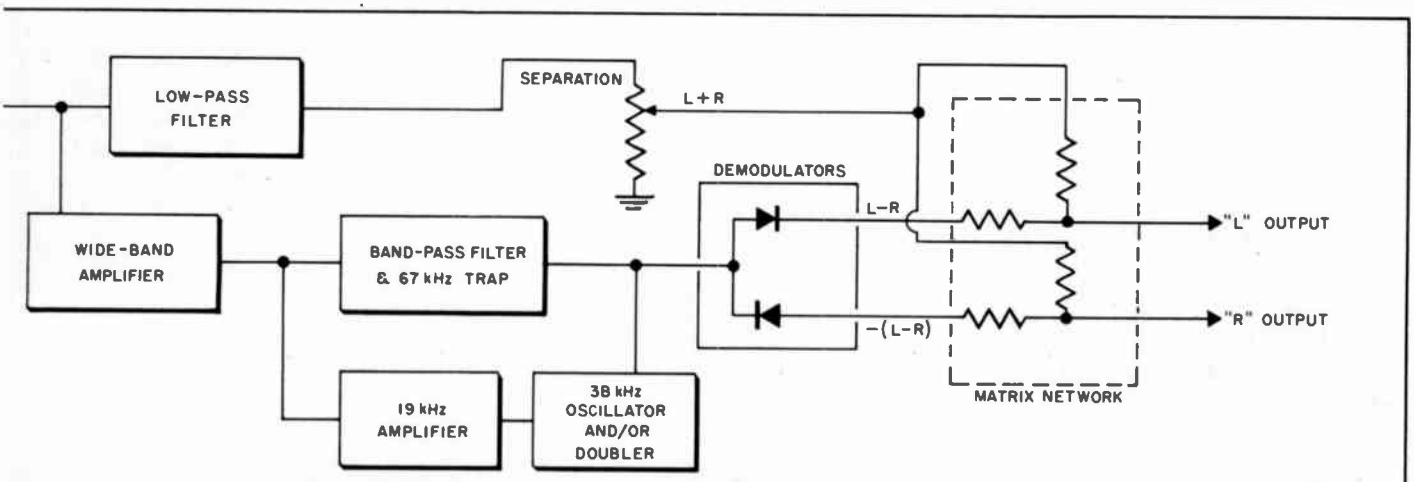
There are two basic methods used today to take composite signals and recover the independent "L" and "R" signals originally picked up from a station's two live microphones, a stereo disc or a stereo tape recording. These are the "matrix" or "time division" methods.

matrix circuits

Though no longer favored by most receiver manufacturers, the so-called "matrix" decoder circuit is the easiest to understand. It was the first approach used in multiplex adapters and all-in-one receivers and there are many thousands of FM sets in use that employ this "brute force" approach.

A simplified diagram of a typical matrix circuit is shown in Fig. 1. The entire composite signal (consisting of L+R, L—R sidebands, a 19kHz pilot signal and, in some cases, an additional background-music subcarrier at 67 kHz) is fed from the conventional FM detector (generally a ratio detector) into an isolation amplifier.

The output of this amplifier



g FM stereo composite signals is described in text. The system has given way to the "time "division" method (see next page).

contains all the elements of the original composite signal in the same proportion as at the input. Its only function is to amplify the signal and provide isolation between the regular FM tuner portion and subsequent decoder circuits. At this point the signal is sent along two parallel paths. The upper path includes a low pass filter, designed to "chop off" all frequencies above 15kHz. In other words, the output of this low pass filter will contain only the L+R signal, since all the other components of the total signal range in frequency from 19kHz to 53kHz. Thus, at the arm of the potentiometer of the "separation" control, we have a true monophonic signal.

Following the signal along its parallel alternate path, it is fed to a low gain, wide-band amplifier in which all frequencies contained in the signal are further amplified. The output of this amplifier is again split into two paths. The upper path includes a bandpass filter which is responsive only to frequencies between about 23kHz and 53kHz.

The output of this filter, therefore, contains only L—R sideband information. The lower path includes a 19kHz amplifier whose tuned circuits are responsive only to 19kHz. Therefore, it amplifies the "pilot carrier" component of the composite signal. This amplified 19kHz signal is then used to recreate the original 38kHz sub-carrier which, you will recall, was supressed way back at the transmitter. This can be done by "doubling and amplifying" the incoming 19kHz signal directly or by using the incoming 19kHz signal to "trigger" or synchronize a local oscillator. The oscillator, in turn, may be set for 19kHz and its output doubled to 38kHz or it may be tuned directly to 38kHz and synchronized by the incoming "pilot" signal on alternate pulses only. Advantages and disadvantages of oscillator vs. non-oscillator circuits will be discussed shortly.

At this point it is essential that you understand why the 38kHz carrier must be re-introduced before successful de-modulation of the L—R information can be accomplished .The diagrams of Fig. 2 help to explain this tricky aspect of the circuits.

Fig. 2A depicts a typical L—R signal to be transmitted. At the transmitter, this L—R signal is used to AM modulate a 38kHz carrier, resulting in the waveform of Fig. 2B. Then, for transmission efficiency, the carrier itself is supressed, leaving only the L—R sidebands (Fig. 2C) which are actually transmitted over the air.

Thus, referring back to the output of the bandpass filter in Fig. 1, we would have the waveform of Fig. 2C. If we were to apply this signal to a detecting diode (much as in an AM receiver), the output of this diode would be a badly distorted version of the original L—R signal shown in Fig. 2A. Since such a diode will conduct only during the positive (or negative, if the diode is reversed) half-cycle of the sideband waveform's excursions. Only by "lifting" the L—R sidebands back onto a locally produced 38 kHz carrier signal can we apply the signal to an AM detector and recover a true facsimile of the original L—R. By inverting the polarity of one of the demodulating diodes in Fig. 1, we can also recover an inverted version of L—R or —(L—R).

Now, if we add a proper amount of L+R to L—R (by adjusting the separation control) we come up with the famous "matrixing" effect, namely: (L+R) + (L—R) = 2L! In the lower leg of the matrix or mixing network we will have (L+R) — (L—R) = 2R! And so, as if by some mathematical legerdemain, we have in faot recovered independent L and R signals from the complex composite signal. The factor of "2" can be ignored, since it only denotes amplitude of recovered signal and is purely a relative term.

"time division" decoders

While the above approach to stereo decoding seems beautifully simple, it does create many problems in design. We have simplified it by implying that all we need are L+R and L—R signals of equal amplitude to mix together for perfect L and R recovery. Actually, not only must amplitudes of these components be equal, but they must be equal in phase as well. That is, the L+R and L—R components must arrive at the matrix networks in exactly the correct time relation-

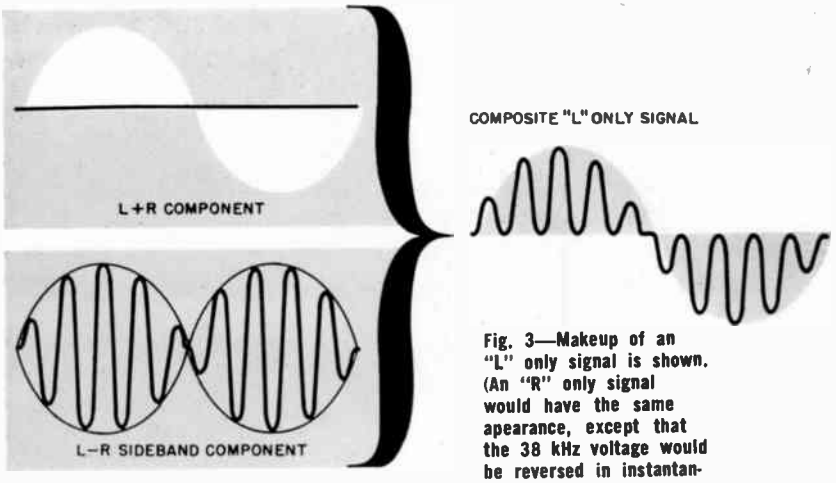


Fig. 3—Makeup of an "L" only signal is shown. (An "R" only signal would have the same apearance, except that the 38 kHz voltage would be reversed in instantaneous polarity.)

