Audio ETC

Audio ©

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • JUNE 1975 75¢ ®
47425

Build a Dynamic Noise Suppressor

Basics of Turntables

PL-A45D

PL-55X

e best
e, get a Pioneer.

Both units are even equipped with a strobe light directed at the strobe marks for easy viewing.

Combine the best automatic features with manual operation

While many hi-fi enthusiasts demand completely manual turntable operation, there are many purists who prefer semi-automatic operation. Pioneer provides this extra convenience in the PL-55X and PL-15D/II. Both models incorporate automatic tonearm return and shutoff. When the record has finished playing, the tonearm automatically returns to the arm rest and the power is turned off.

Automatic tonearm return and shutoff

The PL-A45D is completely automatic. You don't ever have to touch the tonearm when you play your records. This 2-motor model has a special precision gear motor to exclusively handle automatic tonearm lead-in, automatic return, automatic shutoff and repeat play. And when you prefer, you can switch to fully manual operation.

Fully automatic operation in single-play

The PL-71 and PL-12D/II, at both ends of Pioneer's turntable lineup, offer the total involvement that can only be attained by completely manual operation.

Superb S-shaped tonearms for better tracking

The tonearm of every Pioneer turntable system is the S-shape design, for optimum groove tracking. All are statically balanced and all use adjustable counterweights with direct reading of tracking force. All have adjustable anti-skate control and oil-damped cueing for the gentlest application of stylus tip to record groove. Lightweight plug-in cartridge shells insure positive electrical contact and optimum stylus position and angle for lower distortion and reduced record wear.

S-shaped tonearm for better tracking

Unexcelled performance

Still, all of these features and refinements do not guarantee the performance specifications of Pioneer's new turntables. Each tonearm and turntable platter combination is shock mounted in its specially designed natural grain base (with hinged dust cover). Precision machining of all rotational parts plus continuous quality control insure that each will meet or exceed its published specifications — a time honored tradition with all Pioneer components.

Choice of the professionals

Engineers, experts and enthusiasts agree: to get the best performance, select a manual turntable. And to get the best manual turntable, you need a Pioneer. Every Pioneer manual turntable offers a level of precision and performance unparalleled in its price range. And every one is a total system — with dust cover and base — designed for years of professional, trouble-free sound reproduction.

U.S. Pioneer Electronics Corp., 75 Oxford Drive, Moonachie, New Jersey 07074 / West: 13300 S. Estrella, Los Angeles 90248 / Midwest: 1500 Greenleaf, Elk Grove Village, Ill. 60007 / Canada: S. H. Parker Co.

PL-12D/II

PL-15D/II

For the manual turntabl

The manual turntable is rapidly becoming the first choice of hi-fi enthusiasts everywhere. The reason why is quite simple. Today's enthusiasts are more knowledgeable, more sophisticated and more involved with their music. And only the manual turntable can provide the involvement and performance they demand.

At Pioneer, this trend comes as no surprise. We have long recognized the superiority of the manual turntable. And long recognized a simple fact: a record changer in no way improves performance. It can detract from it.

As a result, we now offer the finest and most complete line of manual turntables available. Manual turntables that are designed with the needs of today's hi-fi enthusiast in mind. Turntables that are engineered for precision response.

When you get right down to it, good record playing equipment really has only two requirements: uniform rotation of a turntable, and accurate tracing of a record groove by a tonearm and its cartridge.

Pioneer's engineers have long recognized that these requirements are best met by single-play turntables and precision engineered tonearms. Our five new belt-drive and direct-drive turntable systems mean you needn't settle for the higher wow and flutter and the poorer signal-to-noise ratios (rumble) of record changers. Whether you've budgeted $100 or $300 for this vital element of your high fidelity system, there's a Pioneer turntable that outperforms any record changer in its price class.

Consider the performance advantages

Belt-drive, featured in Pioneer's PL-12D/II, PL-15D/II and PL-A45D, means smoother, more uniform platter rotation than can be achieved with typical idler-wheel/pulley arrangements normally found in record changers. Even changers

Belt-drive for rumble-free rotation

Direct-drive motor reduces friction

equipped with synchronous motors transmit vibration to the turntable platter. This is picked up as low-frequency rumble by the tonearm and cartridge. By driving the platter with a precision-finished belt, vibration is effectively absorbed before it can be translated to audible rumble.

Pioneer's direct-drive models, PL-55X and PL-71 go even a step further in achieving noise-free, precision platter rotation. The DC electronically controlled servo-motors used in these models rotate at exactly the required 33⅓ and 45 rpm platter speeds. Their shafts are directly connected to the center of the turntable, with no intermediate pulleys or other speed reduction devices. This means no extra friction-producing bearing surfaces.

Because of the unique technology embodied in these new, direct-drive motors, it's possible to control their speed electronically. This is more precise than any mechanical drive system. Both our PL-55X and PL-71 offer individual pitch control for both 33⅓ and 45 rpm speeds. Their turntable platters are edge-fitted with stroboscopic marks, so you can adjust precise speed while a record is playing.

Electronic speed adjustment for each speed

For the best performance, get a manual turntable.

PL-71

There's a Pioneer turntable that's just right for your needs

Model	PL-12D/II	PL-15D/II	PL-A45D	PL-55X	PL-71
Type	Manual	Semi-Auto.	Fully Auto.	Semi-Auto.	Manual
Drive System	Belt	Belt	Belt	Direct	Direct
Drive Motor	4-pole synch.	4-pole synch.	4-pole synch.	DC servo	DC servo
Speed Control	—	—	—	±2%	±2%
S/N (RUMBLE)	Over 48dB	Over 48dB	Over 47dB	Over 58dB	Over 60dB
Wow & Flutter (WRMS)	0.08%	0.08%	0.07%	0.05%	0.05%
Tonearm Type	Static Bal. "S"	Static Bal. "S"	Static Bal. "S"	Static Bal. "S"	Static Bal. "S"
Tonearm Length	8 11/16"	8 11/16"	8 11/16"	8 11/16"	8 3/4"
Turntable Dia.	12"	12"	12"	12 1/4"	12 1/4"
Price	$99.95	$129.95	$169.95	$249.95	$299.95

PIONEER®

when you want something better

Check No. 5 on Reader Service Card

Audio

June, 1975 *"Succesor to RADIO Est. 1917"* **Vol. 59, No. 6**

Feature Articles

Equipment Profiles

Record Reviews

Audio in General

AUDIO (title registerd U.S. Pat. Off.) is published monthly by North American Publishing Co., Irvin J. Borowsky, President; Frank Nemeyer, and Jay L. Butler, Vice Presidents; R. Kenneth Baxter, Vice President/Production: Nate Rosenblatt, Promotion Director; Mary Claffey, Circulation Director.
RATES—United States only: 1 year for $7.00, 2 years for $12.00, 3 years for $17.00; outside the U.S.: 1 year for $9.00, 2 years for $16.00, and 3 years for $23.00. Printed in U.S.A. at Columbus, Ohio.

Second class postage paid at Philadelphia, Pa. and additional mailing office. Back issues, $2.00 each. **World Library Congress number**: ISSN 0004-752X. **Dewey Decimal number: 798.9.**
REGIONAL SALES OFFICES: Jay L. Butler, Publisher and Sanford L. Cahn, Marketing Director, 41 East 42nd St., New York, N.Y. 10017, telephone (212) 687-8924.
Jay Martin, 2525 West 8th St., Los Angeles, California, 90057, telephone (213) 385-2917.
REPRESENTATIVES: Continental Europe: John Ashcraft, 12 Bear St., Leicester-Square, London W.C.2, telephone 930-0525.
For Benelux and Germany. W.J.M. Saunders, Mgr., Herengracht 365. Amsterdam, Holland, telephone 24.09.08.
Japan: Japan Printing News Co., Ltd., No. 13.2 Chome Ginza Higasi, Chuo-ku, Tokyo, telephone 541-5795.

AUDIO Editorial and Publishing Offices, 134 N. 13th St., Philadelphia, Penna. 19107
Postmaster: Send Form 3579 to the above address

BELT DRIVE ISN'T NEW.
MULTIPLE PLAY ISN'T NEW.
A TURNTABLE THAT COMBINES BOTH *IS* NEW.
READ ALL ABOUT IT.

Back in monophonic times, turntable motors drove platters through a series of wheels called "idlers".

Many automatics and changers still use this system.

In those days, records and playback systems were still relatively unsophisticated, so the distortions an idler drive system created didn't matter much.

Today, however, distortion is a critical problem. With recordings of increased dynamic range, wow, flutter and rumble must be reduced to inconsequential levels.

A belt-drive system is light years ahead of idler drive in that department.

And here the belt is driven by a unique motor found only in B·I·C turntables. It is a 300 RPM, 24-pole motor and it is inherently freer from noise and vibration than the 1800 RPM units with from 2 to 16 poles, which are standard in even the best of the conventional automatics.

The advantage of Programmed Multiple Play

The 980 and 960 are not record changers.

They are belt-drive Programmed Turntables which are engineered to play as many as 6 records at a time.

They have a 2-point record support system which is far less complicated and far more reliable than any umbrella spindle we've ever seen.

But an even more important advantage is this.

An automatic record handling system like the one on a B·I·C turntable can handle a single record, or 6 at a time, perfectly. No false drops. No bouncing and skating a diamond stylus across the grooves. It eliminates human error, and human error is what damages the sidewalls of your record grooves forever.

The simplicity factor

The 980 and 960 have the visibly lower profile of single-play manual instruments. They've been engineered to be simple machines, so they have fewer parts and fewer potential problems.

They abound in innovations. In the tone arm, the cartridge shell, the program panel, the entire system.

We can send you more detailed information if you write to Dept. 6A, British Industries Co., Westbury, L.I. 11590; or better yet, see them at your local audio specialist.

Check No. 8 on Reader Service Card

B·I·C™

This is the 980 with solid state speed control and strobe. About $200.* The 960 is identical except for these two features. About $150.*

* Less base and cartridge.

Audioclinic

Joseph Giovanelli

Recording Directly onto Discs

Q. In the January, 1974, issue of AUDIO, page 8, there is a reference to the "direct disc method." Please explain how the method is accomplished and compare it to the normal way in which discs are cut.—Scott C. Lewis, La Feria, Texas

A. Most disc recordings nowadays start as tape recordings. The use of tape offers conveniences, such as editing, which were not available when recordings were made directly onto discs. (Before tape equipment was in common use, all recording was made directly onto master discs.) When recording directly onto discs in the earlier days of the art, a mistake meant that the disc was wasted, and that the performance would have to be started from the beginning. Further, today's recording techniques make it possible for one performer to play several instruments because of a technique known as "over-dubbing." This is practical only by way of special tape machines which can hold 16 or even 24 tracks, recorded on a tape which is two inches wide, rather than the quarter-inch tape widths we use on home-type, open reel tape recorders.

Some claim, however, that, if we use today's cutting systems, it is possible to make direct disc recordings which are better than those made under similar conditions many years ago, when the 78 rpm disc was king. Forgetting about editing problems and over-dubbing possibilities, recording directly onto a disc, rather than making the original on tape and then dubbing that tape onto a disc, saves a copying step. Each copying step, no matter how good it may be, still produces some losses. The copy is not quite as good as the original.

In summary, recording directly onto a master disc can produce a recording which has more "transparency," more a feeling of "being there." However, any musical or technical mistakes cannot be corrected. Further, if something happens to the master disc, the entire process would have to be repeated. This means that the performers would have to be rehired. With today's high costs, this would make a re-recording a very expensive matter.

Frequency Ranges of Voices and Instruments

Q. What are the frequencies of musical sounds which singers and orchestral instrumentalists can produce?—Louis Goldfarb, New York, N.Y.

A. The frequency range covered by a vocalist or instrumentalist depends in great part on the skill of the performer, as well as on the type of voice. Therefore the information here is only approximate.

The so-called "high C" sung by a soprano is just a bit above 1,000 Hz. Her lowest note is two octaves lower, around 250 Hz. The singer won't generally be capable of producing much vocal power at this lower frequency. An alto might have a range from 175 to 700 Hz. A tenor can sing over the range of frequencies between 125 and 500 Hz. A bass can sing from about 85 to 350 Hz.

The organ covers a much wider range of frequencies. Its pedal tones start at 32 Hz, and some organs even go down another octave to 16 Hz, though it takes 32-foot pipe to do this. The highest fundamental tones of the organ go up beyond 4 kHz. The lowest tone produced by the bass viol is 41 Hz, while its highest is about 250 Hz. I've heard skilled jazz bassists produce even higher notes. The violin and trumpet cover a frequency range from about 190 Hz to 1 kHz or higher.

Note that the frequencies mentioned above are all fundamentals. All musical tones have harmonics (overtones) which contribute a great deal to the timbre, or distinctive sound quality of the various voices or instruments. These harmonics are multiples which may go as high as eight or nine times the basic frequency.

Adding Capacitance to Phono Pickup

Q. My problem is finding the right phono cartridge for my turntable, Technics SL-1100A, which has a low capacitive load of 165 pF for the entire unit, including the cable and the internal arm wiring. I want to use Shure V-15 type III or Ortofon M-15E Super phono cartridge with it, but they should be used with a relatively high capacitive load. I prefer not buying a stereo/4-channel cartridge to solve my problem.

I do not know the input capacitance of my preamplifier. Can I increase the total capacitance somewhat to obtain the flattest overall response from these cartridges? What would be the effect on the overall response if I use these cartridges with such a low capacitive load? —Robert Chang, Ithaca, N.Y.

A. Let us assume that you require, say, 400 pF to obtain flat response from the cartridge you purchase. To do this you must add capacitance to the system input. The amount of capacitance already in the preamplifier input is very low, and may for this purpose be ignored. In your case you would need to add 235 pF to bring the total up to 400 pF. The simplest way to accomplish this is to open up your amplifier and solder in a capacitor or group of capacitors which equals this value, across the terminals of each phono input jack.

The added capacitance can be readily removed if you change cartridges later.

If there is room in the amplifier and if you have the needed patience and test equipment, you can solder in adjustable trimmer capacitors so that you can adjust their effective capacitance to get the flattest possible frequency response for any particular cartridge.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

APPROACHING THE ULTIMATE

Amplification by Bose

The ultimate in audio amplification is more than the achievement of audible perfection. It is also flexibility of operation, long term reliability, and adaptability to all future signal sources. Through excellence in design and construction, the Bose 4401 Stereo/Quadriphonic Preamplifier and the Bose 1801 Power Amplifier establish standards of performance far beyond those of conventional components.

THE 4401 PREAMPLIFIER features stereo and true quadriphonic operation; a new concept in phono circuit design for the lowest possible noise; flexible tape recording circuitry for two tape recorders with full use of tone controls and filters during recording; internal provision for plug in of up to 3 multichannel decoders; professional "line driver" output circuitry; modular printed circuit board construction including horizontal mounting of input and output connectors for ease of installation.

THE 1801 POWER AMPLIFIER offers extreme reserves of power for reproduction at true concert hall volume in virtually any listening environment; complete speaker and input switching provisions; instantaneous light emitting diode display of power output in addition to standard meters; exceptionally conservative design, 14 power transistors, 1300 square inches of heat sink and modular construction of each amplifier section.

The 4401 Preamplifier and 1801 Power Amplifier. By design and construction the nearest approach to the ultimate in audio amplification. From Bose. For information, write to us at room AE.

BOSE®

The Mountain, Framingham, MA 01701

Tape Guide

Herman Burstein

Tape Deck Minus Electronics?

Q. I am considering the purchase of a tape transport which has no electronics. Does this use regular stereo preamps, or is there a certain kind to get? Is there anything else needed besides the preamps?—Ed Hansen, Jr., Akron, Ohio.

A. I strongly advise against buying just a tape transport with the idea of adding electronics unless you intend just to play prerecorded tapes. In such case you connect the playback head to the *Tape Head* input of an amplifier (Many amplifiers, though not all, have such inputs.). If your amplifier lacks such an input, you can get a separate playback preamp to provide amplification and equalization (bass boost). These amps are available from audio stores and catalog houses.

If you wish to record, then you need *record* electronics, a much more elaborate affair which includes equalization (mainly treble boost), amplification, bias current to the record head and to the erase head, and a recording level indicator. I don't know where you can buy such electronics other than in a recorder.

More On Dolby

Q. I am considering the purchase of a cassette deck. Several of the new recorders which use the Dolby system seem tempting, but I'm puzzled. Since many of my tapes will be prerecorded without benefit of Dolby, will they suffer from playback deemphasis on a Dolby deck? Is it expected that pre-recorded cassettes will be Dolbyized soon? Do decks provide for switching the Dolby circuits in and out?—John F. Motch, Sunnyvale, California

A. More and more cassette machines, and open-reel ones as well, will be using the Dolby B system. They without exception will include a switch for taking the Dolby compensation out of the system, so that previously recorded tapes can be played back properly. There are increasing signs of Dolbyized pre-recorded tapes in cassette and open-reel form.

Making Quieter Recordings

Q. Would I profit by taking one of the following actions? (1) Having the bias adjusted on my TEAC for low-noise Scotch 203 tape. (2) Purchasing an Advent 101 Dolby Noise Reduction System for use with my TEAC and standard Scotch 150 tape. If I adapt my TEAC to use low-noise tape, what effect would this have on my recorded Scotch 150 tapes?—Edward R. Kosek Jr., Killeen, Texas

A. If you find that tape noise is already very low and therefore not a problem, it would seem that you would settle for the simpler and less costly of your two alternatives, namely to have your machine adjusted for low-noise tape. These adjustments involve only the record electronics. Playback of previously recorded tape would not be affected.

FM Recording From TV Antenna

Q. I live 60 miles from Atlanta, and I want to record from my stereo receiver which uses an antenna intended for black and white TV. When I listen to FM, the meter pointer never goes all the way to the 5 position, but stops near 4. Should I get a separate FM antenna? I have another TV antenna designed for color. Should I use this antenna, with a splitter?—Alexander Stewart, Tallapoosa, Georgia

A. In fringe areas it is often desirable to use an antenna designed specifically for FM, rather than one designed for a broader range, as is the case with TV. On the other hand, TV antennas designed for color are often adequate for FM as well (unless designed to omit the FM range). If your FM programs come in noise-free, particularly on stereo, the antenna you are using is satisfactory.

Squeal From White Box Tape

Q. Several of my older recording tapes, on 7-in. reels, cause a very annoying high-pitched squeal when played back. Newer tapes don't squeal. It seems to be a mechanically-produced sound, although the vibration also distorts the audio output. The tapes are 1800-foot Mylar, supposedly lubricated (according to the box), priced at $1.99. I've cleaned and lubricated the record, erase, and playback heads and tape guides, but still get the squeal. I use a Wollensak T-1500 machine, which has had moderate use and no head replacements.—Kenneth N. Sewall, 44 Lakewood Terrace, Bloomfield, N.J.

A. Apparently you are experiencing one of the problems that accompany use of cheap white box tape. Not that high-price, high quality tapes are always free of such problems. But there is substantially less risk of running into problems with better, name brand tapes. I know of no really good suggestions beyond the measures which you have already tried. It may be necessary for you to throw away the tapes that give you trouble.

Where Can I Find . . .?

Q. I am interested in three hi-fi items, but I'm having difficulty locating them. First is a converter which will power an eight-track tape player in a car with a six volt system. The others are containers for open-reel and 8-track cartridge tapes. I need something more sturdy than the containers provided with prerecorded and blank tapes—David S. Johnson, APO, San Francisco

A. Metal containers for open reel tapes can be obtained from photography stores (these are used for film reels). With respect to the other equipment you are seeking, I suggest that you check your local phone book and those of nearby cities for parts stores. If none are close enough, write to Lafayette Radio, Box 88, Syossett, N.Y. 11791, or to Radio Shack, 2617 West Seventh St., Fort Worth, Texas 76017, asking for their (free) catalogs.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

The A-2340...

a stereo deck...

Play pre-recorded tapes, or make them yourself — tailored to your specific tastes, your changing moods.

a 4-channel deck...

Enjoy the exciting world of true 4-channel sound — four discrete tracks on tape.

a 4-track Simul-sync recorder...

If you play a musical instrument, or know someone who does, take full advantage of the A-2340's music making capabilities. With Simul-sync, you can record each part of the tune, one track at a time, in synchronization, until all of the music is the best it can be.

a superb machine for only $739.50...

No matter how you use the A-2340 — to learn, to create, to enjoy — you can count on using it for a long time. It was made to withstand the paces you'll put it through. And that's as it should be.

We gladly invite comparisons, and we'd like you to hear the A-2340, to operate it yourself. You'll find that our retailers are well informed and helpful in general, rare qualities so there can't be many of them. You can find the one nearest you by calling (800) 447-4700.* We'll pay for the call.

*In Illinois, call (800) 322-4400.

TEAC

The leader. Always has been.

TEAC Corporation of America, 7733 Telegraph Road, Montebello, California 90640.

priceless asset. It has been their support in the face of economic adversity, which has made the audio industry at least recession-*resistant*, if not recession-proof. Much of this support has come from the purchase of high-end equipment. The ongoing sales success of expensive audio equipment is phenomenon unto itself. For example, most open-reel tape deck sales these days are in the $600 and up category, with plenty of action in the $1100 to $2000, four-channel-with-sync-track units. I am told that it is almost impossible to sell cassette decks without Dolby noise reduction, with $300 about the average price, and with good sales in the $450 to $600 class. Sales of expensive high class preamplifiers, power amplifiers, and FM tuners up to $2000 have remained healthy, with some manufacturers actually in a back-order position. The higher-priced, more esoteric speaker systems are faring well, as are the fancier turntables, tone arms, and phono cartridges. In talking to a number of high-end manufacturers, they have told me that not only has their business been good in this country, but they have enjoyed excellent export sales.

"In a world with ever-shrinking standards of quality, good audio equipment is one of the few products that offers honest value for the money."

I asked the head of one of the oldest and most prestigious electronics manufacturers in this country why the high-end business had done so well in spite of the poor economic climate. He explains, "In a world with ever-shrinking standards of quality and excellence, good audio equipment is one of the few products that offers honest value for the money." He is right, of course. Value is the key word. In spite of some flirtations with mass marketing, the audio industry is still oriented towards a quality product. It may sound corny, but it is true that most audio manufacturers represent the last vestiges of the old time craft and guild organizations where excellence of materials and pride of workmanship were the guiding philosophies. Name me another product in today's world that can compete in value received for dollar spent with audio components. It's pretty difficult to come up with one. I'm not saying that some shoddy audio gear doesn't reach the marketplace; it does. Fortunately for us, this is the exception, rather than the rule.

The relative success of the high-end manufacturers notwithstanding, even allowing that we are a recession-resistant industry, it is obvious that some sort of shot in the arm is needed to stimulate the overall sales picture. Well, fellas, guess what happened . . . . the audio industry has rediscovered a thing called quadraphonic sound. I am not saying this cynically, and I am not saying that the powers that be cast frantically around looking for a sales gimmick. The fact is that the time was right, since many of the problems which thwarted the growth of quadraphonic sound have been resolved. Thus, by the time you read this, a massive promotional effort to really get the consumer involved with quadraphonic sound will be well under way.

Pioneer, in particular, is mounting an all-out campaign to convince people of the virtues of the medium. They will be featuring several specially-packaged quadraphonic systems and advertising them in the hi-fi press, in nation-wide magazines, and in extensive radio and TV promotions. Other major companies are behind the four-channel push, and record companies are also contributing to the drive. One of the most significant aspects of this new quadraphonic promotion is that virtually all of the hardware and software manufacturers have adopted the policy of boosting quadraphonic sound as an entity desirable in itself and are soft-pedaling the competitive differences between SQ, QS, and CD-4. And rightly so. There have been important technological advances in all of the four-channel systems, which have resulted in considerable improvement in their performance characteristics. Coexistence of the quadraphonic systems is, more than ever, the order of the day, especially since it appears the digital quadraphonic disc, a spin-off of some of the video disc systems, is still some time off in the hazy future.

All of this activity means that at the upcoming Consumer Electronics Show in Chicago, we should see a plethora of new quadraphonic equipment, even though the new four-channel promotion is just beginning, and the lead time may be too short for some manufacturers. You can expect a new generation of quadraphonic receivers with universal facilities for SQ, QS, and CD-4. This time around, with IC chips available for all the systems, in various degrees of circuit sophistication, none of the systems should get short-changed performance-wise.

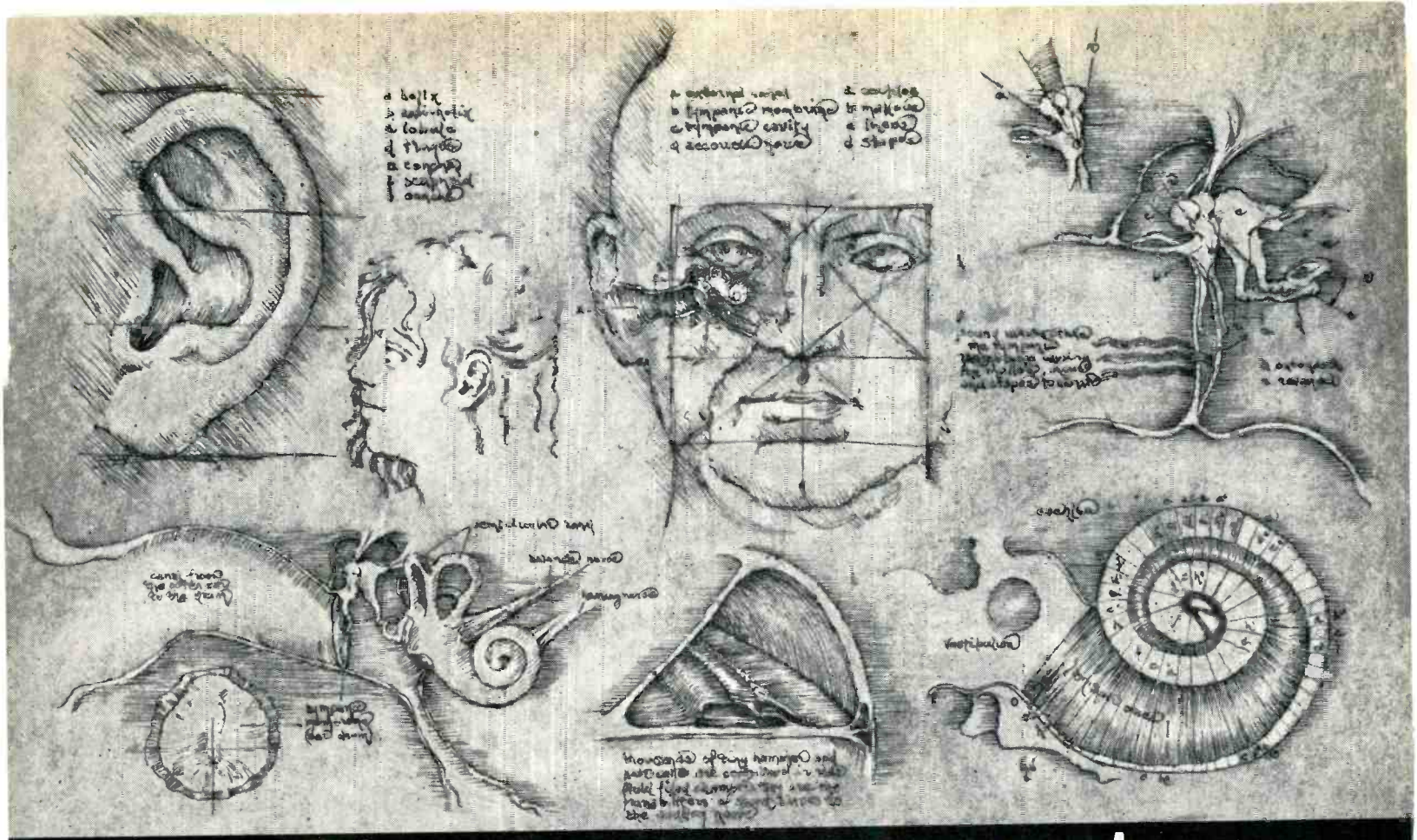
While today's receivers are marvels of convenience and performance, they are just not my bag. I am an unyielding proponent of the separate preamplifier and power amplifier, and there are thousands of audiophiles who feel the same way. For us die-hards, there will be new quadraphonic preamps and amplifiers. There will also be some very intriguing add-on units which will combine state-of-the-art decoding facilities for all the four-channel formats, plus heavy emphasis on ultra-sophisticated synthesizer circuits, and in at least one case, a delay circuit for ambience generation! In the case of CD-4, you will see the appearance of IC chip demodulators, such as the Technics SH400, which has been very impressive. There will be new CD-4 cartridges from several companies not previously in this field, and even some second generation CD-4 cartridges such as the new Pickering XUV/4500Q. All in all, there should be plenty of four-channel hardware in every product category at the CES.

The big question is, of course, will all this new equipment and impressive advertising campaign be sufficient stimulus to create a broad new market for quadraphonic sound? And in so doing, will it give a much-needed boost to the audio industry in these parlous times?

I think there is a good chance of success . . . if a substantial amount of those advertising dollars is spent on *educating* dealers and consumers alike on the merits of quadraphonic sound. This means, most specifically, properly set-up, intelligent, and interesting demonstrations using the highest-quality source material for each format. It means reasonable regard for the acoustic environment in which the demo takes place. It means clean styli and clean records, maintained in that condition. It means asking the prospective customer whether he likes classical or pop music, before he is alienated by force-feeding him the wrong kind of music. It means truly knowledgeable sales people, who can simply, but effectively, explain what quadraphonic sound is all about . . . the differences between surround and ambient quadraphony, etc. It means, among enlightened dealers, the establishment of loan programs for auditioning quadraphonic equipment in the home.

I can say this unequivocally . . . much has been learned about the recording of quadraphonic sound and such is the technical excellence of the hardware available in each format, that it is no problem at all to give a totally convincing demonstration of quadraphonic sound.

Let's hope the new quadraphonic promotion will prove to be a rousing success.



It's not your components that are getting worse, it's your ear that's getting better.

By better, we mean it's learned to pick up things in music that it was never able to before.

And that's why that system you bought may have sounded great a couple of months ago but doesn't sound so great today. The human ear, you see, is the most advanced sound receiver system in the world. Your eardrum is sensitive to one billionth of a centimeter. And it has a tiny bone called the incus that can vibrate up to 20,000 times a second.

Enough said about how good your ears are. Now what can you do to improve your system?

A general tip: Whatever you buy, buy up. You might not think it's worth the extra couple of hundred dollars now but you'll be glad you sprung for it later.

A specific tip: Consider Sony separates.

Separates offer you specs you generally can't get in non-separates. And therefore a better quality of sound. Our TAE-3450 pre-amp, for example, has a low distortion rating of THD 0.03%, a wide dynamic range of 69-70dB and accurate phono equalization (RIAA).

In addition, it offers you such features as a step attenuator gain control (volume control) that allows precise gain adjustment readings (our 2dB reading is the minimum loudness change the human ear can detect), extremely accurate tracking in 2 channels, and a quieter, longer lasting performance due to the use of low resistant sterling silver contacts. The unit also has a single peak program meter with a hold position that allows reading at the highest point of the signal wave form, thereby helping to detect overload distortion. And it also serves as a volume unit meter (vu) that allows for easier monitoring by showing the average value of a signal over a period of time rather than sudden changes within a short period.

We have separates that start at prices a lot lower than you'd expect to pay. And go all the way up to prices you're probably not ready to spend right now. So if your ears ever outgrow the system you buy, we have others they can easily grow into. Why not stop into a Sony dealer and ask one of our salesmen for some help. After all, if you really appreciate music, shouldn't you have a system you can really appreciate it on?

SONY

October, 1974, *Audio*, pp. 16, 17)

But Mr. Canby's dissertation on the value of tapes versus transcripts is so lop-sided it cries out for rectification. Even readers of *Audio*, for example, must marvel at his conclusion that the Nixon debacle proved tapes more important than transcripts. The fact of the matter is that the White House transcript of a previously secret Nixon conversation is what blew him clean out of the White House. The transcript itself was so incriminating, in light of past denials, that no nuance in his voice could have saved him. No one even asked to hear the tape!

Like Mr. Canby, I devoutly wish we had saved all of our tapes from the start, but as the fellow who has put 20 years into building Oral History at Columbia, I scarcely recognize myself in Mr. Canby's "the great Columbia Oral History, in all its majesty." The great Columbia Oral History was so flat broke in its early years that we were forced to reuse our tapes as soon as they were transcribed.

It is not "the mighty" Columbia University that keeps us alive, but our own efforts to respond to the needs of the scholarly community. That community opts for transcripts over tapes. For every scholar who asks to hear a tape, there are roughly a thousand requests for transcripts.

Why should it be so? Scholars, of course, are print oriented, but the reasons go beyond that. For one, they see the transcript as more like a legal deposition than the tape: it has been read over, corrected, and allowed to stand by the oral author, and is therefore more reliable than the first "draft" on tape. Secondly, the transcript is easily indexed, and one can cite and quote passages with page numbers, rather than worry about finding the passage on a tape, and then fretting whether one heard the words correctly the first time.

Nor is Columbia's experience unique. Other oral history projects, including some that have gone out of their way to encourage tape listening, report the same overwhelming preference for transcripts. The exceptions are music, folklore, and linguistic collections. Possibly, future scholars will prove more aurally oriented. Rather than scan 5,500 pages of Madame Frances Perkins' Oral History memoir at Columbia, for example, they will patiently sit in front of a tape recorder and listen to her for five consecutive 40-hour weeks. . . I will believe it when I see and hear it!

Louis M. Starr
Director, Oral History
Research Office,
Columbia University

Mr. Canby replies:

If Dr. Starr in fact had such a woefully small budget that he was forced to erase his tapes in order to use them again, then the case is worse than I thought in respect to the "majesty" of Columbia University.

I do not think that any of us can quarrel with Dr. Starr concerning his many years of devotion to the Oral History project, but I would like to suggest (as I already have to him) that my type of report is not intended to be strictly neutral but, rather, to get at the truth by establishing another point of view. In a sense, this is the time-honored adversary system of our courts, each side presenting a case, with our readers sort of a jury.