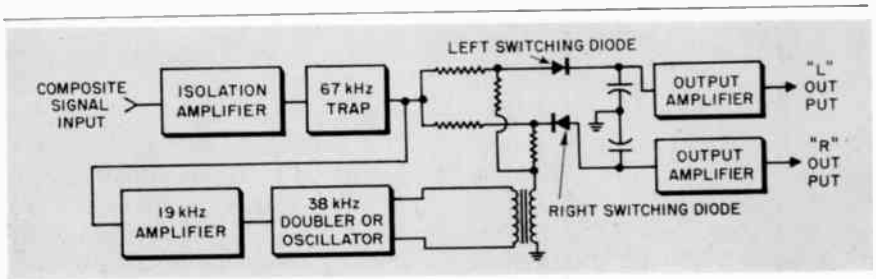
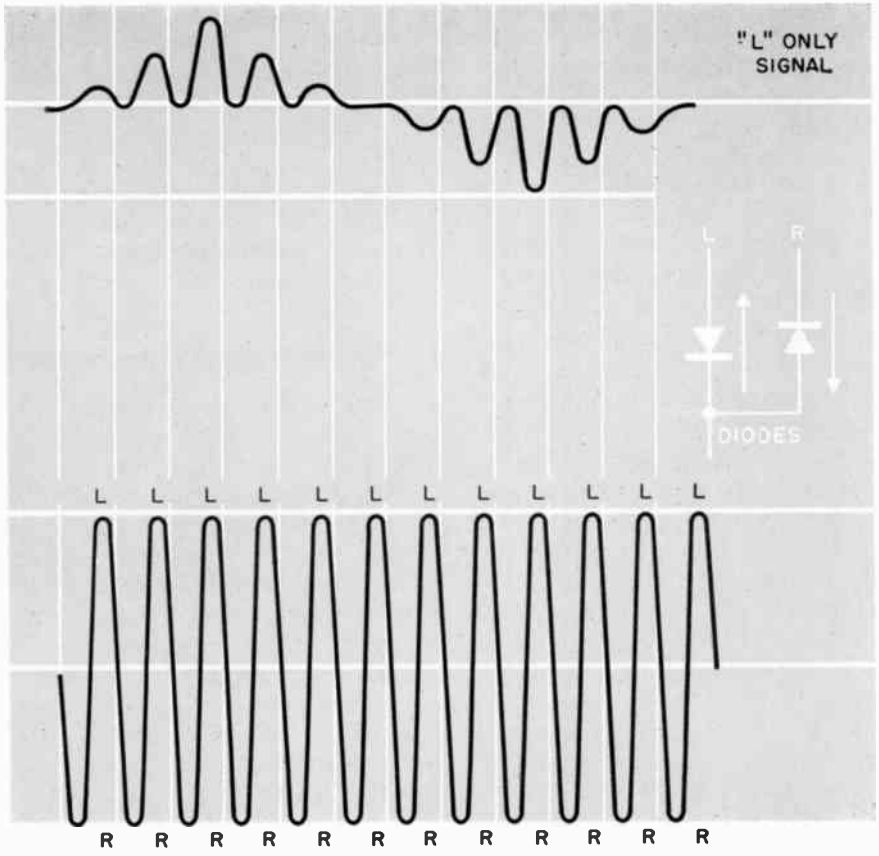


Fig. 4—Here is a block diagram of the "time division" multiplex decoder system so popular in today's FM stereo tuners.

Fig. 5—The superimposition of an "L" only signal and a 38 kHz switching voltage shows how an "L" diode conducts only when an "L" signal is present. The "R" diode conducts only when no signal is present (as it should for this "L" only condition).



ship as originally transmitted.

Unfortunately, low-pass and band pass filters introduce time delays. As a result, it takes extremely complex (and expensive) filter designs for time delays to be exactly equal for both L+R and L–R components. For this reason, the so-called "time division" decoders have almost replaced the "matrix" designs completely. In these designs, all the components of L+R and L–R sidebands travel along the circuit together, right up to the detector or demodulator itself, eliminating the need for low-pass and band-pass filters.

Fig. 4 is a block diagram of this approach. As in Fig. 1, the isolation amplifier raises the level of the entire composite signal. A 19kHz amplifier, oscillator and doubler are also used. The resultant 38kHz signal, however, will not be used for carrier reinsertion. The amplified composite signal, instead of being broken up into separate L+R and L–R sideband components, is passed intact through a 67kHz trap (to eliminate background music interference). The entire composite signal is applied to each of the detecting diodes (which are oppositely polarized.

In addition to the composite signal, the two diodes are fed a polarizing or "switching" voltage at a 38kHz rate. The polarity and phasing of this 38kHz signal is arranged to coincide with correct periodic on-off switching of each diode so that it conducts only when a left signal (in the case of the left diode) or a right signal (in the case of the right diode) is present. To fully understand why this is so, examine Fig. 3, which shows the makeup of a left-only signal.

The composite left signal developed here is superimposed upon the switching voltage (see Fig. 5) to show that the left diode will always be in a conducting mode when elements of "left-only" signal are present. At the same time, the right diode will be in a conducting mode when the composite signal is zero (since there is no right signal present). Thus, prior to any filtering, the net output of

(*Continued on page* 30.)

SIMPLE CHECK-UPS THAT KEEP YOUR SYSTEM TIP-TOP

HOLD ON TO HIGH FIDELITY

it pays to pamper magnetic tape

You don't have to handle magnetic tape with extraordinary care to preserve its qualities. Some reasonable attention to tape care, more on the order of developing good habits, will pay off in handsome dividends.

Perhaps the worst habit practiced by tape enthusiasts is rewinding magnetic tape from the takeup reel to the original feed reel when through recording or playing back. This might seem to be the most logical thing to do. After all, didn't the tape come wound on the feed reel to begin with?

Sure it did. But it was wound evenly, with just the right tension, by the tape manufacturer. For you to rewind tape for storage is wrong! wrong! wrong! Most tape recorders rewind magnetic tape too fast. This leads to excessive tension on the tape, which can s-t-r-e-t-c-h polyester or "Mylar" tape permanently if it's stored in this manner. This can result in increased print-through, among other bad effects. Further, tape is wound unevenly, with ragged edges, due to high speed rewinding. This allows moisture and dust to gather on the exposed, outside portions of the tape.

There's always *some* strain on tapes, even when wound slowly on the takeup reel. In addition, there may be some sticky sections that cause adhesion of one layer to another after some time. Therefore, it's a good idea to play a tape once in a whole, or at least rewind it and let it wind up again on the takeup reel, to give the tape some relief against these incursions to fidelity.

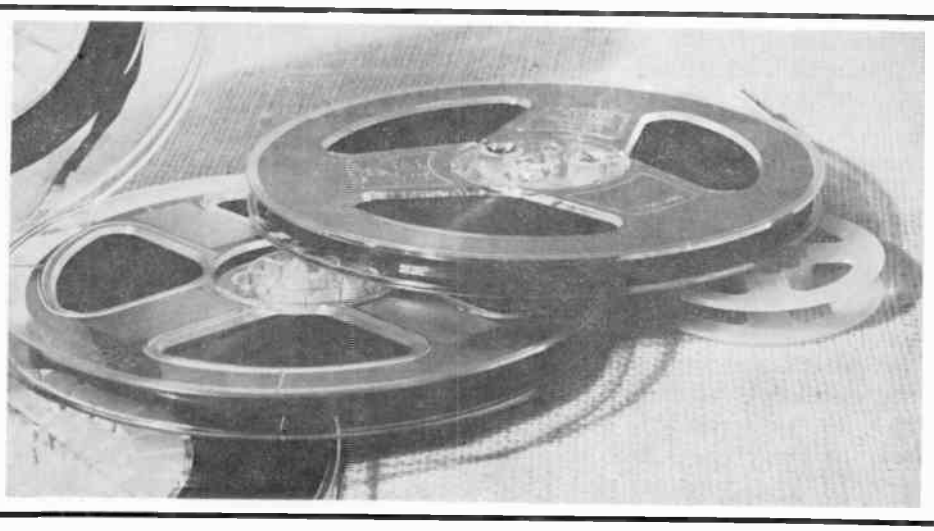
Don't think that storing tape on the takeup reel is "magical" in itself. It's the slow, even wind that does it. So be sure that you don't use fast forward to transfer tape to the reel.

When you're through recording or playback, get into the habit of placing the reel of tape into its storage box. Letting it lie around, whether on the floor or on the machine, only invites dust to gather on it.

It goes without saying that excessive heat and/or moisture can ruin tapes. So keep tapes away from radiators, stoves, and all electronic equipment. It's sure handy to place a reel of tape atop a control amplifier at times, but avoid it if you value high fidelity.

Stray magnetic fields can destroy your hard earned recordings, too. So keep them away from transformers and motors (this includes vacuum cleaners and air-conditioners).

Lastly, store tapes carefully in boxes. This will protect them from dirt and possible physical damage. It's best to store the boxes vertically; this allows minimum strain on reels. If you pile one on top of another, the plastic reels may be distorted. And there's nothing as annoying as the scrape of tape on a reel once very revolution.



Here's an excellent example of what not to do with your reels of magnetic tape. If you get into the bad habit of allowing tapes to lie around unprotected, as shown here, you invite dust to gather on tape, expose reels to possible foot stomping (accidental, of course), etc.

PROFILE OF AN AUDIOFAN

Hi-fi enthusiasts send photos of component systems

Hi-fier's installation, which took considerable time and several thousand dollars to assemble, is on the unorthodox side, bespeaking Ham Shack style.

DEAR AUDIOFAN:

I designed the type high fidelity/stereo setup that I wanted. I made all the panels with the toggle switches and panels with electrical switches.

One of the two racks contains the tape recorders, Magnecord 1024 units. These recorders are quarter-track stereo/monophonic with a fourth head for playing back 2-channel stereo. With these two recorders, two programs can be recorded simultaneously, pre-recorded tapes re-recorded, etc.

The second rack contains all the tuners and SCA subcarrier units. Standard FM and FM stereo broadcasts are received with the McIntosh MR-71 tuners, standard AM broadcasts are received with the Fisher R-200 tuners. The subcarrier units are used with the McIntosh MR-71 tuners for receiving background music.