I did not feel it necessary to point out the advantages of the visible document in print. Nor did I intend to suggest that audible tape will supersede print. Each has its values, its advantages and disadvantages. What we must understand (and those scholars will some day come to understand) is that these values are equal but different. Different, yet EQUAL; in a practical sense, in a strategic sense and, eventually, a legal sense.

I have not heard much lately about those Nixon transcripts; on the other hand, the Watergate Trial revolved to an enormous extent about the Nixon *tapes*, the original documents. The precedent is now set and, I should hope that Columbia University, the *New York Times*, and scholars 1000 to 1 will at least take note, whatever the immediate practicalities may require—which could well be the microfiche. —*E.T.C.*

AM Radio Stations

Dear Sir:

The George McKay article on AM radio (*Audio*, January, 1975) is fascinating, but Mr. McKay is incorrect in asserting that FM broadcasting didn't start until January 1, 1941. Major Armstrong's station in Alpine (New Jersey) started scheduled broadcasting in July, 1939, and by the date mentioned FM was on the air regularly in Boston (WNAC), Hartford, Conn., (WTIC and WDRC) Schenectady (WGY), Rochester (WHAM), and New York City (WOR). The WNAC repeater station on Mount Washington, N.H., had been in continuous operation for almost two years by the date cited by McKay.

In addition, several Canadian AM stations should be included in your listing on page 31: CBA in Sackville, N.B. (1070 kHz) blankets most of coastal New England, day and night, and I've received it regularly in Beach Haven, New Jersey. CBF, Montreal (690), comes in strong throughout much of the Northeast. CBEF, Windsor, Ont. does likewise throughout the Midwest at 540. Where I live in northern Connecticut, I receive Toronto's CFRB as well as New York's WINS at 1010, depending on climatic conditions. CBU, Vancouver, puts a pretty strong signal down the Pacific Coast at night on 690, and blankets much of the state of Washington in the daytime. Finally, the station at Windsor, Ont. at 800 is CKLW. The station in Baltimore at 1090 (which we here in Canaan receive better at night than nearby WTIC is WBAL.

Obviously, if I spent this much time with the article, I enjoyed it. Keep up the good work.

Robert Angus
Canaan, Conn.

Editor's Note: Mr. Angus is Executive Editor of the industry journal *Audio Times*, the Editor of *Modern Hi-Fi*, a Contributing Editor to *AudioScene Canada*, and *Funkschau* (Germany), and a syndicated Columnist for the Toronto *Star*.

Disc and Cutter Response

Dear Sir:

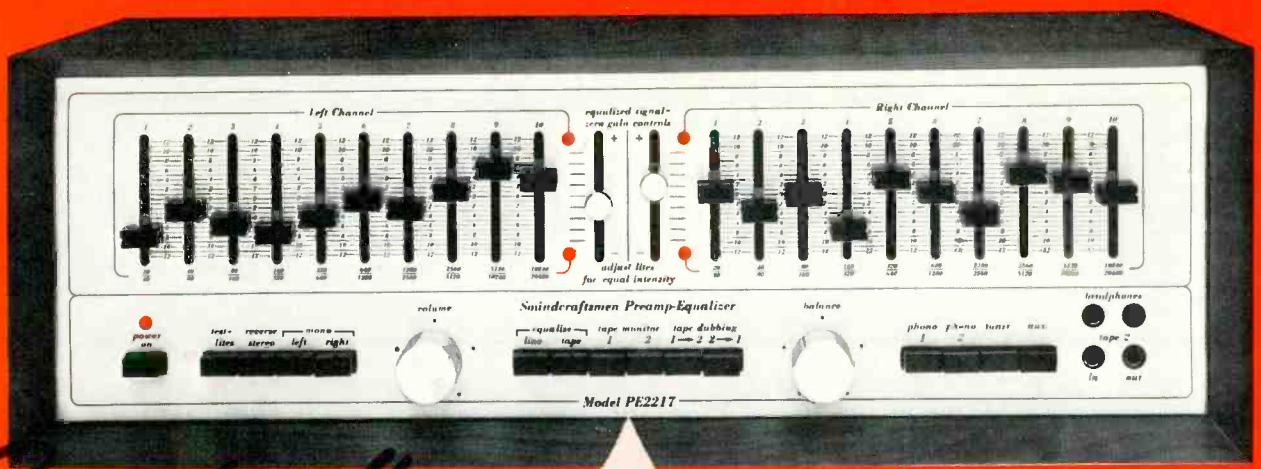
I must comment on Mr. Giovanelli's reply to reader Douglas Cook's question in your November **Audioclinic** column.

Modern cutting systems are quite uniform; for example, the Neuman SX74 stereo cutter is ± 3 dB from 7 Hz to 25 kHz, ± 1 dB from 10 Hz to 20 kHz. Discs with frequency response from 40 to 15,000 Hz are actually quite common.

I have observed everything cut in one studio throughout a particular day on a spectrum analyzer, and almost all program material, from hard rock to classical, had program information from 31 Hz through 16 kHz. A random selection of 10 "top-40" singles played through the spectrum analyzer showed meaningful information at 16 kHz on 90% of the discs, and also at 31 Hz on 50% of the discs, including one which was popular back in the middle sixties. LP discs usually have even wider response.

Regarding cutting roll-offs, the main reason for using them is to correct the esthetic problem of overabundant highs or lows on the master tape due to monitoring deficiencies, etc.

Robert C. Ludwig
Sterling Sound, Inc.
New York, N.Y.



Soundcraftsmen

THE PERFECT PRE-AMP FOR THE GREAT NEW SUPER-POWER AMPS!

For a SUPER-SYSTEM, match the 2217 with any of these TRUE "State-of-the-Art" amps—

• PHASE LINEAR • SAE • CROWN • DYNACO • AUDIO RESEARCH • CITATION • • ESS • MARANTZ • SONY • KENWOOD • BOSE • INTEGRAL SYSTEMS • BGW •

Audio engineers agree that the ultimate Preamp must have all the CONTROL flexibility of a patch panel . . . our new PE2217 has pushbutton-patching, plus 22 more MUST features . . .

SPECIAL FEATURES

• **ALL PUSHBUTTONS INTERLOCKED** to prevent inadvertent program destruction • **DISCRETE-OCTAVE EQUALIZATION CONTROL** of ten octaves on each channel, ±12db each octave • **FULL-SPECTRUM LEVEL CONTROL** for each channel • **AUTOMATIC CONTINUOUS MONITORING** by light-emitting diodes for visual warning of overload in output circuits • **VISUAL ZERO-GAIN EQUALIZATION BALANCING** on music, white noise or pink noise • **SELECTION OF TEST LITES** on or off. • **TAPE DUBBING BETWEEN TWO MACHINES**, with optional simultaneous equalizing and monitoring • **DOUBLE-DUBBING** into two recorders simultaneously • **SEPARATE SYSTEM-SELECTION** enables full use of all other functions during the tape dubbing operation • **LINE OR TAPE** equalization selector • **AUTOMATIC EQUALIZER-DEFEAT** when line or tape equalizer is not in use • **FRONT PANEL TAPE** input-output jacks for easy 2nd and 3rd tape recorder hookup access • **TAPE MONITORING** of either tape at any time • **TWO** stereo headphone jacks • **MONO SELECTOR** for left, right or both channels to both outputs • **REVERSE-STEREO** mode • **TWO** low-level phono inputs • **FOUR** independent phono preamps • **SIX** A/C outlets, 4 switched, 2 unswitched • **ELECTRO-PLATED FERROUS CHASSIS** — (eight sections) — provides optimum shielding to minimize magnetic field-coupling • **SINGLE-POINT** system ground connector minimizes ground-loops • **TWO REGULATED** power supplies

SPECIFICATIONS

FREQ. RESPONSE — Hi-level: ± ¼ db, 5 Hz to 100 KHz
FREQ. RESPONSE — Phono: ± ½ db, 20 Hz to 20 KHz
THD: less than .05% at 1 volt (Typ. .01% at 1 volt)
IM: less than .05% at 1 volt (Typ. .01% at 1 volt)
SIGNAL-TO-NOISE — Hi-level: 100 db below full output
SIGNAL-TO-NOISE — Phono: 84 db below a 10mv input
SIGNAL-TO-NOISE — Equalizer: 90 db below a 1 volt input
OUTPUT IMPEDANCE: 600 ohms
MAXIMUM OUTPUT: 5 volts into hi impedance, 2.5 volts into 600 ohms
EQUALIZER LEVEL: Zero-gain controls for left and right continuously variable, for unity gain compensation
EQUALIZER RANGE: 12 db boost and 12 db cut, each octave at 30, 60, 120, 240, 480, 960, 1920, 3940, 7680 and 15,360 Hz.
MAX. OUTPUT SIGNAL: Variable master volume control allows adjustment of optimum output to match amplifier
CIRCUIT BOARDS: Military grade G-10 glass epoxy
RESISTORS: Low-noise selected carbon-film
POWER SUPPLY: Separate supply for photo and equalizer
DIMENSIONS: Walnut-grained case 7¼" x 20" x 11¼" deep
WARRANTY: 2 years parts and labor
SHIPPING WEIGHT: 28 lbs.

MADE IN U.S.A.

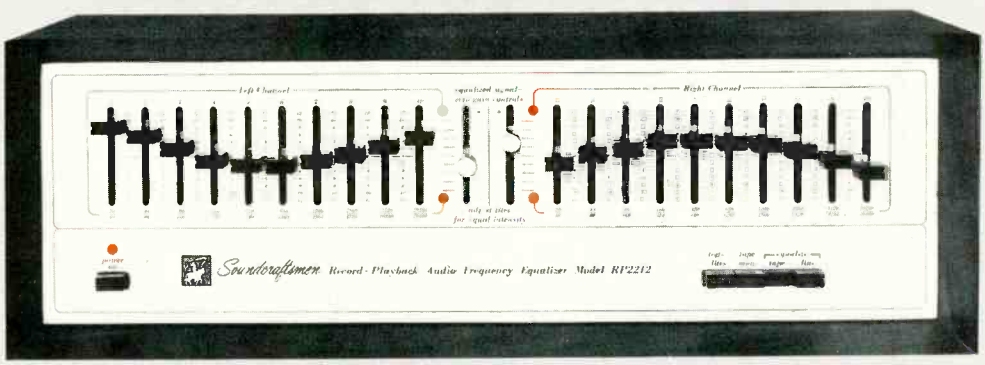
PE 2217 $499.50

includes walnut-grained cabinet or rack mounts.

Soundcraftsmen EQUALIZERS

NOW YOU CAN MAKE YOUR SYSTEM SOUND EXACTLY THE WAY YOU WANT IT TO SOUND!

In a few minutes, you can accurately "tune" the frequency response of your stereo system and room environment to a flat ±2 db! All you need are your own ears and the Soundcraftsmen Equalizer (with its step-by-step instruction record) to transform any stereo system and room environment into an acoustically-perfect concert hall! Or, to provide any special acoustical effects you desire! The Soundcraftsmen Equalizer enables you to instantly compensate for frequency response variations, in system and room.



GUARANTEED to enhance and improve any fine system!

Just plug 2 cables into your receiver's tape monitor jacks, and you are ready to enjoy a new experience in musical enjoyment!

2212	Illustrated above . . .	**$349.50**
20-12	Same specs as RP2212, except no L.E.D.'s, no Tape Equalize on front	**$299.50**

Both models include walnut-grained cabinet or rack mounts.

FREE!

THE "WHY'S AND HOW'S OF EQUALIZATION," an easy to understand explanation of the relationship of acoustics to your environment. This 8 page booklet also contains many unique ideas on "How the Soundcraftsmen Equalizer can measurably enhance your listening pleasures." "How typical room problems are eliminated by Equalization," and a "10-point self-rated Equalization Evaluation Check-List."

Soundcraftsmen

1721 NEWPORT CIRCLE, SANTA ANA, CA 92705

Check No. 28 on Reader Service Card

What's New in Audio

Bozak Multi-Driver Speaker

The Monitor-C loudspeaker is a two-way floor-standing system using four woofer drivers and eight tweeters. The crossover is at 2,000 Hertz. All drivers have aluminum cones, with the tweeters angled to provide wide range horizontal and vertical dispersion. The Monitor-C is rated at 150 watts, and nominal inpedance is eight ohms. Price: $489.50.

Check No. 61 on Reader Service Card

3M Metal Reel

This 7-in. aluminum reel has heavy flanges and is precisely made and assembled to give better protection to tape edges than plastic reels, though it's the same size and has the same tape capacity. It's also claimed to assist better tape alignment. Three threading slots are provided. Sold through most audio dealers at $9.35.

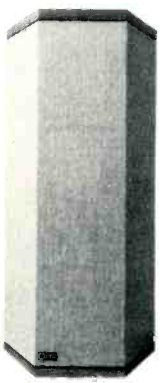
Check No. 62 on Reader Service Card

Superscope Four-Channel Receiver

The QR-450 stereo/four-channel receiver is rated at 20 watts continuous per channel in stereo, 8 watts per channel in quadraphonic, all channels driven, at 1% THD, 40 Hz to 20 kHz, all into 8 ohms. It includes SQ decoding, as well as derived *Ambience* rear sound. CD-4 capability may be added by plugging any CD-4 demodulator into jacks provided for the purpose. Joystick control of balance between four (or two) channels is provided on the front panel. In walnut finish case the Superscope QR-450 is priced at $399.95.

Check No. 64 on Reader Service Card

Design Acoustics Speaker



The D-4 loudspeaker is a 3-way system mounted in a trapezoidal enclosure 38 in. H. x 9½ in. D. x 17½ in. W. The 10-in. woofer radiates from a sealed enclosure out the rear, while each of the three 2½-in. tweeters is mounted on a different frontal plane to achieve maximum dispersion. One 5-in. midrange driver is also used. Controls permit lowering either woofer or tweeter output by 3 dB. Response is stated as flat to 40 Hz. Price: $199.

Check No. 65 on Reader Service Card

Frazier Mark VI-A Loudspeaker

The Mark VI-A is a massive, floor-standing, three-way system employing a 12-in. woofer, an 8-in. midrange driver, and two tweeters. One of these is a 3 in. x 7 in. compression horn, the other a super-tweeter stated to reproduce signals up to beyond the audible range. Crossover networks using air-core inductors are designed for 600 Hz and 3000 Hz. Rated at 30 watts continuous power handling, the system is quite efficient, being specified as producing 85-88 dB sound pressure level at 15 feet with electrical input of only 0.4 watt. Variable midrange and high frequency controls are included. The Frazier Mark VI-A weighs 111 lbs. and is 25¾ in. W. x 29 in. H. x 16⅛ in. D. It is priced at $450.

Check No. 66 on Reader Service Card

JVC Cassette Deck

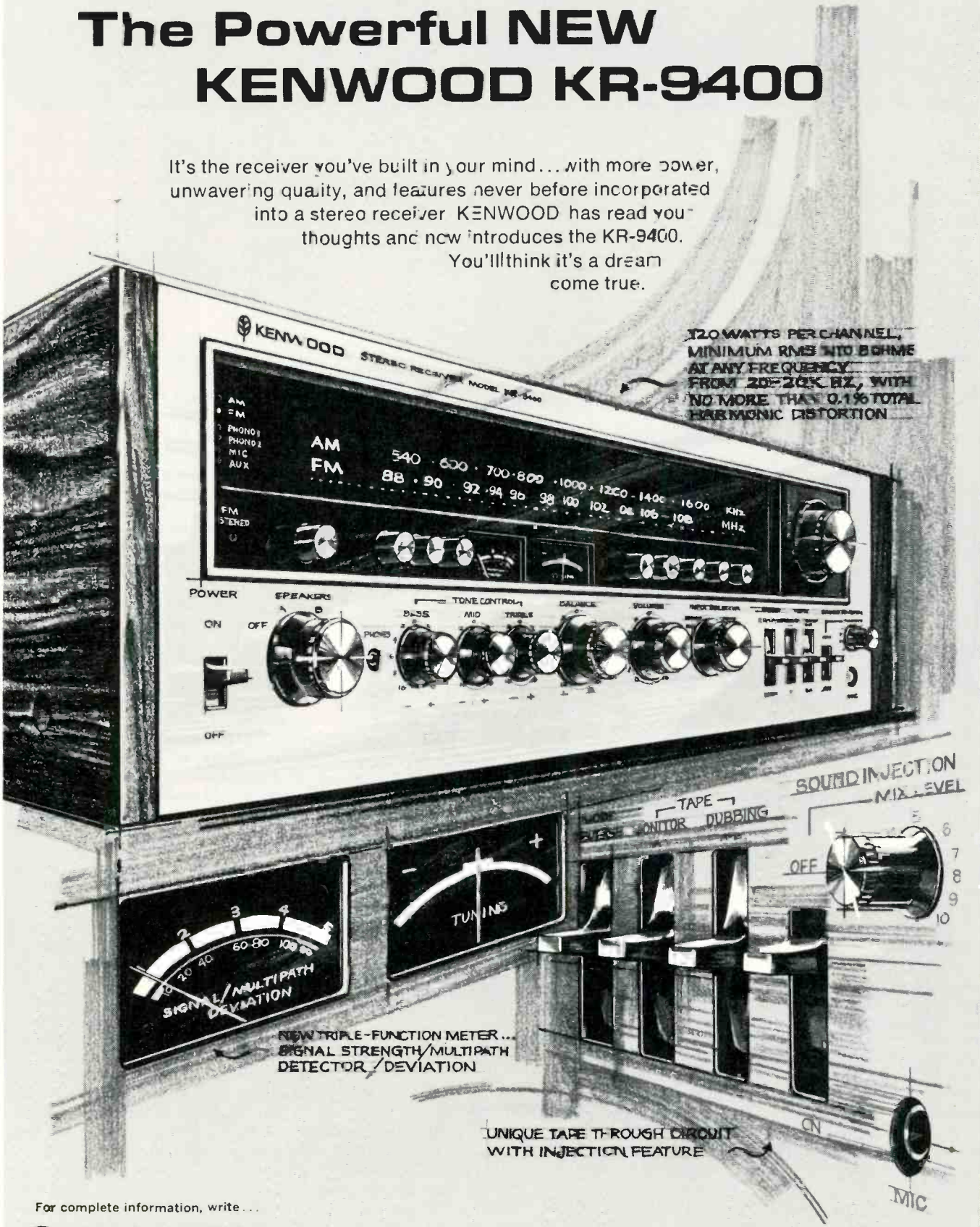
The CD-1669 deck includes JVC's ANRS noise reduction system, along with a detection circuit which automatically, during playback, determines whether the tape was recorded with ANRS and switches the system on or off as required. Two switches permit selecting bias and equalization for three different types of tape; regular, low-noise, or chromium dioxide. In addition to the recording (VU) meters, a warning indicator lamp flashes when overrecording takes place. Tapes may be rewound to a predetermined point, at which time the machine goes into *Play* mode by itself. A remote control unit is included in the price of $499.95.

Check No. 67 on Reader Service Card

From Concept to Reality

The Powerful NEW KENWOOD KR-9400

It's the receiver you've built in your mind... with more power, unwavering quality, and features never before incorporated into a stereo receiver. KENWOOD has read your thoughts and now introduces the KR-9400. You'll think it's a dream come true.



For complete information, write...

KENWOOD 15777 S. Broadway, Gardena, CA 90248 • 72-02 Fifty-first Ave., Woodside, N.Y. 11377 • In Canada: Magnasonic Canada, Ltd.

Check No. 14 on Reader Service Card

Audio ETC

Edward Tatnall Canby

CLAUSTROPHONIA. Some people may wonder why a few of us writers keep hammering away on that well-explored subject, quadraphonic sound. It's a dead goose, isn't it?

Well, I'll admit it's a struggling goose with problems. No wonder it won't fly. It has three wings and eighteen legs and not enough lift to get off the ground. Suffers from discular discrophy, a disease whereby the parts take off in all directions. A flying fibrillation. "Fly SQ!" says one wing. "Fly CD-4!" says another. And the third? Its time will come. Between 'em all, you'll have to admit, quadraphonic hasn't yet reached the stratosphere, though latest measurements place it at least a number of inches into launch, flailing madly. Yet, I love it, and I think it has a future, like the ugly duckling.

You know, this month is our 27th anniversary (and mine) on the audio circuit, a long time and not far from one third of the entire history of reproduced sound, going back to old Thomas Alva Edison and his Little Lamb. What I'm wondering is, will the quadraphonic goose ever make it to its proper niche? A lot of people think not. They don't think it's very important. Just another gadget ploy, etc., and so on. What people think in our sort of business, tends to be the pragmatic truth, at least for the moment. And so quadraphonic sound, right now, *is* suffering from a lack of importance. In a word, it is being ignored.

What concerns us is why? And some curious ideas have been sprouting within me on this score. I don't believe these people! What I think is that quadraphonic is too important. It offers too much. Too much, too quick. So we pretend it isn't there.

Music Everywhere

In the big world outside of hi fi, where people these days are practically wired for sound, with transistors, pocket recorders, car radios, 8-tracks, cassettes and, of course, stereos all over, plus sound in banks, elevators, rest rooms, planes, supermarkets, swimming pools, ski runs, quadraphonic admittedly has no place. These messages are coded for our own zany sort of listening, lo-fi, fragmented, backgrounded, threshold-liminal even at top volume and perfectly satisfactory to most hearers. These signals need no help from our latest four-way system. They do very well in straight mono (even via stereo!), from the thin squeak of a tiny radio, dangling on a wrist, to the bellow of gigantic mono sound I looked at the other day in a New York rock-type night spot, the big speakers turned off and silent. These are brute-force messages, even the tiny ones, and they do their job without quadraphonic aid.

But even our musical friends shun quadraphonic, which is something else again. People who will go right out and spend thousands of dollars on "good equipment" (they avoid the term "hi fi") in order to set up the right sonic environment for their home living, even these people, stay away in droves. They buy stereo.

Sticking With Stereo

A young lawyer, very music minded, just called me. He has bought himself a whole new system, from the ground up, including a cassette deck. (Guess why he called. You guessed. He wants to copy off my disc records.) After a long description of it all, I asked him, why not quadraphonic? *H---no*, was the instant answer. *Why that?* Perfectly affable, of course. *Just not in any way interested.* It's not for him. Why?

I didn't press the issue. But if I had, he would have trotted out all the appropriate reasons. *Expense.* That's easy. Anything is expensive when you don't really want it. *Too complicated. No room for it.* In that big place of his! *And anyhow, what's in it for me? A lot of extra fuss for nothing much but gadgetry.* That would be his attitude.

I see it differently. Quadraphonic, he has sensed all too quickly, might just be a bit *too much* for him. This he is not saying, but I get the drift. Even sight unseen and sound unheard, he is already aware of a certain something in this quadraphonic, a sort of threat. He is not stupid. He gets the all-important message.

He spends plenty of time listening. He wants his music right, of good quality, up to date, well reproduced, well played, and ready at his elbow. But it is only a *part* of his life. It must fit, elegantly. It must not be too pervasive; that would be disrupting. (It's his home after all.) This music must be around, but not too much around, if you see what I mean. And that's what he has, to perfection.

What I perceive, then, is a carefully hidden element of *fear*. He doesn't realize it, but I sense it. This quadraphonic thing might make the sort of demands on his lifestyle that he is not prepared to accept. Why should he?

Our problem is that he is instinctively right. This is indeed the very nature of the quadraphonic impact—haven't we been saying so right along? You can catch the idea easily enough just from the ads. **Surround Sound!** It grabs. It plasters you with

(Continued on next page)

The source of perfection in sound...tracks at one gram (or less) in stereo and discrete.

Frankly, perfection doesn't come easily.

Pickering's engineers pursued the idea of a totally new departure in cartridge design with all the zeal of true crusaders.

They had a reason . . . there was a demand for a pickup to play both stereo and discrete (as well as SQ and QS) with total and absolute precision at one gram.

That they succeeded is a remarkable achievement because this cartridge successfully tracks all types of records at forces even lighter than one gram. It is a real first to do it this accurately.

The Pickering's XUV/4500Q possesses excellent performance characteristics that provide outstanding frequency response and separation beyond 50 kHz. These improvements make possible the most faithful reproduction of the 30 kHz FM-modulated material on discrete records. It is noteworthy that Pickering's exclusive, new design development, which provides superior 4-channel discrete performance, also greatly enhances the reproduction of stereo records.

The XUV/4500Q features Pickering's patented Quadrahedral® stylus assembly. The Quadrahedral stylus assembly incorporates those features that produce extended *traceAbility*™ for 4-channel as well as stereo. This means that it possesses not only superior performance in low frequency tracking, but also in high frequency tracing ability. When combined with the exclusive Quadrahedron™ stylus tip, a brand new shape, it can truly be called: "the Source of perfection in Sound", whether the playback requirement is stereo, SQ, QS or discrete 4-channel.

The specifications are so exciting that we hope you will write to Pickering and Company, Inc., Dept. A 101 Sunnyside Blvd., Plainview, New York 11803 for further information.

PICKERING

"for those who can hear the difference"

Check No. 23 on Reader Service Card

sonic experience. It comes at you from everywhere on all sides, it lifts you right out of your living room (uh-uh), it plonks you right in the heart of the music (uh-uh). Correct. The four-way speaker array is, in fact, much more potent than any mere two-speaker stereo, over on one side of a room. It carries more information, *it demands more attention.* It removes more of the actual environment, plays down the listening room, builds up the music itself. Good. But our lawyer friend, before he has heard so much as a note of it, steers straight away. To a safer sound—stereo. Fine thing.

That message is getting to a great many people and in my mind, over and above ALL the other pressing reasons, this is *the* reason quadraphonic is still making a slow start. *This thing really might change our lives* (and we aren't too sure we like the idea). Fear of the unknown.

How We Listen

The change, again, is much more profound than mere equipment and furniture problems might indicate, though these make a fine excuse because they do exist. It's in our listening itself, our very habits of living. Long held habits, collectively built up over several lifetimes straight from Edison through the mono age and on safely into stereo—habits so finely tuned now and so extremely satisfactory at this late date that few people can contemplate any sort of fundamental listening change without feeling very uneasy.

I think that stereo for a short time posed a similar problem, back at the beginning, and ran into similar emotional resistance. It didn't last long. Mainly, stereo was just a physical nuisance, since it involved a then-drastic rearrangement of furniture, from the concept of a single point-source mono sound, to the idea of a whole wall, or a wide stretch thereof. I can remember how thoroughly I had to rebuild my own listening area and my whole concept of speaker placement, room reflections and so on, before I got the hang of stereo listening. So it was with most of us. But what we soon found, was that once our stereo was settled in place, we could settle back pretty much into our old listening habits.

Stereo brought extra sonic information, more realism. In mono, we had listened through a sort of "hole in the wall" (a favorite analogy, back then), from our listening room into another and bigger space in which the music played. (The virtues of recorded space were discovered long before stereo came along.) Stereo enlarged that hole to encompass an entire wall. You looked right through one end of your room, or out one whole side, into that other and bigger space, now made more immediate and real via the stereo interaction between the speakers. But the music, you understand, was still *out there,* beyond. You were still *in here,* on your side of the wall, listening from the safety and comfort of your own private quarters. You still are, in present stereo. It's a foolproof listening system. To be in two places at once! Marvelous idea. Isn't TV the same? And reading the morning paper at the breakfast table? This is so much a part of our existence that it amounts to a basic security. We need it. A good part of a century has gone into the development of its myriad details in all their subtlety. Let's not rock that living room couch too hastily.

Stereo, you see, went just far enough and not too far. It modified our lives mainly in pleasurable ways, without any great new demands. We became, in the end, relaxed and confident with it, at ease in our home listening. Stereo was, and is, a big success.

One might suppose that quadraphonic merely adds a bit more to the same easy, happy perception. Reasonable—but not so. We can manage the new furniture. What bothers is the crucial surround sound, the very basic and prime idea of quadraphonic, the configuration which launched it in the first place. It works. It breaks straight into the whole concept of living room listening which we have built up so carefully over these years. No more walls. No more you, in your living room, looking out, towards those other sonic places—that safe, private, and detached you, enjoying just as much as you want and no more. Now you are IN the music. It buffets you, it hits you. **Surround Sound.** Don't you see how the very ads we have used are bound to generate resistance, as well as sales? Fascinating, but also scary. Here are those four speakers, and there you are trapped, caught. Where is your fine living room now? Gone! The ads tell you so. The music engulfs you from every side. You aren't even there; you are in some new and (maybe) wonderful place. Ugh. Some people just want to sit down and relax. I can see how some might call it *claustrophonia.*

Of course, this is all figurative, not literal. The furniture stays put, the living room is still comfortable. (Though some people wrongly think you'll need swivel chairs, preferably motorized.) You can hear the new back speakers without even craning your neck; they behave very nicely. You're really OK! You're out free. You can go ahead, just as usual.

And yet you can't. There is a difference and you will not be able to avoid it. The difference will grow on you, inevitably, without fail, and you will indeed have to adjust your life style to some degree. You will listen harder. You have to. You won't be able to help it. Slowly but surely, in the end, you will have to adjust. It may be a bit trying, but in the end, it will be very rewarding.

Stick with stereo, though, and you'll have no problems. A lot of people *are* sticking with stereo. Which shows an awareness, I think, that has not yet come to our manufacturers. People in general are surprisingly quick to catch on when their close interests are involved.

So, problems or no, quadraphonic sound is the best thing that has ever hit home listening. I say that as a teacher, not a salesman. I say it because, for the first time since Edison, our sound can now take our listening back towards where it began—live music and *active* involvement. The live concert, as you know, if you go, demands a kind of attention that we simply have not been prepared to give to our home listening. No noise, no wiggles, and if you so much as rustle a program you get stared at. Living music, in the act of being made, on the spot, in real time. It is *there*—and so are you—a marvelous conjunction. If you are knowledgeable, if you know how, you can be entirely rewarded for that sort of concentration because live music has a formidable audio-visual punch.

Now we have an electronic medium, at last, with a similarly potent punch—not merely volume, but information power. It is NOT the same as a live performance. But it has *comparable potency,* and this for the first time. If that power is there, then people will find out how to use it. Sooner or later they will come around. A new impact at home, and new ways of ordering lives to fit. That will take adjustment. Which is exactly what people now understand.

Sextaphonic, octaphonic, room-aphonic. Once this new medium gets going, we'll never be the same again. So have patience! We have to get the lumbering, discrophic, quadraphonic goose into the air, first of all. We should lay off all that **Grab-You-Surround-You** propaganda. It scares. Lay on some soothing syrup. It's not going to be as bad as you think, folks. Might even be **Fun.**

"Transistor sound?" Our new power amplifier is too fast for it.

Reducing harmonic distortion in most amplifiers requires a great deal of negative feedback. Which means a lot of voltage gain is needed—and a lot of voltage gain stages.

As a result, an electrical signal takes so long to be fed back within most amplifiers that you end up with transient intermodulation distortion (or "TIM") and "transistor sound"—an acoustical signal with a harsh edge to it.

Our revolutionary new Model CM912, however, requires relatively little feedback—and only two voltage gain stages instead of the customary five or seven. So the electrical signal travels a lot faster, the TIM is virtually eliminated and the resulting sound is remarkably smooth, natural and un-transistorish.

As specialists in components for the professional and for the serious audiophile, we knew we could do away with transistor sound by combining skilful design with the use of top-quality components—because better components mean we don't have to compensate by using as many of them. And this, in turn, reduces the amount of feedback we need.

NAME-BRAND COMPONENTS THROUGHOUT

So we specified high-speed Motorola transistors in a fully complementary common-emitter arrangement, Allen-Bradley low-noise resistors, General Electric 24,000-μF power supply capacitors and oversized extruded aluminum heat sinks for maximum heat dissipation. We also insisted on glass epoxy printed circuit boards.

Our determination to make our dual-channel power amplifier a quality unit didn't stop there either. We've incorporated such unusual features as high-accuracy power meters, positive-latching speaker relays, a thermostatically controlled cooling system and fully modular construction as well.

If your dealer doesn't yet carry the CM912, just drop a line to C/M Laboratories, 327 Connecticut Avenue, Norwalk, Connecticut 06854. We'll not only mail you additional information, but, if you wish, we'll arrange a demonstration for you at a dealer in your area. (No obligation, of course.)

Hear the CM912—and move ahead to the sound of the future...fast!

KEY SPECIFICATIONS

POWER OUTPUT: 225 watts RMS per channel into 4Ω, 150 watts RMS into 8Ω, with less than 0.2% total harmonic distortion, both channels driven, at any frequency from 20 to 20,000 Hz.

IM DISTORTION: Less than 0.1% up to rated power.

FREQUENCY RESPONSE: ±0.1 db from 20 to 20,000 Hz. ± 0.25 db at 12 watts from 5 Hz to 130 kHz.

OVERLOAD RESPONSE: Recovery from clipping less than 2 μ sec.

DAMPING FACTOR: Better than 50 at 8Ω, 20 to 20,000 Hz.

HUM AND NOISE: 100 db below 200 watts RMS.

STABILITY: Will drive any load up to 6μF at full power from 20 to 20,000 Hz.

CIRCUITRY: Fully differential input, fully complementary common-emitter output.

SPEAKER PROTECTION: Relay type.

C/M LABORATORIES
EXCEPTIONAL COMPONENTS FOR THE EXCEPTIONAL EAR.

Check No. 11 on Reader Service Card

Basics Of Turntables

David L. Josephson

RECENTLY AN AD for a major manufacturer of turntables appeared in this magazine, showing an LP record supported on a hand-held pencil; in the other hand was a phonograph cartridge. The ad was headlined, "This is all we want to do. But perfectly." That sums up the whole turntable game in one phrase. All of the arguments for the various types of motors, drive systems, and tone arm types are all toward one end . . . spinning a record at a constant, specified speed with no vibration in any plane, and holding a phono cartridge exactly tangent to the record grooves, with just the right amount of downward pressure, and no other pressures or forces. If a turntable could do all those things, it would be the be-all and end-all of all turntables, and the arguments would end there. But as it is now, there are as many different kinds of turntables as there are of any other stereo component (excepting speakers—*Editor*), and no one can *clearly* be called best.

This article will attempt to clear up some of the confusion and mystery surrounding these record-playing devices, and should help you make your next turntable purchase with a little more insight into what is needed to do that spinning bit mentioned above.