Both racks contain panels with electrical outlets for turning off and on the various units in use. The rack with the tape recorders contains a switch which will turn everything off completely. Panels with toggle switches connect one unit to another.

The console contains stereophonic pre-amplifiers, power amplifiers and monitor amplifiers. Each pedestal has a McIntosh MC-240 40 watts per channel amplifier, Magnecord PT6-6JX amplifiers for monitoring (mono) with headphones the various programs being recorded. Headphone connection to the tape recorders is in stereo. The top of the console contains the pre-amplifiers, McIntosh C-22 units. Toggle switches are also located in each unit for various changes in program material.

At the present time all my music is on tape. At a later date a turntable unit may be added. Below is a list of the components used in the system.

- 2—McIntosh power amplifiers, Model MC-240
- 2—McIntosh stereophonic preamplifiers, Model C-22
- 2—McIntosh stereo FM tuners, Model MR-71
- 2—Fisher AM/FM stereo tuners, Model R-200
- 2—Music Associated subcarrier units
- 2—JBL speakers, Model LE-14C
- 2—Magnecord tape recorders, Model 1024
- 2—Magnecord amplifiiers (Monitor), Model PT6-6JX
- 2—Norelco dynamic headphones, Model K-50
- 2—Clevite-Brush single-unit headphones, Model BA-210
- 1—Apparatus Development FM antenna, Model FM/Q "Super Mark I"
- 8—Control panels (toggle switches)
- 4—Electrical Outlet panels (silent switches)
- 1—VU Meter (AC) Panel mounted
- 1—Robins Head Demagnetizer HD-6
- Tape library (pre-recorded and off-the-air tapes)

Provisions have been made to connect extension speakers, microphones, television sound, etc., through this system.

Ellsworth Kittel, Jr.
North Branford,
Connecticut

Radio control room style "hi-fi room" features two of almost every basic stereo component.

SHARE YOUR HI-FI INSTALLATION . . .

AUDIOFAN MAGAZINE will pay $10 for photos or hi-fi component arrangements it uses. Simple snapshots will do, together with a few words on how you found the best spot in the room.
This isn't a contest. It doesn't matter whether your hi-fi stereo system is big or small, elaborate, or simple. So let's hear from you.

Send material to
AUDIOFAN MAGAZINE
25 West 45th Street New York, N.Y. 10036

Audiofan tells how he solved hi-fi component location problem in his living room.

DEAR AUDIOFAN:

With the addition of a new tape deck, a problem arose: what to do with this new equipment? The deck wouldn't fit into my existing equipment cabinet, and there wasn't room for a larger cabinet. Therefore, I decided to build a small tape deck cabinet and mount it on the wall over the existing equipment cabinet, as shown in a photo which I am enclosing. These cabinets, made of ribbon mahogany plywood, I placed at one end of the living room. The original cabinet houses the following gear:

1. Dyna PAS preamp
2. Two Dyna 60 watt power amplifiers Mark 111
3. Garrard Type A record changer
4. Scott tuner and multiplex adapter LT 10
5. Two speaker switches and plug for Koss stereo headphones
6. On-off switches for Preamp and Two amps.

To allow air circulation, the bottom shelf is made from expanded metal. On the underside of the shelf, I attached two-inch thick insulating material This shelf was placed 14 inches above, to allow for good air circulation. With this setup, the heat from the two 60 watt amps have no effect on the equipment above it.

To conceal the wires running from the tape deck to the preamp, I made a vertical column of matching wood, from the deck cabinet to the preamp cabinet. At the other end of the room, I built two storage cabinets of birch plywood. These cabinets house my Bozak speaker systems (B-199A Bass, B-209A Mid-Range, B-200Y Treble, and N-10102 Crossover Network). The cabinets also house a TV cabinet with a drop-down front and storage. Space for cameras, hi-fi cleaning equipment, etc.

To store my records (approximately 400), I built a set of end-tables of birch plywood. Each end-table has a record storage drawer which holds 225 records. These records are filed by manufacturers' name. I also keep a notebook in which I record all records alphabetically by manufacturer and a card file where I record all records on a card by type of music: Jazz, Vocal, Popular, Semi-Classical, etc. I carry my record book with me when I go record shopping. This quick reference saves me from buying duplicates.

If anyone is interested, the room size where I keep my Hi-Fi equipment is 22 feet by 11½ feet.

A. Louis Stabile
Arlington, Mass.

Audiofan solves no-room-in-cabinet problem for new Ampex 1150 by situating it in a matched wood cabinet directly above his equipment cabinet. Speaker systems are placed near the ceiling on an opposite wall, as shown below.

build an audio neon lamp power indicator

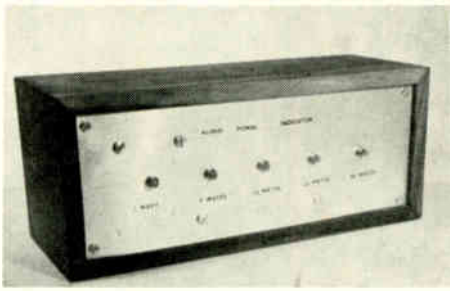
Do you have any idea how much power your hefty amplifier is putting out? What's it doing when you're settled back in your easy chair listening to some pop music? How much power does it take to simulate an orchestra playing some Wagnerian crescendos?

If you're at all curious about your power amplifier's output while its operating, then we've got just the device for you to build: a neon lamp power indicator. It'll show you, from a distance, the amount of power driving your speakers. And the device is easy to build and inexpensive, to boot.

There are other reasons for using a power indicator than satisfying that inner urge to learn just how much power it's taking to fill your listening room with sparkling music and vocals. You'll learn when your speakers are being threatened by more power than they can handle.

With today's trend toward higher and higher output power, speaker safeguards like this are important.

Some speaker manufacturers publish a maximum power rating for their products. This maximum power figure (unlike the amplifier power rating) generally means the maximum allowable sustained power that may safely be applied to the speaker without damaging the voice coil, paper cone or both. Obviously, a relatively efficient speaker, rated at ten watts, should not be fed the full fifty watts available from a high-power amplifier. This does not necessarily mean that such an amplifier should not be connected to a low power-handling speaker. It simply

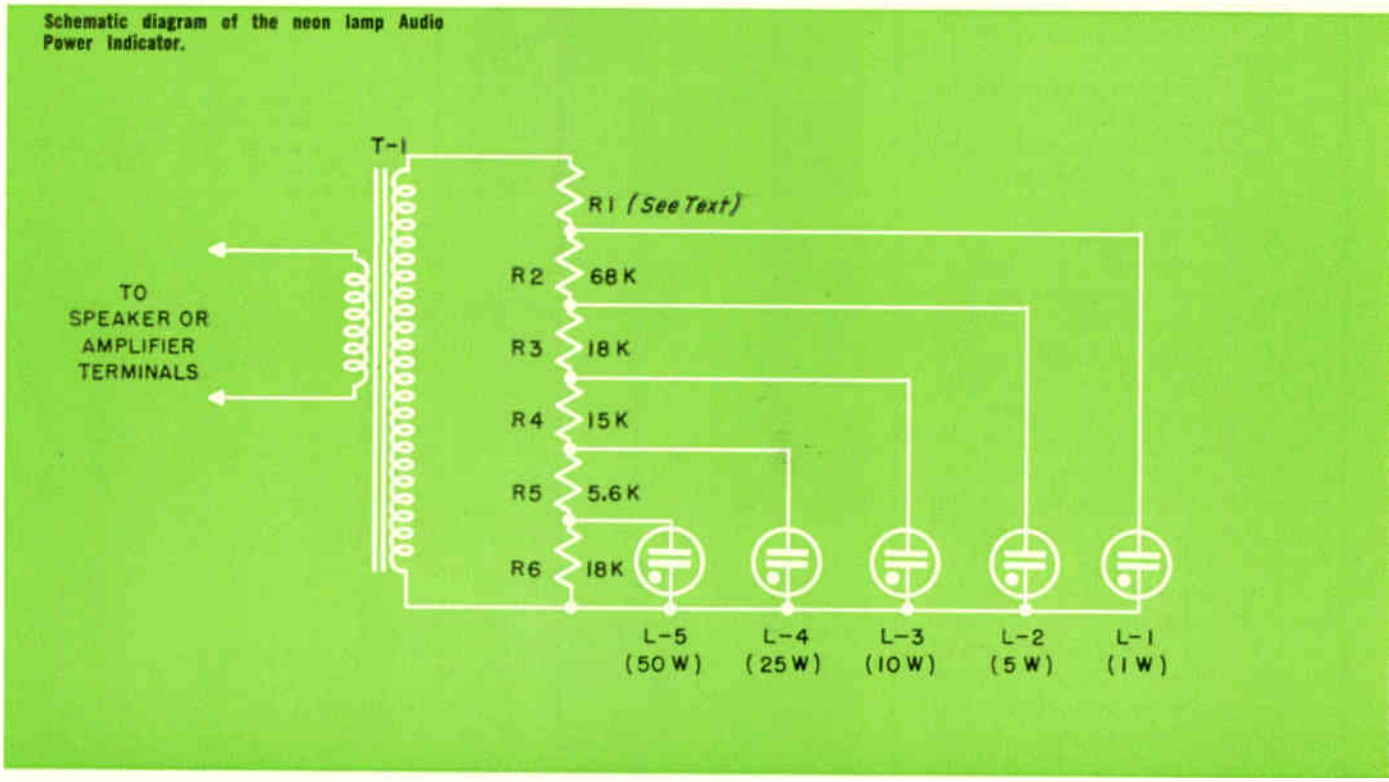


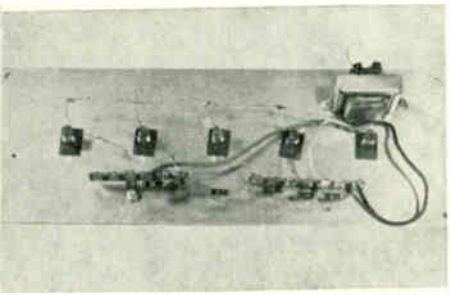
Completed audio power indicator device.

PARTS LIST

L1-L5 Neon Lamp, type NE-2 in holder
R1 See Text (not required with 4 ohm speakers)
R2 Resistor, 68K, ½ Watt, ±10%
R3 Resistor, 18K, ½ Watt, ±10%
R4 Resistor, 15K, ½ Watt, ±10%

Schematic diagram of the neon lamp Audio Power Indicator.





Back-panel view shows layout of parts.

R5 Resistor, 5.6K, ½ Watt, ±10%
R6 Resistor, 18K, ½ Watt, ±10%
T1 Transformer, Audio Output, 7000 ohm primary to 8 ohm secondary
Metal Panel, Aluminum, 5″ x 10″
Miscellaneous: Terminal strips, hook-up wire, solder, hardware.

means that such an amplifier should never be "opened up" fully. Otherwise, the speaker may be damaged. How, then, can you tell when you are driving a given loudspeaker too hard?

You could, of course, connect a fairly expensive audio wattmeter to your amplifier's output terminals and sit and watch the meter movement, with one hand standing by at your volume control, in case a dynamic music passage sends too large a slug of power into the voice coil of your laboring loudspeaker. At that, you probably wouldn't do the speaker justice anyway, since wattmeters of this type are rather sluggish, and in reading anything but continuous sine wave power (a single tone) will give a reading far below the true "peak" of the instantaneous program power.

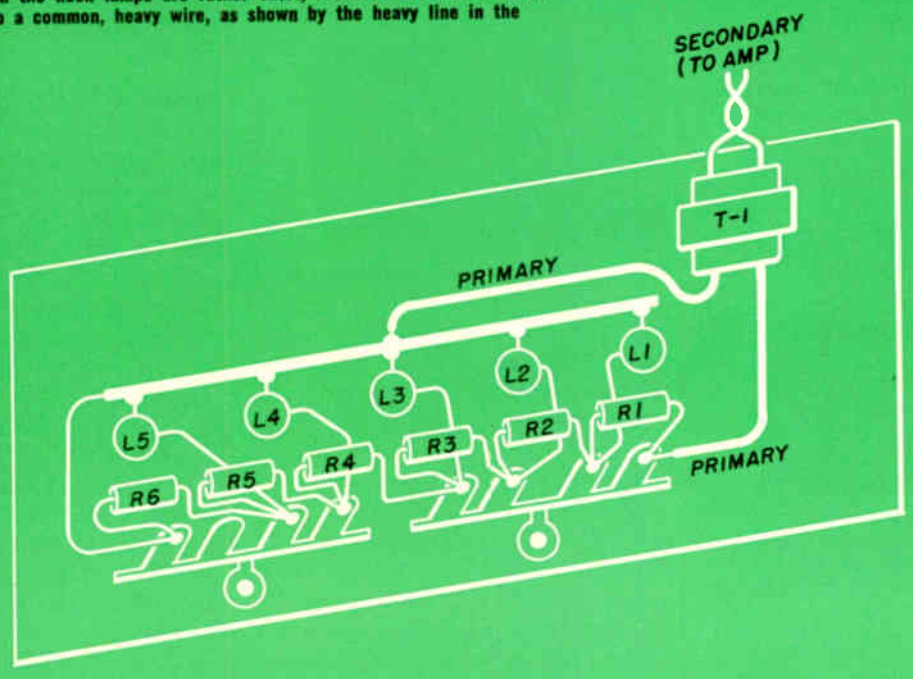
Alternatively, you could build the little neon bulb indicator we mentioned above, save money in doing so, and possibly prevent a real catastrophe in the form of a "dead" loudspeaker.

The device to be described is completely passive, requiring neither an AC or battery connection. It is powered entirely by the audio energy coming from your amplifier and will last indefinitely. Furthermore, because it consumes such a minute amount of power and has virtually no effect on the performance of your amplifier, it can be left connected permanently. Thus you can constantly monitor power to protect your valuable loudspeaker systems.

The principle upon which the power indicator is founded is

(*Continued on page* 30.)

Since wire leads from the neon lamps are rather short, it's best to connect a lead of each neon lamp to a common, heavy wire, as shown by the heavy line in the wiring diagram.

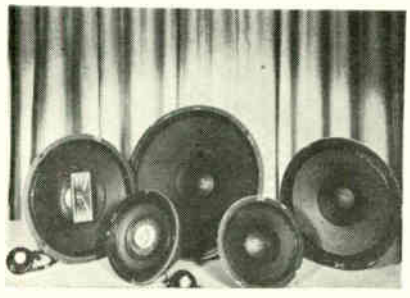


WHAT'S GOING ON

SPEAKERS/SPEAKER SYSTEMS

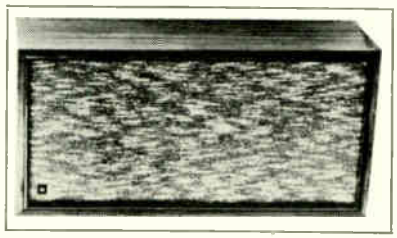
A wide variety of loudspeakers and systems have been announced recently. Raw speakers, bookshelf types and floor-standing systems mark the diverse offerings of speaker manufacturers in recent months. Here's a sampling.

ELECTRO-VOICE With speaker systems, that is, matched speaker-enclosure combinations, almost completely dominating the field, it's refreshing to see a line of separate speakers available to handier, more adventurous hi-fiers. EV's offering here consists of five loudspeakers, the company's "Wolverine" line. They are: two eight-inch speakers (Models LS8 and LT9); two twelve-inch speakers (Models LS12A and LT12), and a fifteen-inch speaker (Model LS15). The LS prefix in model numbers indicates coaxial types. The LT prefix, on the other hand, indicates three radiating elements: LT12 adds a VHF driver; LT8 has a long-throw woofer in addition to the two elements of a coax system. The line of speakers has been constructed with aesthetics



in mind, too, it seems. They feature slim, die-cast frames which are finished in misty green metallic, apparently made easy on the eyes in preparation for use in an existing closet. Prices range from $20 to $36.

H. H. SCOTT Scott's new air suspension loudspeaker system, the bookshelf model S-8, is the first in its "Controlled Impedance"



(CI) series. The new speaker system is designed for almost constant impedance throughout its entire frequency range, advises the manufacturer. As audiofans know, speakers ordinarily exhibit impedances that vary according to frequency (impedance ratings are generally made at 1000 Hz only). This can influence power output, especially with solid-state equipment. A nearly constant impedance gives optimum system performance of the amplifier-speaker system combination, assures the manufacturer. The 23½" wide x 11¾" high x 9" deep speaker system uses a 10-inch woofer (air suspension type) and a five-inch midrange-tweeter. Price is $69.95.

ACOUSTIC RESEARCH. A-R has a modified version of its AR-4, called the AR-4x. The new speaker system replaces the AR-4, though the older one will still be available on special order. The AR-4's 3½" tweeter has been replaced by a new 2½" unit which is said to improve dispersion of highs, as well as improving smoothness and high-frequency range. The cross-over frequency has been lowered from 2000 Hz to 1200 Hz. Interestingly, the company advises that the new unit is compatible in stereo with the AR-4. The price of the new unit is unchanged: $57 for the oiled walnut system.

MICROPHONES

SONOTONE Sonotone breaks a long tradition of manufacturing ceramic microphones by adding a slew of dynamic microphones to its line. The new line of dynamics uses diaphragms made of polyester film to withstand high temperature and humidity conditions, and a rubber casing which makes the mikes shock-resistant and minimizes handling noises. There are seven basic models in the line, all omni-directional types. Model DM70-100 has an impedance of 50K ohms; Model DM-70-200, 10K ohms; Model DM70-500, 200 ohms. Each has a frequency response of 80 to 15,000 Hz, and dimensions of 4½" high x 15/16" diameter; weighs 2¾

ounces; and priced at $32.50. A second group of dynamic microphones have the following specifications: Model DM10-100, 50K ohms impedance; Model DM10-200, 10K ohms impedance; Model DM10-300, 600 ohms impedance; Model DM10-500, 20 ohms impedance. Frequency response of the foregoing mikes is 80 to 16,000 Hz; price is $37.50. All dynamic mikes come with a combination lavalier/table stand at no extra cost.