Perhaps the first criterion for judging turntable quality is speed accuracy. The two standard speeds today are 33 1/3 and 45 rpm; 16⅔ and 78.26 rpm however are sometimes encountered. A good turntable should be able to hold its set speed within 0.5% (at worst) over extended periods of time. The accuracy of nearly all types of turntable motors depends directly or indirectly on the frequency accuracy of the incoming power line to keep the table at a precise speed. Power line frequency is almost always accurate to within about 0.04%, so the speed of the turntable can be no more accurate than that.

An equally important turntable standard concerns more rapid changes in speed—wow and flutter. These are periodic variations in the speed of the turntable, producing a wavering sound. *Flutter* is defined as a fast variation in record speed; usually on the order of 10 cycles per second or more (not Hz, because it is a cyclic variation and not an a.c. signal). It is usually caused by mechanical irregularities in the motor itself (bumps on the drive shaft or magnetic problems in the motor) or in the drive mechanism (pulleys, idlers). *Wow*, also known as once-around flutter, is a variation which occurs only once for each revolution of the turntable. The most common cause of this is a warped record. When the stylus is tracking the bumpy (and therefore stretched and/or compressed) record surface, the surface speed changes and thus the pitch of the reproduced sound changes. Wow can also be caused by variations in the turntable platter; whichever part of it is driven by the motor. A motor defect in a direct-drive turntable would be more likely to cause wow than flutter. In any case, the total wow and flutter, periodic variations in speed of any type, can be kept below 0.2% in a well designed turntable. Flutter and wow are especially bothersome in solo piano, flute, and guitar recordings . . . flutter above 0.3% can be easily detected when listening to such music, and it rapidly becomes very annoying.

Rumble

Any periodic extraneous mechanical noise added by the turntable to the program material is called *rumble*. Rumble is usually caused by poor isolation of the motor from the rest of the turntable, the platter and arm in particular. Rumble is usually worst in a rim-drive turntable, since the platter is driven directly from the shaft of the high-speed motor through a relatively stiff rubber idler wheel. In belt-drive turntables, rumble is usually considerably reduced (for a given motor and speed) because more of the vibration is damped out in the stretchy rubber belt. Rumble is also directly related to motor speed . . . the lower the motor speed, the lower will be the frequency of the rumble, and therefore the less objectionable (theoretically). The rumble frequency of the usual 1800-rpm, 4-pole induction motor is around 30 Hz, and most cartridges and amplifiers, and many speakers reproduce down to 30 Hz . . . rumble of this frequency and higher is especially bothersome. The theoretical minimum-rumble motor would be one operating at the record speed itself . . . a direct drive machine. Nearly all of the rumble in this type of motor would come not from the motor itself, but from friction and vibration in the various motor and platter bearings.

Rumble is measured in much the same way hum and noise is measured in purely electronic equipment. A standard 1-kHz tone recorded at a specified lateral groove velocity is played, and a notch filter takes out the 1-kHz tone; everything else is measured as rumble. It is expressed in decibels (dB) below the reference tone level. Most rumble measurements are made through a "weighting" filter which accentuates the higher frequency components (above 20 Hz) so that as the frequency of the rumble increases up to about 500 Hz, the indication of rumble level also increases. This system is fine except for the subsonic

rumble which may be present in the turntable. We will discuss this later. The long-established National Association of Broadcasters standard for rumble in reproducing turntables is (for stereo) that the low-frequency rumble shall be 35 dB or more below a 100 Hz tone cut at 1 cm/sec peak velocity in either plane. High frequency rumble is to be at least 50 dB below 100 Hz, at a peak velocity of 5 cm/sec. These are not up to the performance standards of today's turntables and can be plainly audible. Any turntable aspiring to the high-fidelity market should have rumble down at least 45 dB, and the better units exhibit rumble down 60 dB or more. Many turntable manufacturers are switching to the DIN B method of measurement or the similar Japanese standard; both are somewhat similar to the NAB technique but are more stringent.

Poor design in under-deck components of a turntable can cause problems with *hum*. Inductive fields from the motor can induce hum in an unshielded cartridge or in the leads from the cartridge to the turntable output jacks, which are often unshielded for increased flexibility. The rumble figure for a given turntable almost always includes the hum and noise in the output as well as rumble from mechanical sources.

Two Basic Design Choices

Now that we have examined the various criteria and measurement standards by which turntables are judged, we can more easily understand the methods various manufacturers have used over the years to achieve these standards. There are two: The method used for transferring the power from the motor to the turntable platter, and the type of motor used.

The simplest turntable motor, found in kiddie record players of the $29.95 variety as well as in a number of high-priced stereophile models, is the 1800-rpm, 4-pole induction or "squirrel-cage" motor. The 60-Hz line current is applied to the four field windings which form "poles" in such a manner that a rotating magnetic field is produced. In a 4-pole motor, this field spins at 1800 rpm. For a *n*-pole motor, the rotating field speed ("synchronous" speed) is found by using the equation:

$$\frac{(\text{power line frequency})^2}{n/2} = \text{synch speed (rpm)}$$

The rotating part in the middle of the motor, called the *rotor* or the *armature*, catches and is spun by the rotating field. Because of the losses in the air, and in the rotor itself, it never reaches full synchronous speed, but rather a speed about 3% lower. This loss in speed is called "slip." The induction motor is about equally sensitive to variations in power line frequency and to voltage. If the frequency changes, the speed of the rotating field will change, and if the voltage changes, the amount of slip will change. Further, since it is not a constant-speed device, it will also change speed with variations in load (the amount of work it's required to do). Induction motors can be made very cheaply and are fairly stable in speed if the load, power line frequency, and voltage remain stable. They also produce a higher amount of torque for a given motor size (and cost), and thus are used to run all sorts of mechanical contraptions, not to mention record players.

The first *constant speed* motor for turntables was the *hysteresis synchronous* motor. In this type, the rotor's internal magnetic structure is changed so that the slip is reduced nearly to zero. This makes the synchronous motor dependent almost entirely on the accuracy of the incoming power line frequency for its speed stability. Since in the U.S. this is usually 0.04% or better, it is a reasonable standard upon which to hang something. The line voltage can vary as much as 10% before the slip in a synchronous motor will change enough to change its speed. Synchronous motors can be made constant in speed within about 0.1% for a given power line accuracy. The speed of a synchronous motor may be computed using the same formula as for the squirrel-cage motor. Thus we find that a direct-drive synchronous motor needs 216 poles to operate on 60 Hz line current. Incidentally, a synchronous motor going that slowly, and supplying enough torque to drive a 12-in. turntable would have to be about a foot in diameter.

At least one company has combined the virtues and liabilities of the two motors described so far into one unit. Garrard has used this type of motor for many years under the trade name Synchro-Lab. This motor has better speed regulation than a standard induction motor, and greater torque for a given size than a standard synchronous motor of similar size.

So far we have been dealing with motors operating directly from the power line, and dependent on the power line voltage or frequency for their accuracy. The power line is often, at any given moment, at a quite different voltage from a moment previous, although in the U.S. the *frequency* accuracy is very good. It is possible to sample the actual speed of the turntable and compare it with a frequency standard generated within the turntable, and adjust the speed of the motor so that the two correspond. This general system, whether it uses an a.c. motor or a d.c. motor, is called *servo-control*. In the a.c. system a synchronous motor is fed the output of an amplified oscillator. The speed of the turntable is sensed and compared with the separate oscillator, and the frequency of the motor-driving oscillator is adjusted to stay in step. This eliminates speed fluctuations caused either by power line variations (within reasonable limits) or by mechanical changes in the motor drive parts.

It depends only on the accuracy of the standard oscillator and the response time of the servo-control. In a d.c. servo system, the speed variations are compared with the standard oscillator, and the difference is converted into a change in the d.c. power going to the motor.

Standard d.c. motors use a commutator and brushes to mechanically switch the polarity of the magnetic fields in the armature. In motors required to have stable speed, this causes a problem in that the rotating field is not a continuously moving force, but rather a series of repeated impulses. Problems also arise when the commutator and the brushes wear to the point where they arc every time the brushes pass a particular part of the armature. Most d.c.-operated motors used in high fidelity equipment are not really d.c. motors at all. Most are either synchronous motors driven by d.c.-powered oscillators, or else use electronic means to switch the power going to the various coils instead of brushes and a commutator. A series of coils around the circumference of the motor case is fed a signal genera-

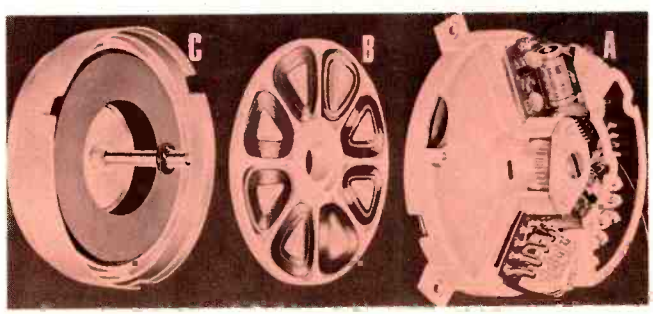


Fig. 1—Exploded view of a servo-controlled d.c.-powered motor (Dual 701 turntable) Right (A) house servo circuitry, middle (B) is a field coil assembly, left (C) is rotor, atop which goes platter.

ted by the servo-control circuitry. This produces the same rotating field used in synchronous and induction motors. In order to keep the output speed constant, the speed of the motor is sensed, either by photoelectric means or through another series of coils and magnets which generate an a.c. signal proportional to the motor speed as the motor turns. This is then fed back to the oscillator in an inverse feedback loop to keep the motor speed constant. It is possible to achieve very high stability in a motor of this kind, as shown by wow and flutter figures for these turntables being typically less than 0.1%.

Several interesting developments have been made in motor design, one of which is the "inside out" synchronous motor. This uses the same principle as a standard synchronous motor except that the field coils are on the inside of the motor and the armature (rotor) spins around them. This permits the rotor to be bigger for a given field coil size providing greater flywheel effect, hence less flutter.

Once the motor has gotten up to the right speed its power must be transferred to the turntable platter, to turn the record. There are three different ways to effect this transfer: *idler-rim* drive, *belt* drive and *direct* drive. Each method has advantages as well as disadvantages. You can best decide which system is appropriate for you when you know how each works.

Idler-Rim Drive

Idler-rim drive, the most common type, uses a relatively high-speed motor. This can be either an a.c. line-operated unit, or a servo-controlled motor. The motor has a stepground shaft, with various diameters corresponding to different speeds. When the turntable is turned on, a small rubber wheel (called an idler, puck, or tire) is engaged between the motor shaft (at the proper diameter for the desired speed) and some drivable surface of the platter. The turntable turns in the same direction as the motor shaft, at a speed dependent on the motor speed and the ratio between the motor shaft diameter and the diameter of the driven part. For higher speeds, the motor shaft diameter is larger, while the rotating speed of the motor remains unchanged. Flutter can be reduced to a very low level if the coefficient of friction between the motor shaft and the idler, and that between the idler and the platter drive surface is made high enough . . . in other words, if the rubber is good and live. Very little torque is lost in this type of drive system, so record changing mechanisms operated from the platter instead of directly from the motor itself still get plenty of power to operate. Another advantage is that speeds can be changed easily, just by shifting the position of the idler vertically so that it contacts different diameters of the motor shaft. Because of their high torque capability, rim-drive turntables also start quickly, making them useful in broadcast applications where instant cuing is required.

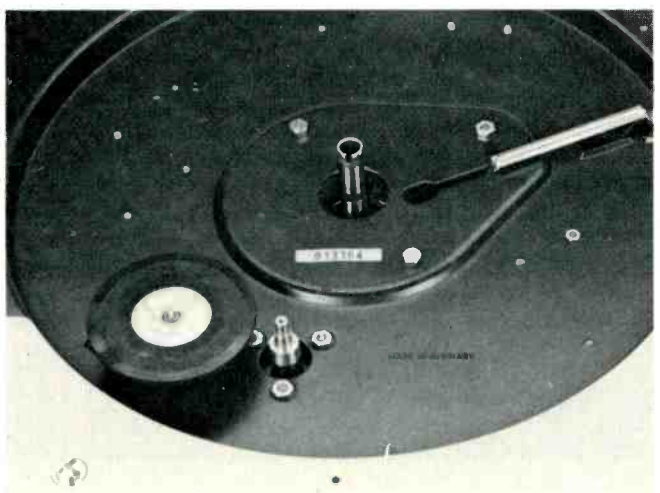


Fig. 2—Dual 1219 uses typical idler-rim drive. Note stepped motor shaft at right of the idler which contacts both the shaft and the inside of the platter when installed.

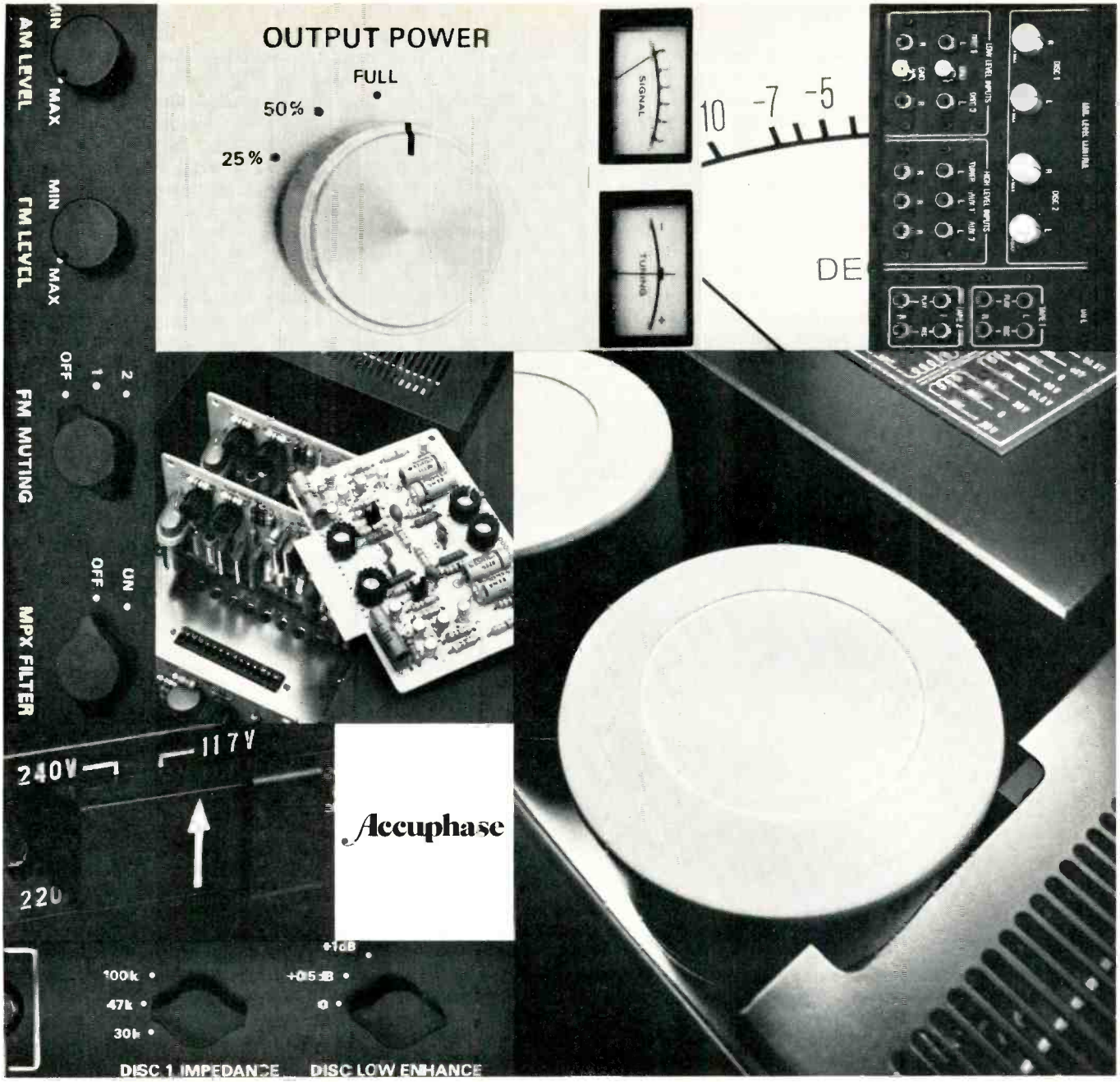
The main problem with the idler-rim drive system is rumble. First of all, the motor must run at a relatively fast speed in order to drive the turntable at a proper speed through the reduction of the idler. This makes the rumble frequency higher to begin with than it would be with a slow speed motor, and therefore more objectionable. Second, the motor is connected directly to the platter by means of the solid idler. Thus any vibration in the motor is transmitted to the platter and comes out as rumble, even if the motor is totally isolated from the turntable in its mounting. If the idler is made too spongy, to eliminate the rumble transmission, it gets slippery. Make it stiffer, to transmit more torque, and you're back to lots of rumble. With proper design of the motor, support fixtures and drive mechanisms, the rumble of rim drive turntables can be reduced to an acceptable level. One interesting approach to the rumble problem inherent in idler-rim drive turntables is used by only one manufacturer, the Swiss Lenco Company. Instead of a vertical motor shaft and horizontal idler, the motor is suspended horizontally by springs, and the idler wheel engages between the motor shaft and the *underside* of the platter. This seems to make the rumble mostly vertical, rather than lateral or radial, so that the standard stereo reproducing cartridge does not pick up as much noise as with conventional idler-drive systems.