TAPE RECORDERS

CONCORD The new Model 300 compact, portable tape recorder has a string of automatic features. For example, it records in both forward and reverse directions at the turn of a lever. This "Reverse-A-Track" feature eliminates the bother and fumbling attached to reel changing. Another innovation is an automatic record control circuit which automatically sets recording levels. Thus, you can move away from a subject and the recorder will automatically compensate for lower volume. The 300 also has an automatic power selector circuit which automatically disconnects its six

1966 coming ■ events

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.

type-C batteries when the unit is plugged into household current. The solid-state machine has 3¾ ips and 1 7/8 ips speeds, fast winding speeds in both directions, a recording level and battery condition meter, an integrated loudspeaker, and a detachable carrying handle. It accepts standard 4-inch or smaller reels. A number of useful optional accessories, including a voice-operated microphone, are available. The small (3" x 9" x 10"), light (6½ pounds) machine is priced at $125.

VIKING Viking of Minneapolis' Model 880 four-track tape recorder includes a solid-state, 10 watt stereo power amplifier and two-way detachable speaker systems which consist of 5-inch woofers and 2½" tweeters, with electrical crossovers. The stereo recorder features three separate, hyperbolic tape heads for erase, record and playback. In case you're unfamiliar with hyperbolic heads, they're curved in a manner that allows magnetic tape to make close contact without the need for pressure pads. Among the unit's other features are a headphone pack and a pause control. Priced at $439.95.

FM ANTENNA CHARACTERISTICS YOU SHOULD KNOW ABOUT

Antenna specifications can be confusing, if only because many terms are unfamiliar to audiofans. Understanding the meaning of some common antenna expressions, however, can guide you well in choosing an antenna for your FM tuner.

Terms such as "gain," "directivity," "front-to-back ratio," and "VSWR" can really throw you. As discussed in a previous article on FM antennas, *What Makes An FM Antenna Click?*, in the October 1965 issue of AUDIOFAN, antennas do not exhibit gain as we know it from our audio amplifier experience. Instead, a half-wave dipole antenna, the simplest kind, is arbitrarily chosen as a reference point for antenna "gain." Thus it is considered to have zero db gain and antennas which capture more energy than the half-wave dipole start their decibel (db) gain from this point.

If you have multipath distortion, that is, trouble from those reflected signals that come in from side and back angles, directivity becomes very important. Sharp directivity and high gain go naturally hand in hand.

A quick way to express directivity is by the front-to-back ratio. This is the sensitivity of the antenna to signals at the front compared to the sensitvitity for signals at the back. (A complete specification of directivity shows the gain of the antenna in each direction around the full 360 degrees—a "polar chart"). The front-to-back ratio of a highly directional antenna may range from 15 to 20, depending on the frequency.

Another antenna characteristic often given in literature is the impedance match, along with, or alternately replaced by, the VSWR, or "voltage standing wave ratio." The impedance of the antenna, its total "resistance" (in the general sense) to a-c signals, must match that of the lead-in (which must match that of the set input) to avoid reflections of the signal backward from the lead-in or the set.

A reflection causes a standing wave, which can act like a resonance. But we don't want anything like resonance at the points where energy is transferred and transmitted. Resonance is good for the capture of energy, but not for passing it along smoothly. If there is a mismatch in impedance at the transfer points (antenna to lead-in wire or lead-in wire to tuner) there will be reflections and standing waves. The VSWR expresses the degree to which the maximum standing wave bunches up above the average signal strength: a ratio of 1 to 1 means no standing waves.

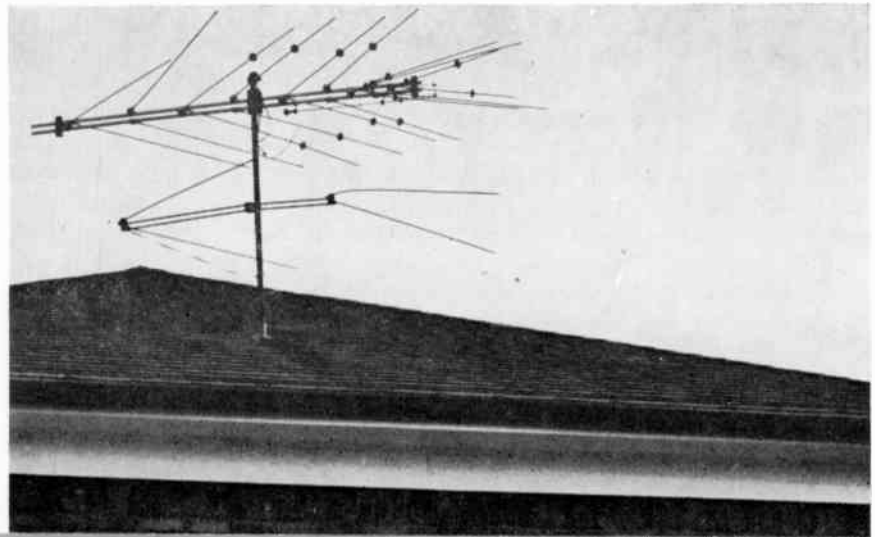
Standard impedance for FM lead-ins and sets is 300 ohms. Getting a complex a-c device like a broad-band antenna to have exactly 300 ohms impedance over the whole band is quite a trick, so a maximum VSWR of about 1.75 to 1 should be considered and anything under 1.5 to 1 *very* good. On some stations, the VSWR may be near perfect, or near 1 to 1, but in most designs it will vary over the band.

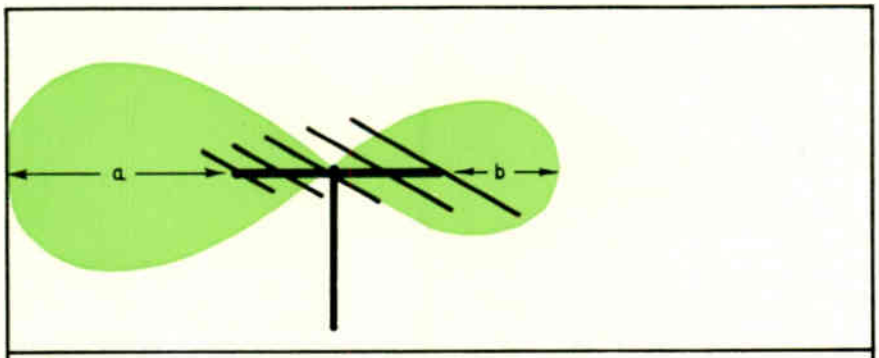
Now let's consider some antennas that vary from, or extend greatly, the characteristics of the standard dipole array. One that has been around for a long time is the one-frequency Yagi, an array in which all the elements are cut for the same frequency. Since every member of the "team" is pushing hard at the same time, so to speak, the one-station Yagi can have tremendous gain, 20 db or more. By the same token, it is extremely directional. "Log-type" antenna designs have come to the fore in recent years, with great success.

The gain depends quite directly on the number of elements. Theoretically, both gain and imped-

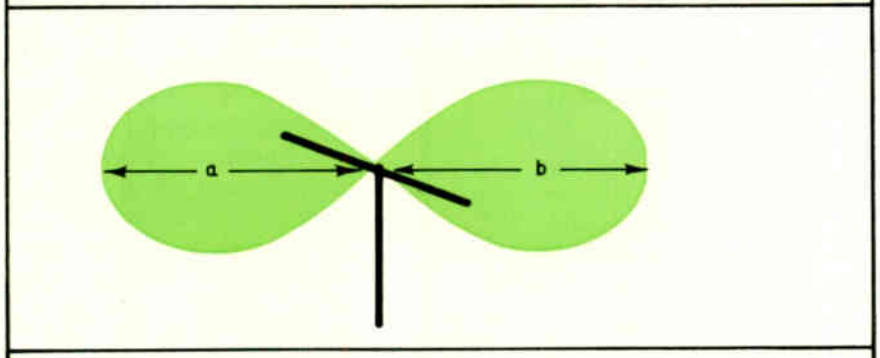
(*Continued on page 24.*)

The JFD "Log Periodic" FM stereo/VHF-UHF TV antenna (top) typifies the new combination antennas available today.

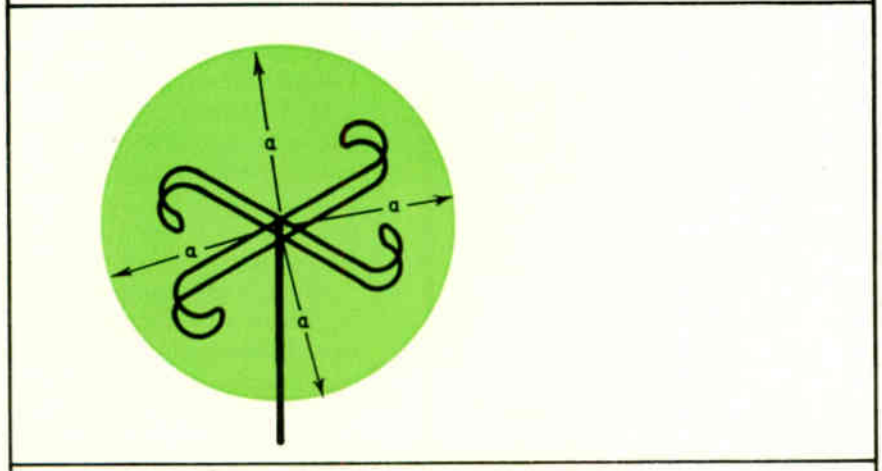




In a strongly directional FM antenna, signal sensitivity at the front (a) is much greater than sensitivity at the back (b). This type of antenna might display a front-to-back ratio (a/b) of 10 or more, as an example. Gain is generally very high.

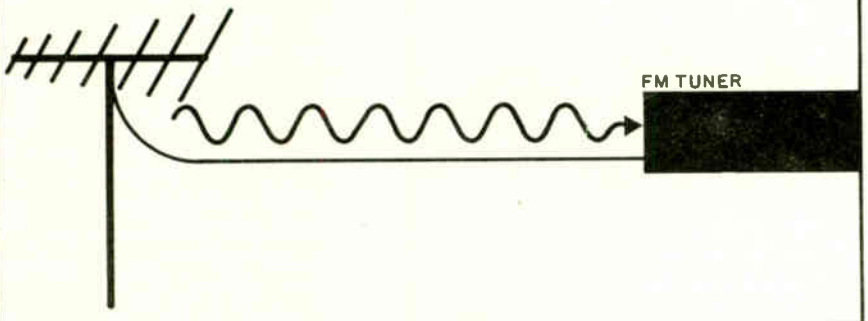


A single dipole antenna's front-to-back ratio, in contrast, is 1 (a=b). Thus, it can't discriminate between stations, as the directional FM antenna does. Further, its gain is considerably lower than a multi-element antenna's.

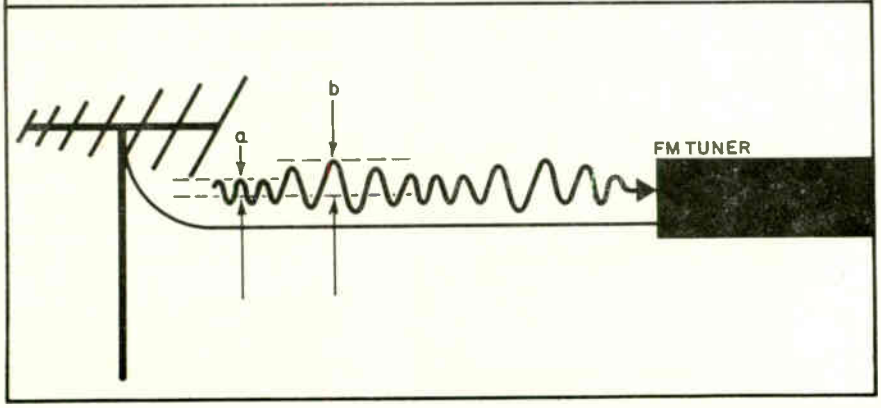


A crossed dipole or "turnstile" antenna has equal sensitivity in all directions, whereas the antennas above it display low sensitivities at sides. Neither a turnstile nor a single dipole antenna should be used for FM stereo where there are signal reflections or obstructions.

VOLTAGE STANDING WAVE RATIO (VSWR)



If signal voltages are the same all along the lead-in wide—an unlikely event—there's a perfect impedance match between the antenna and the FM receiver. Thus, the VSWR is 1.



However, if reflected signals cause high and low voltage points, then the standing wave ratio is b/a or the ratio of the high point to the low point. Therefore, it's greater than unity or 1.

FM STEREO ANTENNA GUIDE

Reception Conditions	Antenna Needed
Very strong signals, no reflections; usually not more than 5 miles from station (but many locations in cities do not qualify because of reflections and obstructions).	Indoor antenna: a piece of wire or "power cord" antenna "twin-lead dipole," or other indoor antenna (some have a little more gain than twin-lead).
Moderate to strong signals, usually up to about 10-15 miles, with no reflections: small city (no tall buildings) or close-in suburb.	Omnidirectional roof antenna: "crossed dipoles" or similar design. (Will be low gain).
Moderately strong signals, with reflections from buildings or hills causing multipath distortion: locations in large cities and in suburbs, from close in up to about 25 miles. Stations all in same direction from home.	Directional roof antenna of moderately high gain (3 to 6 elements), mounted in fixed position pointing at stations.
Same, but FM stations in widely different directions.	Same antenna, but with a motorized rotator so antenna can be pointed toward station tuned in.
Weak signals, typical of 25 to 40 mile distances.	High gain antenna, 7 elements or more. Will be directional so rotator is needed if stations are in different directions.
Extremely weak signals (Over 40 miles: maximum may be as much as 100 miles, in extremely favorable situations).	Several possibilities: if only one station, use a Yagi cut for that frequency only (two for two stations; more gets awkward): an array of 10 or more elements with or without an electronic booster; stacking two or more antennas; combinations of these. If stations are in different directions, a rotator will be needed.

ance match can be made flat over the band, but actual performance depends on how competently and accurately the design has been carried out (as with any antenna array). The actual gain is likely to be comparable to the broadband dipole arrays with a fairly large number of elements, but the evenness of gain over the band is likely to be superior.

Now let's back-track and consider indoor antennas for a moment, because some of us are using them with less than good results. The long-traditional "twin-lead dipole" which so many city listeners have used for mono FM is by definition, a zero-db antenna. There are a number of specialized indoor antennas for FM on the market, and some have moderate gain, up to a few db. The very strong signal needed for success with such low-gain antennas can be found in a fair proportion of in-city locations, but not in all by any means. But indoor antennas do not boast a high degree of directivity. Thus the pre-condition to successful use of an indoor antenna is an absence of multipath trouble.

There are many antennas aimed at solving two problems (often both in the same antenna): getting even *more* gain over the whole FM band, to help people who want FM stereo at considerable distances from the transmitter; and *combining* FM reception with VHF TV, UHF TV, or both. If you have FM and all-channel TV (and increasingly large numbers of us have all these services), you would need three separate antennas, with three separate lead-ins, clustered on your roof like a convention of cranes, under the old order of antenna design. An all-service antenna is an obvious solution to this problem, and a number of manufacturers have brought out combination antennas. You can expect in such antennas the use of

many elements—20, 30, or even more—and combinations of devices like dipole arrays and corner reflectors: the latter has been associated mostly with UHF TV in the past. Again, in a very rough way, the more elements the higher the maximum gain, with the gain in the best designs moving up toward 20 db. But the more elaborate the antenna the harder to judge its performance purely on an element-count.

We can match all the various *styles* of antenna against specific reception conditions, in a general way, as shown here in a table. But always remember that *individual* antennas will vary somewhat from the average for that style, particularly *over the band.*

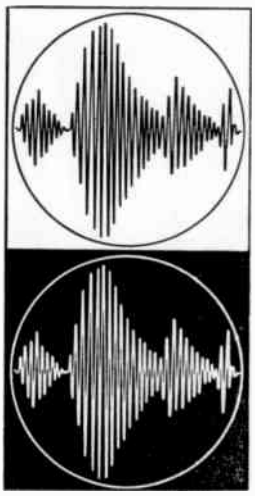
So if you can possibly manage it, a trial period is in order for any antenna in a location where reception conditions are demanding or marginal.

Since FM multiplex has poorer signal-to-noise ratio and greater susceptibility to multipath problems than mono FM, indoor antennas are a poor choice for stereo reception. An outdoor FM antenna is needed for good reception.

There are ways to increase the gain of an antenna. One method is to use an electronic booster. These are supplied with some antennas or can be bought separately. A booster is simply a tube, or more often today, a transistor amplifier that, in effect, adds one or more stages of RF amplification to your tuner: it raises the tuner sensitivity perhaps by 10 to 20 db. It's more desirable to have a booster mounted up at the top of an antenna mast, near the elements, rather than on the back of an FM set or somewhere else in the home. By amplifying signals atop an antenna, you avoid picking up noise from the down lead wire.

"Stacking," using two or more antennas connected together so that the energy from all is added together, is another way to get more gain. Stacked antennas are mounted one above another on the same mast. They have to be connected in such a way that signals are in phase; out of phase signals would tend to cancel each other and you would get *less* from two antennas than from one. Stacking kits, and full instructions for using them, are sold by a number of antenna manufacturers.

With sufficient signal strength and no multipath distortion, however, the quality of FM stereo reception is generally indistinguishable from FM mono. And that can be amazingly good, we know.



the technical quality of records and tapes

Reviews are concerned with audio reproduction qualities of recordings, not musical performance by James Quigley

A few days ago, browsing in a record store, I came across some selections I hadn't seen on a record label in a long time.

"That's a great record," the clerk commented as he walked past. Well, yes, I guess it is. But the funny thing is that it was recorded around 1935!

Although the LP jacket takes no specific note of the fact, these recordings were originally made in Italy as 78's. Now an American company has seen fit to dub them onto an LP and reissue them, with the words "HIGH FIDELITY" displayed prominently on the outside. If they were pops, the LP would probably be called a pirated recording today. But being classical collectors items no longer protected by copyright, the word "piracy" just doesn't come to mind.

You can still get the original 78's, if you want them. There are record dealers, often with avid mail-order followings, who specialize in servicing the collector. These particular discs (Rossini excerpts, sung by Conchita Supervia) are not rare, as such things are accounted. Of the half-dozen or so that were used in compiling the LP, most should turn up in good copies with a little digging. Total cost for the whole set (once you manage to get them all)—about ten times what the LP would set you back.