Belt Drive

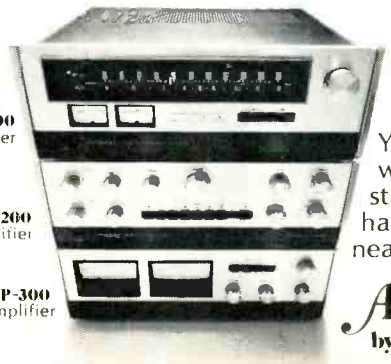
The first commercially built turntables which merited the phrase "high fidelity" were belt-driven ones from Components Corp. during the mid-Fifties. Interestingly, Emile Berliner, who developed the flat phonograph disc, also used belt drive. With this drive system, the motor has a pulley on the end of its shaft that drives a flexible rubber belt. The motor can be outside the platter and the belt around the platter's outer circumference, or it can be inside, as with a rim-drive turntable, driving an inner pulley machined into the platter. Motors and speeds used are often similar to those in rim-drive turntables, as the ratio of motor diameters to drive-surface diameters is similar. Nearly all of the rumble in the motor shaft is damped out by the elasticity of the belt. Once the motor and platter get up to speed, flutter and wow are reduced to very low levels. The main problems with belt drive are functions of the belt itself. Quite a bit of torque is lost in stretching the belt while bringing the relatively massive platter up to speed; thus belt-drive turntables usually take at least a full revolution to get up to the playing speed at 33⅓ rpm. Further, this torque loss limits the use of complex record-changing devices which use the main turntable motor for power. Another problem with belt drive is the difficulty in changing speeds. You either have to electrically switch the speeds of the motor, which requires a d.c. or oscillator-driven a.c. motor (because the speed ratios commonly available in ordinary a.c. motors do not correspond to the ratios of record-playing speeds), or else mechanically change the belt from one section of the driving pulley to another.

Direct Drive

Perhaps the most promising new type of turntable design for home use is direct drive. With this system, the power from the motor does not pass through any speed-reducing



If the whole is greater than the sum of its parts, imagine what happens when each part is greater than it has to be.



T-100
AM/FM Stereo Tuner

C-200
Stereo Preamplifier

P-300
Stereo Power Amplifier

Your Accuphase retailer will be happy to demonstrate exactly what happens. To find the one nearest you, write us.

Accuphase by TEAC

TEAC Corporation of America, 7733 Telegraph Road, Montebello, California 90640.

weight (½ to 1½ grams), while others will not stay in the groove accurately ("track") at less than 3 grams. In most cases the cartridge weighs considerably more than the recommended tracking force, so the arm, by means of a spring or counterweight, balances this out except for the recommended tracking force.

Tangent error is that error in the angle of the cartridge with respect to exact tangency with the circumference of the record. When this error is too great, the edges of the stylus can grind off the delicate ridges of the record grooves, making the sound permanently muddy. Smaller amounts of tangent error will simply cause distorted reproduction. For a conventional tone arm, tangency only occurs at one point along the arm's arc across the record. However, there have been two methods developed to reduce this error to near zero, and these are described later on.

The bearings in the pivot of the tone arm are quite important, since their design (and condition) determine how much force the stylus must exert on the outside groove edge in order to stay in the groove. Kiddie record players and inexpensive changers use very simple sleeve bearings, which require quite a bit of force to move compared to the ball, point, knife, and magnetic bearings used in the better manual turntables and separate arms.

One final consideration is arm resonance. This is the frequency or frequencies at which the arm will vibrate to some extent when the stylus comes across a note of this frequency on the record. This can cause strange peaks or dips in the frequency response of the system near the resonant frequency. Really bad effects can occur if the rumble frequency of the turntable motor is at or near the arm resonant frequency. The rumble would be magnified many times and could cause severe intermodulation distortion of the audio. Several means have been used to lower the resonant frequency of arms below the audio range. The arm can be a metal tube, filled with a wood dowel or fiberglass wool, or the entire arm can be made of wood, or duraluminum, which is substantially less likely to resonate than other metals.

Minimizing Tangent Error

Four types of tone arm designs have been used over the years, none of them completely ideal. The main difference between them has been in their approach to the problem of tangent error.

The straight arm with the cartridge mounted at an angle on the end has the largest tangent error. Straight arms are inexpensive to make, and with proper selection of the angle at which the arm pivot and cartridge shell are mounted, they can be perfectly adequate for many listening purposes.

One obvious and simple solution to the tangency error of a straight arm is simply to make the arm longer and bend it into an "S" shape. One can in this way significantly decrease the tangent error without resorting to an arm which is longer overall.

The first approach to the absolute solution of the tangent error problem was the *straight-line* pickup arm, and it wasn't really a new approach for the disc process at all. All professional recording lathes use this design to drive the cutter head across the surface of the disc by a spiraling leadscrew. The straight-line reproducing arm can be of two types. The first is free to move across the surface of the record, being suspended on one or more metal rails. This presents the obvious problem of friction. The other straight-line reproducing arm design uses a servo motor to drive the cartridge across the record. The straight-line arm was first introduced in the fifties under the name Ortho-Sonic. Since then a number of companies, including Rabco and Marantz, have made arms using this technique.

Finally, the *pantograph* arm presents an entirely different solution to the tangent error problem. In this type of arm, also introduced in the 50s, some part of the arm is constructed so that the angle of the cartridge head is continuously varied with respect to the tangent of the record circumference. In the original Ortho-Vox arm, the entire arm would change angle as it progressed across the surface of the record. In the more recent Garrard design, the cartridge head is pivoted, one corner being connected by a rod parallel to the main arm to a series of levers and cams at the main arm pivot. This continuously changes the tangent angle of the cartridge shell with respect to the record.

Both straight-line and pantograph designs reduce the tangent error to a point where it ceases to be a factor. It can't ever be exactly zero, but either design effectively eliminates the problem.

It has been argued that the infintesimal betterments of sound quality achieved with these various rumble-reducing and tangent-error-reducing systems are for naught; that the average commercial record quality does not even approach that of the finer home audio systems. This is true; the average commercial record quality is pretty poor *compared to the best*. But the aim of audiophiles is to extract every bit of realism possible. Thus every little bit of garbage one can remove from the signal helps, even with the worst commercial records. And, of course, you can only derive the fullest enjoyment from the *best* recordings when you have a system that will allow every bit of the recorded sound to get out of the record and into your ears.

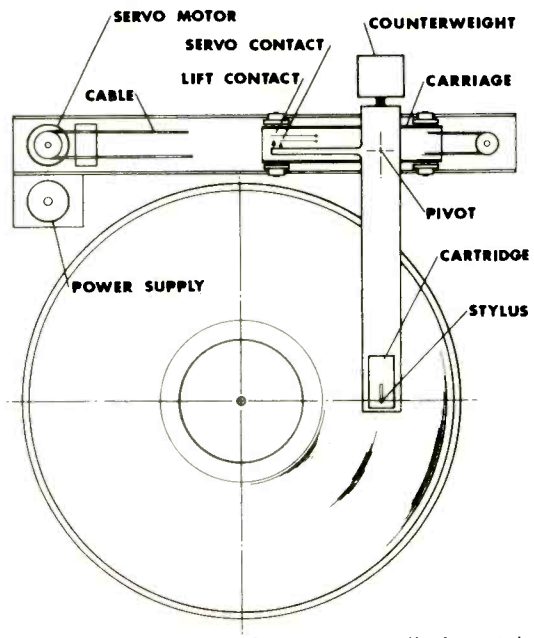


Fig. 6—Simplified drawing of servo-controlled straight line arm, Rabco SL-8.

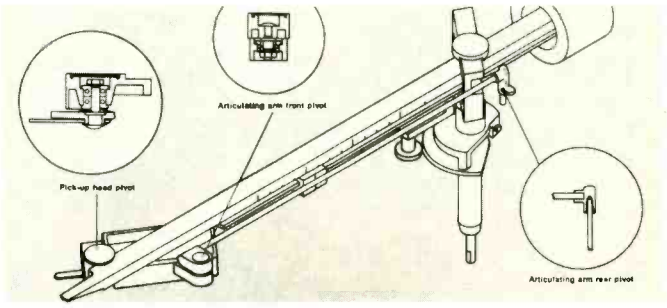
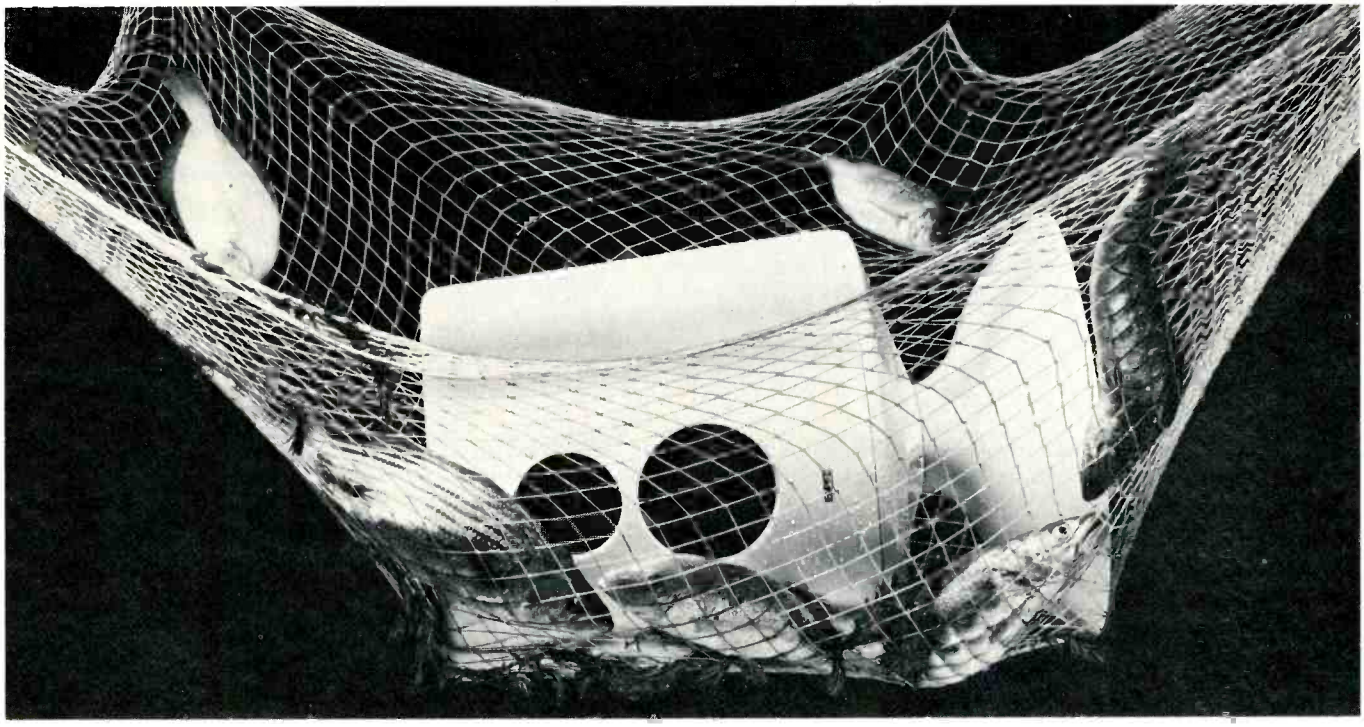


Fig. 7—Pantograph action of articulated arm developed by Garrard.

A weatherproof 3-way system makes Empire's Jupiter 6500 more than just another fish in a sea of speakers.



It's quite a catch!

It's not easy deciding on a system in today's ocean of speaker models.

Comparing, listening, wading through all the technical specs, trying to catch the most for your money.

So we've netted an easy choice.

The Jupiter 6500.

It provides features you would only expect to land in more expensive speakers.

A complete 3-way system with: 12-inch woofer, mid-range radiator and ultrasonic tweeter — powerful enough to reel in over 90 watts RMS.

Empire's automatic, resetting circuit breaker to prevent overload and burn out.

Individual testing of each driver and a complete system check after assembly.

Then there are features you wouldn't expect to find in any speaker.

A durable, marproof enclosure that's totally damped so there are no vibrations.

Completely weatherproofed drivers and cabinet so you can enjoy your system, indoors or out, all year round.

Contemporary styling to fit any decor with 4 luring colors to choose from: Gloss White, Sun Yellow, Bittersweet and Flemish Blue.

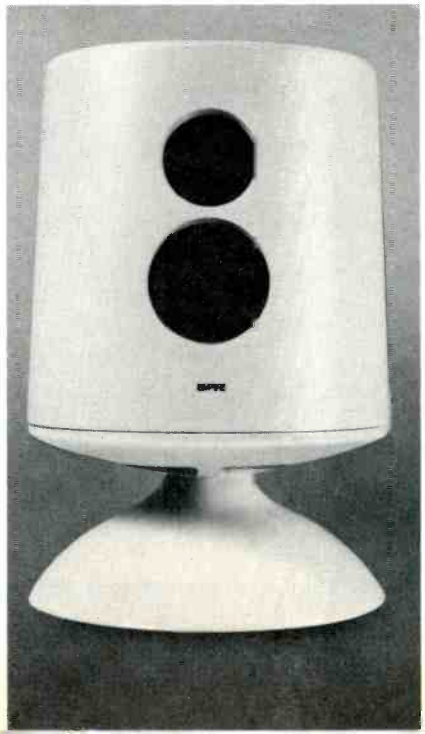
With all the care Empire puts into every Jupiter 6500, you won't want to let this one get away.

Write for your free Empire catalogue:

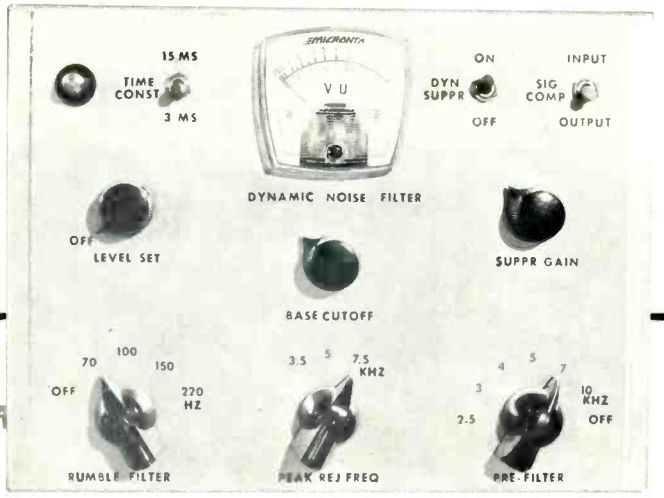
Empire Scientific Corp.
Garden City, N.Y. 11530
Mfd. U.S.A.

EMPIRE

MEMBER IHF INSTITUTE OF HIGH FIDELITY



Check No. 12 on Reader Service Card



Construct

Maxwell G. Strange

THE SERIOUS collector of older recordings faces the challenge of getting the best possible sound from imperfect originals. Most of these records are quite noisy by today's standards. For example, 78 rpm commercial discs, even though in mint condition, will have a typical signal-to-noise ratio of only 30 to 35 dB due to the somewhat abrasive nature of the record material.

Most collectors dub their best records onto tape. This way they may be played as often as desired—and conveniently shared with other collectors—while the often irreplaceable originals are safely preserved. Also, the sound can often be improved considerably during the copying process through equalization and filtering. I'm going to describe a flexible, low-cost noise filter designed for taping records with a maximum "fidelity-to-noise" ratio. It can be duplicated by the serious electronics hobbyist for about $60, or slightly less if certain features or ranges won't be needed. Although not recommended as a beginner's project, the experimenter with some circuit experience should have no difficulty. Minimum equipment requirements are an oscilloscope, sine wave generator, and multimeter.

The heart of this circuit is a dynamic noise suppressor with frequency characteristics and convenience features which are optimized for its intended use. The concept of dynamic noise suppression has existed for many years. Workable circuits were designed by H.H. Scott in 1946, and their performance was improved by Scott and others in 1947 and 1948. Then, with the advent of the vinyl microgroove record and the rapidly increasing use of tape, both of which offered a considerable noise improvement over the 78 rpm system, the dynamic noise suppressor was almost forgotten. Recently, R. Burwen has revived this principle and applied it primarily to tape playback. Taking full advantage of modern integrated circuits, Burwen has designed highly sophisticated and flexible systems with impressive specifications. These, however, are too expensive for many hobbyists and do not have frequency characteristics optimized specifically for old, intrinsically band-limited material.