Ten times as much for "old-fashioned 78's" as for the same music on a modern, convenient, unbreakable, quiet-surfaced, lightweight, compact, ravishingly beautiful LP? What's going on here?

Well, just between you and me there is undeniable snob appeal in owning the "originals"—of anything. But for the audiofan, there may be very real advantages in terms of sound, as well.

Notice that I say "may be." Remember that those discs you pay six to seven dollars for (or much more, if they're harder to come by) are not new. They have been played—perhaps with a sapphire stylus, perhaps with a cactus needle, perhaps even with a rusty wire brad by someone fooling around with Aunt Martha's old, windup Victrola. They have been subject to other kinds of wear, too, paper scratches, cat hairs, spilled Coke, stacking without covers.

But some surprising sounds are waiting for you if you haven't played a good 78 in some time. Listen, for example, to some of the Boston Symphony recordings made around the end of the acoustic era. Sometimes, when I feel a bit too smug about the current state of hi-fi, I put on the Petruchka Suite. The fullness, detail and dynamic range of these recordings will astonish you if you think of this era in terms of the wheezy, "golden age" discs with which the apostles of the phonograph sprinkle their radio programs.

Similarly, if you think all 78's must have discouragingly high surface noise, try some of those glorious German Polydors or the Victors from the 30's with the scroll design on the label. Then compare them with some of those early, injection-moulded, polyethylene LP's!

This question of surface noise can be confusing if you're not used to 78's. Sounds seem to vary all over the lot; and sometimes the same recording will sound quite different from one pressing to another.

I remember the look of distaste on a singer friend's face once when I bought some of the Galli-Curci/Schipa duets.

"We had them at home," he complained. "I can't stand the way they sing off-pitch."

But I insisted he listen; and to his surprise, he was delighted. The difference was that I was playing HMV pressings, whereas he had been brought up on wartime Victors, whose inferior surfaces introduce a sort of harmonic distortion that can make sweet voices sound sour.

Formulas for "shellac" were carefully guarded company secrets in the days of 78's. RCA Victor had hundreds of formulas. Canadian Victor, however, developed its own (and some collectors prefer their product). A recording on these Victor labels might also be available from England in pressings by HMV. Their material, while matched by the best Victrola pressings from the 30's, enjoyed a reputation as the finest in the world.

But times change. If you have admired an old John McCormack

There's gold in them thar 78 rpm records, if you have the time and energy (maybe the money, too) to dig them out. Sometimes the sound on 78's are better than of LP copies. And where copies were never made, low-fi is better than no-fi.

disc, you may be able to get it in a postwar Irish pressing. But don't expect it to sound the same as the earlier one. Even more noticeable is the deterioration in the postwar Italian HMV (La Voce del Padrone) pressings of early electrical and late acoustic records by such operatic greats as Ponselle, Gigli and Pinza.

Similarly, when World War II prevented Victor from getting the materials they had been using, they changed the formula completely. The resulting pressings, which continued to be issued without major improvement until after the advent of vinyl, were recognized from the first to be a giant step backward.

To the user of modern LP's, it would seem to be a pity that more 78's were not pressed in vinyl. But the resiliency of the material makes a considerable difference to the reproduction. LP's are cut with that factor already allowed for. And besides, at slow speed, with light stylus tracking, relatively little "give" is induced in the material.

When you find vinyl 78's, however, you will usually also find mushy sound. And the tendency of vinyl to develop a static charge tends to undermine its intrinsically lower surface noise by substituting the crackling sound of dust for the even hiss of good shellac.

Frequency response? There's no getting around the fact that most (but not all) of the 78's in existence were recorded with equipment that we would not call wide range today.

Deutsche Grammophon (the postwar name for German Polydor) made some brilliantly wide-range 78's that are, if anything, even more vivid than the famous English Decca (now London) *ffrr* pressings. But still, db for db and Hz for Hz, 78's can't match the modern LP.

Still, if you savor the individuality of sound with those subtle differences that make each recording unique, you owe it to yourself to get out those old 78's and give them another try. The truism that "modern hi-fi equipment can't do a good job with 78's" simply isn't true.

The more versatility you have in your system, the more you can expect to get out of your 78's. Variable compensation curves, variable filtering, tone controls, variable loudness—all these can be an advantage in matching playback to the flavor of the originals. It sounds like a lot of work; but if you're a nut like me, it's worth it.

But how will these 78's compare with the LP dubs? Wouldn't you be better off buying the LP, which should have within its groove the best sound that can be got out of the originals? Not necessarily.

Aside from dubbing jobs that

the technical quality of records and tapes

(*Continued from previous page*)
are downright sloppy—and a good many of them have quietly been foisted off on the American record-buying public—there are two basic types. The first, and generally the best, is done by the owner of the original masters. The second uses records on which copyright has expired or makes use of special provisions of the copyright laws where the recording is more recent. Quality on this second type is sometimes pretty poor; try to listen before you buy.

For the company who owns the original masters (the "Vault Treasures," as they are wont to call them), this is an opportunity to pick up a fast buck without paying artists or studio costs. And some of the results betray the fact. More often, however, a great deal of energy is expended to insure that the product is as fine as modern technology can make it.

Remember when RCA Victor was still holding out against Columbia's LP system? Having touted 45 as inherently superior, RCA had some fast talking to do when they put out their first LP issue. So, on a parchment scroll distributed to their dealers, they proclaimed that they would condescend to favor the LP format with their recordings where the program material was "suited to the peculiarities of the medium," if I remember the phrase. One of their first issue of LP's included a dub of Friedrich Schorr's singing of the Fledermonolog from the late 20's. Originally, it had filled both sides of a 12-inch 78. But, in spite of the fact that continuity would certainly be reckoned one of the "peculiarities" of the LP medium (by contrast to both 78's and 45's), Victor didn't even bother to splice the two halves together.

In many cases, when plans are made to issue old recordings in the LP format, it develops that metal matrices no longer exist or are deteriorated to the point that pressings from them will be inferior to good shellac pressings of the original issue. In that case, the question arises as to the best way of dealing with the characteristic.

There are three basic methods of dealing with this kind of noise. The purist approach would not touch a hair of that precious sound: it would keep response in the copying equipment flat to beyond audibility on the theory that although the original recording equipment may not have had much to offer beyond 9,000 Hz, still there might be *something* that would be altered by filtering.

The high-handed approach would filter out anything that's there until all trace of surface (and a good deal of the sheen and sparkle of the music along with it) is gone. When a collection that includes some not-so-good originals is being put on LP, this approach would filter them all, reducing them all to the lowest common denominator of quality. The intent is to reduce the "intrusiveness" of surface noise sounds and fluctuating quality; but the results can be dreary. (If you get the chance, compare the originals of the Carmen excerpts with Farrar and Martinelli with the Camden reissue, now out of print. About half of the originals were good, bright, late acoustics with all their "S's and T's" in place. A couple were poor. In the LP, everything is uniformly muffled and unintelligible.)

The third method of attacking the surface noise problem is the sneaky approach. Electrola (a German EMI affiliate, now marketed in this country as Odeon) is among the best-versed in this technique. They have frequently employed it in their series, grandly titled *Unvergänglich*, *Unvergessen* (which might be translated as "Unfailing, Unforgotten"). These recordings carry the legend: *Technisch verbessert im . . .*" (literally, "Technically improved (sic!) in shellac surface noise.

(*Continued on page* 30.)

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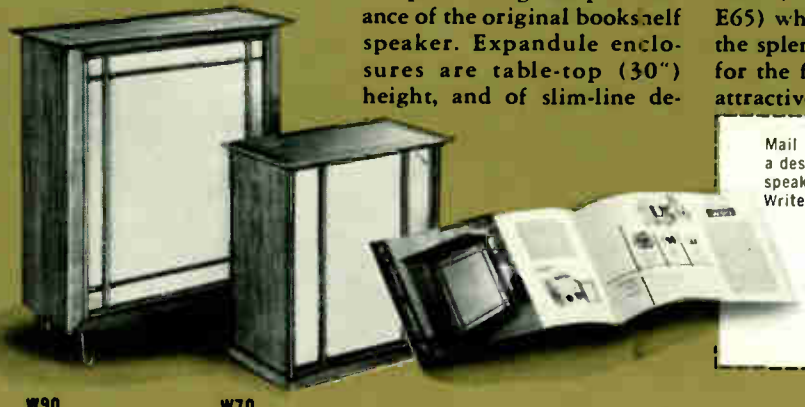

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FM STEREO DECODERS

(*Continued from page* 14.)

the left diode would appear as shown in the upper waveform of Fig. 5. After filtering (just as in any RF detection), the 38kHz components would be smoothed out and a single continuous sine-wave traced out. This sine wave is, of course, the original left-only signal.

A similar analysis could be made for a right-only signal. In Fig. 5, such a signal would have negative peaks for the first half of the waveform and positive peaks for the second half (just the reverse of the L-only representation). Consequently, the R diode would conduct when a signal was present and the L diode would be in a conducting mode when no signal was present. Logically, one can see that even when both L and R signals are contained in the composite waveform (as is true most of the time under actual program conditions) the proper diode conducts at the proper instant of time to recover separate L and R signals.

Many scholarly treatises have been written to show that both systems of detection are really forms of matrixing, viewed from different mathematical points of view. For our purposes, the important thing to bear in mind is that so-called time-division circuits have gained favor over conventional matrix types because they are more economical in the use of parts and, at relatively low cost, result in good stereo separation. That is not to say, however, that a matrix circuit cannot be designed to perform equally well, if enough care is exercised in the design.

There remains one major set of design alternatives to consider: the use or non-use of a local 19 kHz or 38kHz oscillator. As had been mentioned, some manufacturers amplify the incoming 19 kHz pilot carrier directly and double it to create the needed 38kHz signal. Others use the pilot as a synchronizing signal for locally generated 19kHz or 38 kHz voltages.

Generally, the direct use of incoming 19 kHz signals result in a less expensive and less critical design. Unless properly executed, however, this design approach is particularly susceptible to "multipath" problems (distortion, hissy "s" sounds, and wandering separation somewhat analagous to TV "ghosts"). On the other hand, local oscillators must be extremely stable and not be subject to change of phase or frequency under conditions of varying temperatures. Otherwise, oscillators may cause loss of separation or, ultimately, go out of "lock." Should this occur, the result would be an annoying "putt-putt" sound and no separation whatever.

A recent happy compromise is the "triggered" oscillator, one which remains non-oscillating until triggered by an incoming 19 kHz pulse or pilot carrier. All of these approaches, of course, have led to adequate designs capable of good stereo reception. Considering the complexity of stereo transmission, it is gratifying that all this extra circuitry has added so little to the cost to FM receiving equipment.

the technical quality of records and tapes

(*Continued from page* 29.)

. . ."). The Marcel Wittrisch record I have in front of me as I write was *Technisch verbessert* in 1958; and if that's *verbessert*, I'll eat my copy of *The Victor Book of the Opera.*

The reason I call the method sneaky is because they try to make up for the highs lost in filtering surface noise by introducing a bump in the response curve just below the filter shoulder. The result makes the lovely lyric tenor of the original take on an odd, strangling quality. Sopranos treated to this method, particularly when the originals are early electrics (hardly a flattering vintage for the soprano voice), can develop the most appalling, pinched screech.

Fortunately, not all of the series (or others of the sneaky school) are so drastically *verbessert.* But, even allowing for the many superb and ingenious jobs of dubbing represented in the current *Schwann Catalog,* it should be obvious that a good deal of the delight can be retained only if you're willing to go back to the originals. It should be obvious, too, that there is a great deal more to be gained by seeking out some originals than there is with others. But next time a friend finds "some of those old 78 records" in his basement, don't just chuck them out. Give them a listen. Chances are you'll still want to chuck them out; but still, every now and then . . .

(*Continued from page* 19.)

simple. As you may know, there is a class of neon lamps (such as the NE-2 and NE-51) which glow when a potential of 65 to 70 volts (AC or DC) is applied across them. In the unit which is illustrated here, a series of these lamps is arranged so they light progressively as more and more audio voltage is produced at the output of the amplifier.

The lamps are arranged to fire at the following power peak levels: 1 watt, 5 watts, 10 watts, 25 watts and 50 watts. Remembering that power $P = E^2/R$, where E is the voltage at the loudspeaker terminals and R is the impedance of the speaker (usually 4, 8 or 16 ohms), you can readily see that at 50 watts output (using a 16 ohm speaker) the voltage across the speaker terminals would be a mere 28.2 volts. (Turning the formula around, $E = \sqrt{P \times R}$ or, $E = \sqrt{50 \times 16} = \sqrt{800} = 28.2$ volts).

This voltage, corresponding to the highest power under consideration, falls far short of the necessary 65 to 70 volts needed to "trigger" even our first neon lamp. Accordingly, it becomes necessary to "step-up" the voltage appearing at the speaker terminals by means of a step-up transformer. An ideal transformer to use for this would be a small, inexpensive output transformer, used in reverse. That is, the low impedance secondary is connected to the speaker terminals, whereas the high impedance primary is used to trigger the various neon lamps by means of a suitable voltage dividing network of resistors, as shown in the schematic diagram. In the diagram you will note that R1 is not given a specific value. That is because you must first decide on the impedance of the speaker you wish to protect.

For example, 1 watt of audio power represents 2 volts across a 4 ohm speaker load. To get one watt of power across a sixteen ohm speaker will require 4 volts of audio across the speaker terminals. Thus, R1 is, in effect, a calibrating resistor which is determined by your speaker impedance. For 4 ohm speakers, R1 should be left out entirely. For 8 ohm speakers, the value of R1 should be 47K and for 16 ohm speakers it should be 120K. Of course, if you wish to make the instrument even more universal, you might want to add a three-position switch with which you can select the correct value of R1, depending upon the impedance of the speaker to be monitored. If you were to refine the instrument in this way, it would become useful for monitoring any loudspeaker in the hi-fi field. The other five resistors (R2 through R5) were chosen to the nearest standard 10% values and will give results within a few percent of nominal power desired.

operating the power indicator

After you have completed construction of this instrument with the aid of the wiring diagram here, connect the leads of the secondary of T1 to your amplifier terminals (directly in parallel with your speaker leads). If you prefer, the device may be permanently connected at the speaker location as well.

Here's how it operates. Let us assume that you have a 4-ohm speaker. As the audio output approaches 1 watt, the voltage appearing at the secondary of T-1 will approach 2 volts. Since T-1 has a turns ratio (or step-up ratio) of about thirty, this means that approximately 60 volts will appear across neon lamp L-1 (remember, in this case, R-1 is not in the circuit).

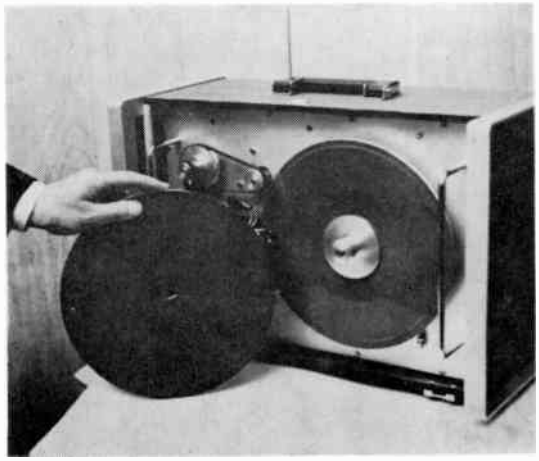
This voltage represents an rms value, and really has a peak value of over 80 volts peak, which will cause lamp L-1 to glow. The additional voltage dividing resistors, R2 through R5, are selected to cause L-2 to glow when 5 watts of audio is fed to the speaker, L-3 when 10 watts is applied, etc., all the way up to 50 watts, at which time all 5 lamps will glow.

Consequently, you simply glance at the neon monitor (you need two for stereo) to learn how much power is fed into your speaker at any given moment.

■ **Remember the LP that so many hi-fi manufacturers latched on to at last year's hi-fi show in New York?** It was *A Taste of Honey* —Herb Alpert and the Tijuana Brass (A&M Records). And the hi-fi exhibitors showed their good taste—**the** record won **four** Grammy Awards from the National Academy of Recording Arts and Sciences: Best Engineering, Best Instrumental Arrangement, Best Non-Jazz Instrumental Performance, and Record of the Year. Among other winners were: **September of My Years,** Frank Sinatra (Album Of The Year); **Horowitz at Carnegie Hall—An Historic Return,** Vladimir Horowitz (Classical Album Of The Year and Best Engineered Classical Recording); Berg's *Wozzack*, Karl Boehm conducting the Orchestra of the German Opera (Best Opera Recording).

■ **The biggies in the recording industry may have hesitated for awhile concerning the continuous loop stereo tape cartridge,** but they've taken the giant step and announced that their catalogs will be available on 8-track. Thus Columbia, Capitol and Decca, among others, follow RCA Victor's lead. This isn't to say that 4-track is dead. How can you ignore some 600,000 plus 4-track cartridge players already installed in autos, largely in the Far West? There's talk of "compatible" cartridges under development, too. And speaking of BIG ones throwing their caps into the 8-track tape cartridge arena, General Motors has advised that they, too, are planning to bring out 8-track tape cartridge players for their '67 line. (Ford already has 'em, as readers of this column know, and Chrysler went the musical route, verbally, some months ago.)

■ **Magnetic discs were very much in the news just about the time AUDIOFAN broke with an article last month on** Ampex' use of **it** for recording and playback in broadcast studios and Sony's application for video recording and playback. The Sony disc, shaped like a record, records from and plays back on TV color still pictures. The disc itself is said to cost only a few dollars (original reports from Tokyo had it priced much higher, as were erroneously reported last month). A photo of the disc and the "turntable" is shown here. Another announcement at about the same time caused a wave of excitement. CBS was reported to have developed a magnetic disc resembling a 45 rpm record that plays motion pictures over television. CBS denied development of such a device, but strong rumors still persist. If true, this would make it a poor man's video tape recorder (without the record function).



Video disc operates with TV set to record and play back still pictures.

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