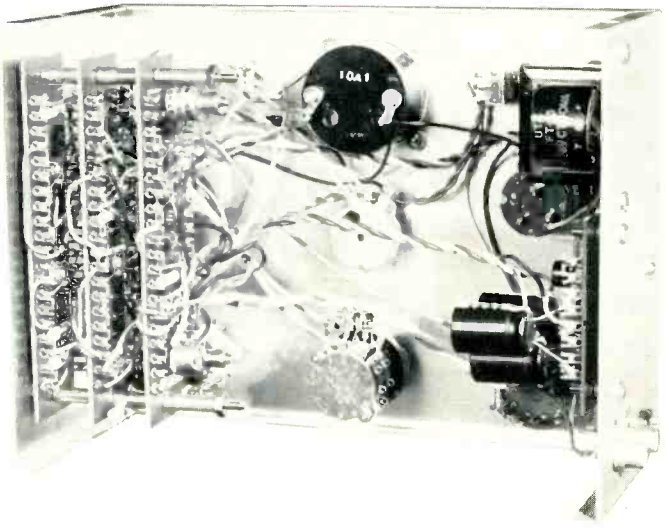


Fig. 1—Interior of the dynamic filter.

Theory

Dynamic noise suppression is simple in concept. Record surface noise varies in spectral content, but the higher frequencies (above 1 or 2 kHz) predominate. Low-pass filtering is commonly used to limit noise. But unless used sparingly, this type of filtering band-limits the program material, making it sound muffled and lifeless. The dynamic filter, however, provides a method by which a signal can be effectively extracted from the noise (at least subjectively) when signal and noise occupy overlapping frequency ranges.

Operation of the dynamic noise suppressor depends upon a characteristic of the human auditory apparatus. If two signals occupying well-separated frequency ranges are present simultaneously, they are clearly perceived as individual entities. (This effect is often used to advantage in public address systems for noisy environments. If considerable high-frequency boost is used, voice announcements will seem to cut through ambient noise of predominately lower frequency without having to be excessively loud.) This is the case, at least for a large portion of the time, for a typical recorded signal with attendant surface noise; hence, the annoyance of the noise. However, if two simultaneous signals occupy substantially the *same* frequency ranges, the ear will tend to hear only the louder signal and ignore the weaker one. A level difference of only a few dB is sufficient for one signal to effectively override, or mask, the other. Operation of the dynamic noise suppressor depends upon this masking effect.

The dynamic filter has a fairly steep low-pass character-

A Dynamic Noise Filter

istic which, in the absence of signal, starts cutting off at about 1 kHz. This very effectively rejects the noise spectrum. When a signal having high-frequency components at sufficient amplitude comes along, the filter is made to "open up"; that is, its cutoff frequency is quickly raised. As the high-frequency program content drops in frequency and/or amplitude, bandwidth contracts. The idea is that when high-frequency signal components are present, they will tend to mask the accompanying noise. When highs are not present, the wide bandwidth is not needed. Admittedly, the recovered signal is not as faithful as a noise-free original would be. For example, high-frequency content in low-level passages may be lost. Of some help here is the fact that many musical instruments tend to have less harmonic content at low acoustic levels. In spite of this compromise, the processed signal is usually far more pleasing to the ear than the noisy input signal.

The bandwidth control signal is derived by separating the high-frequency program components from the signal-plus-noise. Unless the signal level is consistently higher than the noise to begin with, this becomes impossible. Thus, there is a minimum signal-to-noise requirement below which no improvement is possible. As the original S/N improves, the dynamic suppressor's performance improves also.

Ideally, the signal frequency range to which bandwidth is most sensitive should correspond to the frequency range of maximum noise. The optimum filter characteristic for separating the bandwidth-control signal from the noisy input thus varies widely with the characteristics of the noise with which we are dealing. Bandwidth control sensitivity (or gain) must be set properly for the incoming signal level and noise properties. Bandwidth should respond rapidly to signal changes to avoid loss of transients and to prevent audible "swishing" sounds which can be produced by delayed bandwidth contraction.

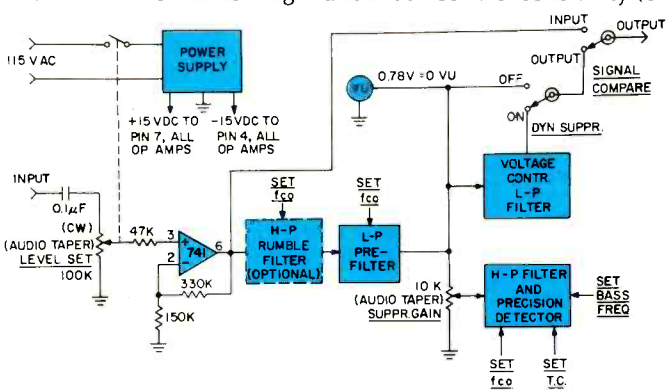


Fig. 2—Block diagram of system.

Design Approach

I have tried to implement the basic requirements outlined above as completely as possible in an easy-to-use, low-cost unit. A dynamic high-pass filter stage was considered but later dropped, as high-frequency noise predominates on most older records. It is my experience that low-frequency noise can usually be handled adequately with a simple manually-set rumble filter.

Figure 2 shows an overall block diagram of the noise filter. Operational amplifier A1 is connected as a non-inverting amplifier with a voltage gain of 3.2 (10 dB), enabling the system to be driven to 0 VU with an input level of 0.25 volt. This amplifier also serves as a buffer, providing an input impedance of 100 kilohms for compatibility with virtually any signal source.

Amplifier A1 drives the *rumble filter*, which could be

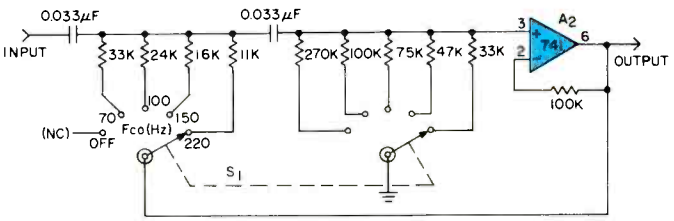


Fig. 3—Optional high-pass rumble filter schematic.

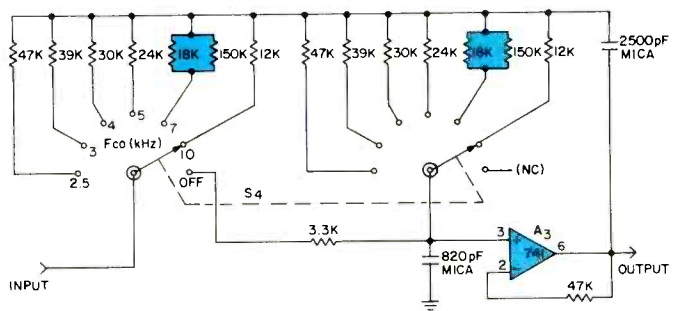


Fig. 4—Schematic of the low-pass pre-filter.

omitted if one is available in the associated external equipment. Following this is the *pre-filter*, which is simply a low-pass filter with a manually-set cutoff. This filter is important for several reasons. First, it removes noise which is above the frequency range of the recorded signal. Many recordings have no signal content above 4 or 5 kHz (even lower for acoustic records), and no program content is lost by cutting off the upper range. Thus, the total noise voltage is lowered, often appreciably, permitting the use of higher suppression gain settings as will be seen later. Another reason for this filter is that the dynamic filter can do nothing to reduce the annoyance of high-frequency distortion. Furthermore, since a limited-bandwidth signal cannot effectively mask higher-frequency noise, removal of the latter helps to eliminate audible evidence of the continually changing bandwidth.

From the pre-filter output the signal passes to the *voltage-controlled l-p filter* and, via the *suppression gain* control, to the *h-p filter/precision detector* whose function is to derive the bandwidth control signal. This point additionally goes to a switch which permits the dynamic filter to be bypassed at will so that its effect with various control settings may be easily judged. Another switch permits the output to be compared with the "raw" input signal.

All of the filters used in this system, including the voltage-controlled filter, are of the 2-pole active type, giving a 12 dB/octave rolloff slope. The damping factor is chosen (with one exception) for a Butterworth response, which produces the steepest possible slope beyond cutoff with no peaking in the passband. (High-pass filters with 3-dB peaking were tried, but these produced a slightly rough, "grainy" sound compared to the flat-passband version.) The design approaches are widely published and need no further discussion here. The rumble filter (Fig. 3) and the pre-filter (Fig. 4) are of this type; their response curves are shown in Fig. 5. The rumble filter is not essential to proper suppressor operation, but is convenient in case an effective low-cut filter is not included with the associated preamplifier in the copying setup. The design shown here has rather high settings intended primarily for acoustic records.

The bandwidth control signal is derived with the circuit of Fig. 6, which consists of a high-pass filter followed by a precision detector. The filter damping factor is made low in order to produce a pronounced peak and more rapid low-frequency rolloff (Fig. 7). Three selectable cutoffs produce peaks at 3.5, 5, and 7.5 kHz; these were empirically determined to best accommodate a wide range of noise characteristics and recorded bandwidths. The filter output is coupled to the detector via a small capacitor to make the low-frequency rolloff even steeper below 1.6 kHz. The precision full-wave detector uses diodes in the feedback circuit of an op-amp to effectively produce ideal rectification characteristics down to the millivolt region. The output amplifier doubles as a post-detection filter. Resistor R determines the gain, and capacitor C makes this stage behave as an operational integrator with time constant RC. A switch is provided for increasing the time constant by paralleling capacitor C1; this is helpful with sources having sharp impulse noise. The output of the detector/filter circuit controls the bandwidth of the dynamic suppression filter according to the curve of Fig. 9.

Early experiments showed that it is undesirable to make the no-signal cutoff lower than absolutely necessary to substantially reduce noise with a particular signal source. When the cutoff is made lower than actually needed, weak signals are unnecessarily band-limited and the dynamic filter produces such a level-dependent bandwidth contrast that its action is much more likely to be audible. Hence a BASE CUTOFF (not "BASS CUTOFF") control was found to be desirable. This control is simply a pot which offsets the detector output at zero signal level by applying a variable reference voltage to the op amp non-inverting inputs. This voltage, variable from about −1 volt to −6 volts, establishes a "starting point" or base cutoff frequency which can be set just low enough to virtually eliminate no-signal noise.

The variable-cutoff filter, Fig. 8, is the very heart of the system. Since there is some part selection and adjustment necessary, it must be checked out separately. The basic configuration is similar to that of the pre-filter, except the latter's switch-selected resistors have been replaced by field-effect transistors (FETs). FET channel resistance R_{DS} changes as a function of gate voltage V_{GS} as shown in Fig. 11, thus varying cutoff frequency. A resistor across each FET establishes a solid lower cutoff limit and smooths the control characteristic as the FETs approach their "off" state. The gate circuit network, consisting of diode D1 and resistors R1 through R5, is used to empirically shape the control curve (Fig. 9) for best audible results. Diode D1 prevents excessive positive gate drive, maintaining isolation between the gate and signal circuits.

An input attenuator (R10 and R11) limits the signal amplitude presented to the FETs to about 0.1 volt p-p at 0 VU to ensure low distortion. Output amplifier A7 makes up exactly for this loss. An op amp having external frequency compensation was used here so that this relatively high-gain stage could be tailored for flat response to 15 kHz (a μa741 could be used, but would roll off slightly above 10 kHz). Resistors R16 and R17 attenuate the output signal by an amount equal to the gain, so that this amplifier doubles as the unity-gain buffer required for filter operation. The highest cutoff frequency is dictated by minimum FET resistance and capacitors C1 and C2. The latter should have values in a ratio of about 3:1 to produce the desired Butterworth response. Figure 10 shows the measured response of the complete filter for four values of control voltage.

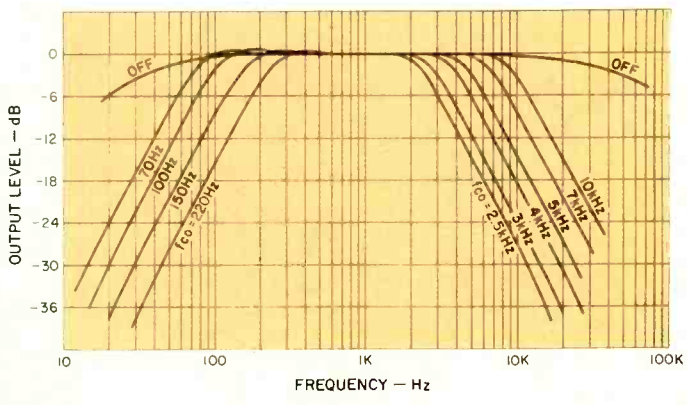


Fig. 5—Frequency characteristics of the manually-set rumble filter and pre-filter.

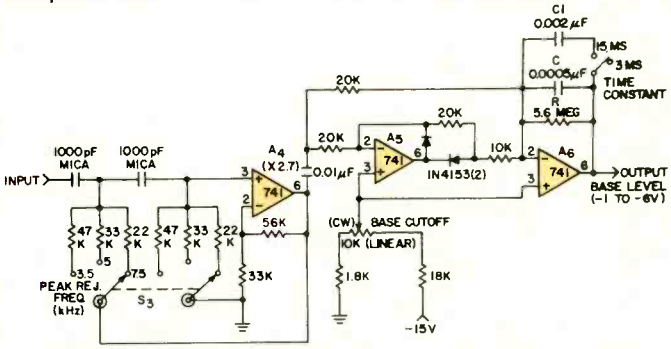


Fig. 6—Bandwidth-control signal separation filter and precision rectifier.

Quad Almighty.

The universal 4-channel receiver.

Since 4-channel has been created, music lovers everywhere have been waiting for a universal method to decode every 4-channel system. SANSUI has created it, and here it is, like a revelation: Quad Almighty.

The SANSUI vario-matrix* now incorporated in every SANSUI 4-channel receiver is able to decode effectively with remarkable musicality and clarity, all 4-channel matrix encoded records, QS or SQ, tapes and broadcasts. The Sansui QRX-7001 as well as the QRX-6001 also incorporates our CD-4 demodulator.

Of course the Sansui vario-matrix has the unique synthesizing capacity to give you breathtakingly beautiful 4-channel reproduction from all of your stereo records, tapes or broadcasts.

Also available is the SANSUI QRX 6001, 3500, 3000, and QR 1500 for the fullest line of 4-channel receivers.

Hear a demonstration of any of the QRX family of Quad receivers at your franchised Sansui dealer today or write to us for our booklet: "The Sounds of SANSUI".

* Sansui's unique technology that permits the highest degree of channel separation and gives unequalled 4-channel synthesizing from any 2-channel source.

SANSUI ELECTRONICS CORP.

Woodside, New York 11377 • Gardena, California 90247 • SANSUI ELECTRIC CO. LTD. Tokyo, Japan
SANSUI AUDIO EUROPE S.A. Antwerp, Belgium • ELECTRONIC DISTRIBUTORS (Canada) B.C.

Sansui

Check No. 26 on Reader Service Card

Unfortunately, FETs vary widely in characteristics, even between units of the same type, so these devices must be selected. The two FETs must be reasonably well matched over a 15:1 R_{DS} range for a 15:1 range in cutoff frequency (15 kHz to 1 kHz). (Dual matched FETs are available, but are more expensive and not necessarily matched for the parameter of interest here.) A transistor curve tracer is most convenient for this purpose and permits selection for best linearity as well as matching. I used N-channel 2N4220s on hand ($1.50 each) and selected the best matched pair out of a group of 6 units. Figure 11 shows the V-I characteristics of one of these. There are many other inexpensive FETs which should work as well, such as the 2N5484, 2N5716, and 2N5717 at under $1 each. In fact, any general-purpose, depletion-type FET with fairly low zero-bias current (I_{DSS}) and pinch-off voltage (Vp) should be usable. P-channel units would require reversing diodes D1 and D2 and the polarity of the control voltage.

If a curve tracer is not available, the setup of Fig. 12 can be used. A transistor socket will facilitate changing FETs. A good procedure is to first measure R_{DS} at V_{GS} = 0. Then increase V_{GS} (negatively for N-channel FETs) until R_{DS} is about three times the zero-bias value; this corresponds to a mid-range cutoff frequency where matching is the most critical. With this V_{GS} setting try different FETs until a 10 percent or better match is found. If R_{DS} values seem to cluster higher or lower, try another unit as a reference and try matching to it. When matched units are found, check the match at minimum R_{DS} (V_{GS} = +0.5 V) and at 10 times this value of R_{DS}. A 20 percent mismatch can be tolerated at these extremes. My 2N4220s measure 610 ohms at zero bias, 360 ohms at V_{GS} = +0.5 V., and about 8 kilohms at V_{GS} = −0.7 V. R11 and R12 are chosen for a cutoff of between 800 Hz and 1 kHz with the control voltage at its maximum negative value of about −6 volts. Circuit cutoff at zero FET bias should be roughly 12 kHz (see Fig. 9). A slight forward bias, limited to about +0.5 volt at the FET gates by diode D2, then boosts the cutoff to at least 15 kHz with maximum positive output from the precision detector.

Resistors R6, R7, R18, R19, and R20 reduce harmonic distortion significantly. R6 and R7 feed some signal to the FET gate circuit so that signal voltage does not appear between source and gate, which would make R_{DS} vary slightly with instantaneous low-frequency signal amplitude and polarity. R18, R19, and R20 feed back some output signal to the gates to further reduce distortion (this is a cancellation effect, not true negative feedback).

Distortion settings are best made in the vicinity of cutoff, where FET linearity is the most critical. Connect a variable-voltage d.c. source (the slider of a 5K pot temporarily connected between −15 V and ground will suffice) to the bandwidth control input and set it for a cutoff frequency of 2 kHz. Then, with a 2 kHz sinusoidal input at about 0 VU (2.2 V p-p), set trimpots R7 and R18 for lowest harmonic distortion at the output. It should be possible to sharply null the total harmonic content, which consists primarily of the 2nd and 3rd harmonics, to at least 60 dB below 0 VU. Then vary the cutoff frequency and make sure distortion is low for all settings. Of course, the filter itself will reduce harmonic distortion appreciably at its lower cutoff values. Lacking a distortion meter or wave analyzer, these adjustments can be made quite well by driving the input at 7 volts p-p (10 dB above 0 VU) to accentuate the distortion and setting very carefully for a symmetrical output waveform as monitored by a 'scope. Fixed resistors, determined by two decade boxes (the settings interact somewhat), could replace the pots. These adjustments, once made, are permanent unless the FETs are changed.

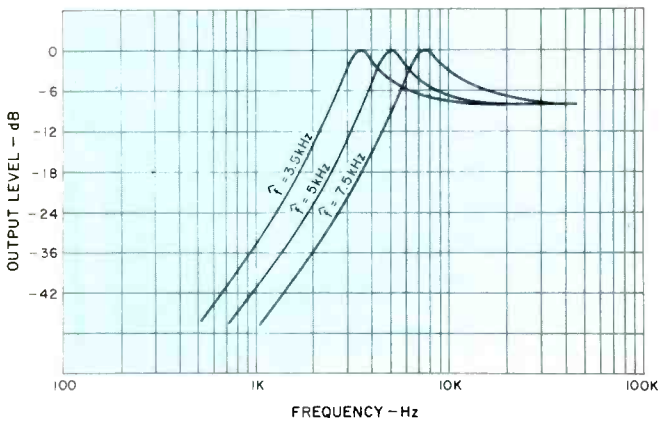


Fig. 7—Frequency characteristics of the filter used to derive the bandwidth control signal.

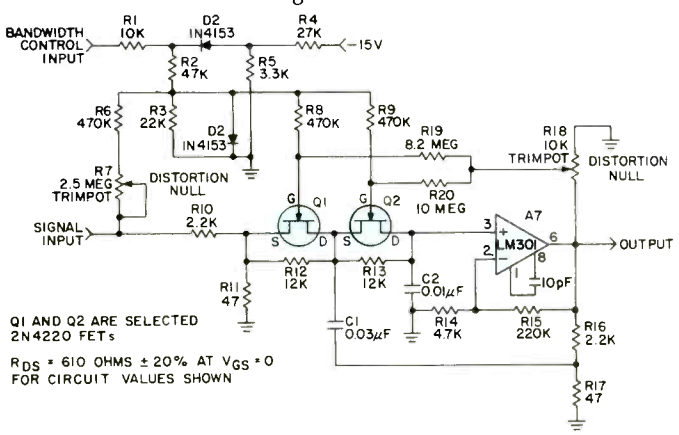


Fig. 8—Voltage-controlled filter schematic. FETs *Q1* and *Q2* are critical and must be selected (see text).

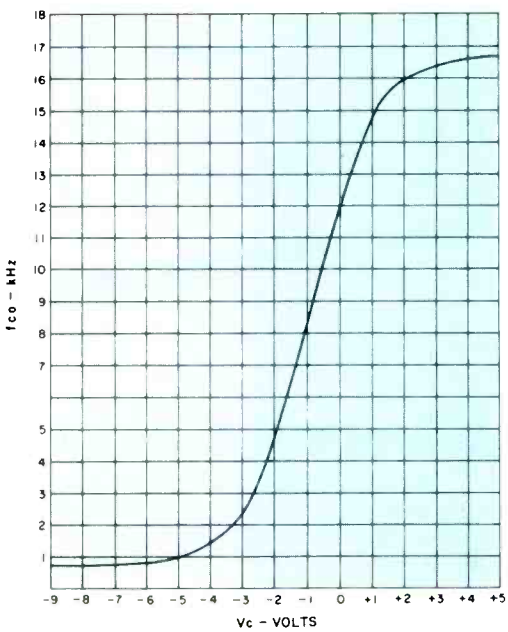


Fig. 9—Variable-bandwidth filter cutoff frequency vs. control voltage.

Before you buy a manual turntable, consider what "manual" really means.

"Manual" means more than just "single play." Every time you play a record, you must pick up the tonearm and move it to the record. And at the end of play, you must stop whatever you're doing, go to the turntable and return the tonearm to its resting post. All by hand.

Not only is this inconvenient, it's also risky, because the business end of a tonearm is virtually weightless. Handling it without damage to the delicate stylus and your fragile records takes a very steady hand.

What about the automatic's extra moving parts?

An advantage often assumed for the manual turntable is simplicity: few moving parts. The automatic turntable does have additional parts, but they serve only to move the tonearm to and from the record when cycling. During play, a fully automatic Dual turntable has no more moving parts than a manual: motor, platter and drive system.

What's more, every manual turntable requires one additional moving part that no Dual ever requires: you.

Why many manual turntable owners switched to Dual.

From warranty cards, we know that many Dual owners formerly owned manual turntables and switched to enjoy Dual's quality performance plus fully-automatic convenience and safety.

For many years, more audio experts—hifi editors, engineers and record reviewers—have owned Duals than any other make of quality turntable. So have the readers of the leading music/equipment magazines. Certainly no group is more concerned about record protection and the quality of music than these people.

Even the lowest priced Dual, model 1225, at $129.95 has more precision than you are ever likely to need. As for the highest-priced Dual, the $400 electronic, direct-drive model 701, test reports have been extraordinary. Most independent test labs acknowledge that its rumble, wow and flutter are below the measuring capability of their test equipment.

A word for those who still think they want to play manually.

Despite all the above, you may still prefer to play your records manually. The Dual tonearm gives you this option, because it is as free-floating during play as any manual-only tonearm. Thus you can always place it on the record or lift it off—manually.

However, we predict that you will soon take full advantage of the convenience and security of Dual's full automation. Which is what most Dual owners prefer.

And considering what kind of people own Duals, that's something you really should consider.

Dual®

The multi-play automatic Dual 1229Q, $269.95. Other multi-play automatics from $139.95. All less base and dust cover. Single-play automatics are the Dual 601, $270; and the electronic direct-drive Dual 701, $400. Both include base and dust cover.

United Audio Products
120 So. Columbus Ave.,
Mt. Vernon, N.Y. 10553
Exclusive U.S. Distribution Agency for Dual

Check No. 15 on Reader Service Card

Fig. 13 shows the distortion of the complete noise filter measured at two fixed values of bandwidth control voltage. At normal levels, distortion is so low that it is largely a measurement of the harmonic distortion of the test oscillator. The large margin above 0 VU passes the highest program peaks ever likely to be encountered without clipping.

The simple power supply of Fig. 14 easily supplies the power requirement of ±15 volts at about 10 mA.

Construction

The entire filter can be duplicated for about $60 with new parts. Sources of the major components are shown in the Parts List; substitutes can be used in most cases. Quarter-watt, 5 percent composition resistors are suitable. Layout is not critical, since signal levels are high and impedances are relatively low. I strongly recommend that each of the functional blocks of Fig. 2 be built and checked for reasonable conformance with the curves before integration into the system. This makes troubleshooting for errors and occasional bad components much easier, practically ensuring success. My unit (Fig. 1 and lead photo) is a "breadboard in a box." The circuit is still undergoing occasional changes, even though it is a third-generation model. Parts are mounted on terminal boards which were on hand. A neater approach would be to use the commercially-available perfboard with snap-in terminals.

Operation

After checking the wiring, apply power to the unit and check for proper power supply voltages. Positive and negative supplies should both be between 14 and 16 volts with respect to ground. Much lower values would indicate a short circuit or bad op amp. Current drain should be on the order of 10 mA.

The noise filter can be conveniently connected to your audio system by means of the *Tape In* and *Tape Out* jacks included on most preamplifiers. An advantage to this connection is that the processed signal passes through the preamp tone controls, which can be set for the most pleasing final balance. For taping, the recorder input is paralleled with the output which drives the power amplifier.

For initial set-up experience, a record having a good frequency range and moderate, steady surface hiss is desirable. (A slightly noisy FM station can also be used, but results will not be quite as good because of the latter's flatter noise spectrum.) Initial control settings should be:

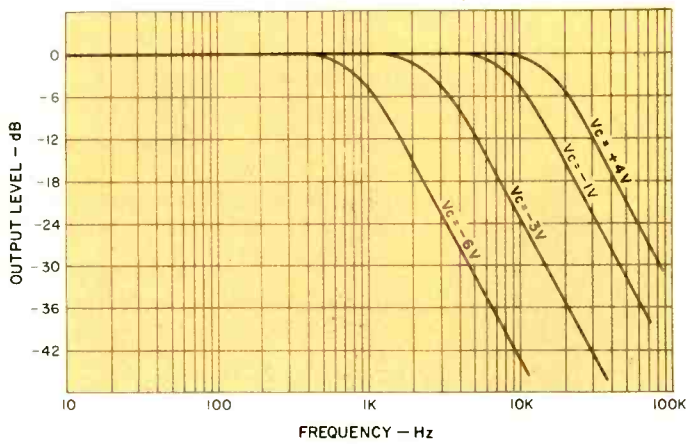


Fig. 10—Variable-bandwidth filter characteristics for several control voltage values.

Pre-Filter: Off
Rumble Filter: Off
Time Const: Off
Peak Rej. Freq.: 5 kHz
Base Cutoff: CCW
Suppr. Gain: CCW
Dyn. Suppr.: Off
Sig. Compare: Input

The signal should now pass through the unit unaffected, except the *Level Set* control will vary the gain from zero to 3.2 (10 dB). Set the level for 0 VU on signal peaks as you would set a recording level. Whenever the source is changed, the signal level should be reset as necessary.

Now switch the *Sig. Compare* switch to "output." The signal is now passing through the rumble filter (if used) and pre-filter, but bypassing the dynamic filter. Lowering the *Pre-Filter* cutoff setting should progressively cut off the highs. At the lower settings, which are primarily for acoustic records, the signal will sound severely band-limited. The best setting is the lowest cutoff which does not significantly affect the recorded bandwidth. I have found that with vocal music, the unfiltered sibilant sounds provide a means of judging bandwidth. If sibilants are quite strong and natural, a 7 kHz or higher cutoff is indicated. If they are weak or have a slight "whistling" sound, the upper limit is about 5 kHz. If sibilants are lacking, a 4 kHz or lower setting is best. Of course, the presence of high-frequency distortion may dictate a compromise setting a notch or two lower than indicated above. The filtered and unfiltered sounds may be compared at any time by means of the *Sig. Compare* switch. The optional rumble filter is used for the occasional records which have warpage or bumps or low-frequency noise in the recording. For acoustic records it can be routinely left at 150 Hz, as nothing is recorded below about 200 Hz.

Next flip the *Dyn Suppr* switch to "on," putting the dynamic suppressor in the circuit. The sound should become very dull and lifeless, as the high-frequency cutoff is now 1 kHz or less. Increase the *Base Cutoff* setting until record noise just begins to be audible. The signal will probably still be quite lacking in high-frequency content (if it is not, only the pre-filter may be needed for this particular source). Now turn up the *Suppr Gain* slowly. This should "magically" restore the highs without increasing the noise level. The highest possible setting which does not noticeably increase the noise is normally best.

At this point it is edifying to monitor the bandwidth control input signal to the variable-bandwidth filter with a d.c.-coupled oscilloscope. The instantaneous voltage here is a measure of high-frequency program amplitude and dynamic filter bandwidth (see Fig. 9). It should follow transients rapidly and may reach saturation (about +14 volts) on musical passages having high harmonic content and on strong voice sibilants.

The *Peak Rej. Freq* switch selects the frequency of peak rejection by choosing the appropriate filter curve (Fig. 7) for separating the bandwidth-control voltage from the input signal. The *5 kHz* position is used for most electrical 78 rpm records. For acoustic records or very noisy electrical 78s where the pre-filter is set for 4 kHz or less, the *3.5 kHz* position gives better results. Here the *Time Const.* switch can be set for *15 mS*. The longer time constant also helps to attenuate sharp clicks and pops occuring in quiet passages, as it prevents the bandwidth from increasing rapidly enough to follow their steep wavefronts. The *7.5 kHz* position is used for wideband recordings and tape.

With a little practice, you will be able to set the controls quickly for optimum performance. It is often best to set the

Because the best was not good enough.

TR-2075

For a free 8-page booklet on TR-2075, write, telephone, or telex

TANDBERG
OF AMERICA INC.
Labriola Court, Armonk, New York 10504 · Telephone: 914-273-9150 · Telex: 137367
A. Allen Pringle Ltd., Ontario, Canada

Base Cutoff for a significant improvement, rather than to try to eliminate the noise completely. This will minimize low-level band limiting, and the suppressor will be less likely to betray its presence with obvious bandwidth changes.

Performance

Figures 5 and 10 indicate the bandwidth ranges available. The pre-filter and dynamic filter (slope is 24 dB/octave above both cutoffs) can together provide well over 60 dB of noise attenuation at 10 kHz and over 40 dB at 5 kHz. The overall improvement in signal-to-noise ratio is strongly determined by the character and spectrum of the noise, which varies greatly with records. With the steady hiss typical of new electrical recordings on shellac, an average improvement of 8 dB (unweighted) is realized from the dynamic filter alone. Including the effects of the rumble filter and pre-filter on band-limited material, S/N improvement can be more than 12 dB. The apparent improvement is even greater, since the ear heavily weighs the higher frequencies where record noise is concentrated. The effect of the noise filter is surprisingly great on records which were originally thought to be quiet without filtering. It is a little weird at first to hear a familiar old record with realistic strings and brass and clear voice sibilants, but with the background suddenly rendered deadly quiet. I have spent many hours listening to the records and tapes in my collection and enjoying them anew.

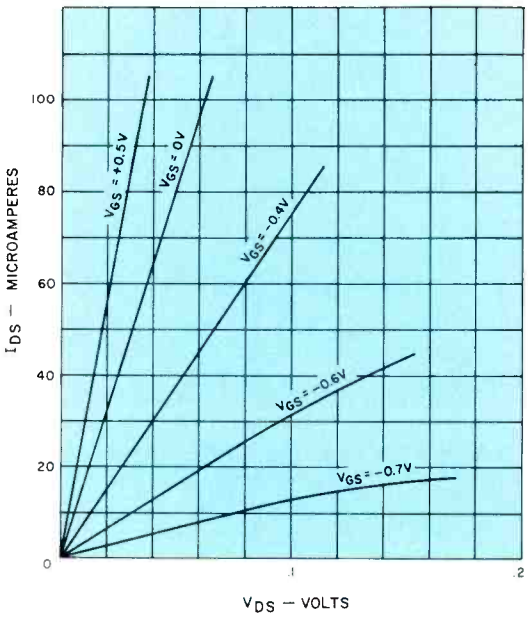


Fig. 11—Variable-resistance characteristics of a junction field-effect transistor with low values of drain-to-source voltage.

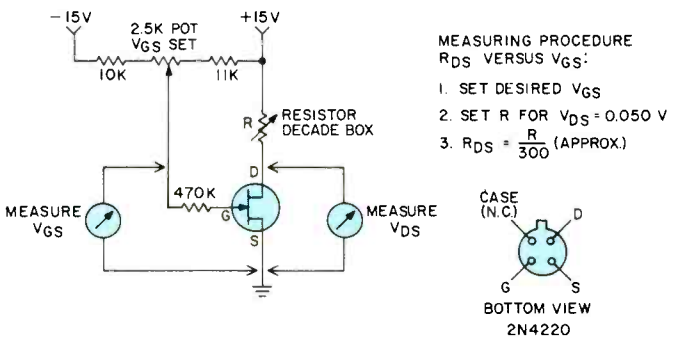


Fig. 12—Set-up for selecting FETs by static measurements (see text). Small 15 V batteries or the power supply of Fig. 13 may be used.

The noise filter works very well on tape noise, providing at least 8 dB total S/N improvement. A stereo version built for tape only could be simplified considerably, as only the *Level Set, Base Cutoff, Suppr. Gain,* and *Sig. Compare* controls would be needed. The power supply as shown can easily handle two channels.

The noise level of the filter itself depends mostly on output amplifier A7. Of several units I tried, the noise level ranged from 62 to 68 dB below 0 VU.

A few tips on the mechanical aspects of copying records are in order here. The importance of good tracking cannot be overemphasized. More can be gained here than with any amount of electronic processing. Groove radius, depth, and angle were not standardized on early discs, and experimentation with tracking force and stylus size, if possible, may yield a considerable improvement in both noise and distortion. The playback stylus should, of course, ride on the sides of the groove. If it is too small it may ride the bottom of the groove and skate from side to side in a partially uncontrolled manner, creating severe distortion. If too large, it will ride high in the groove where it is more sensitive to surface blemishes. Also, larger styli cannot follow high-frequency modulation as well, especially on the inner record grooves. Elliptical styli are helpful on relatively wide-range 78s if the latter have not been damaged by previous playings.

Acoustic records (1925 and earlier) tend to have a larger groove, since with acoustic playback the mechanically-imparted stylus motion had to supply all the sound power. For these, a stylus of 4-mil (.004") radius may produce better results than the standard 3-mil size. Custom-made styli with a

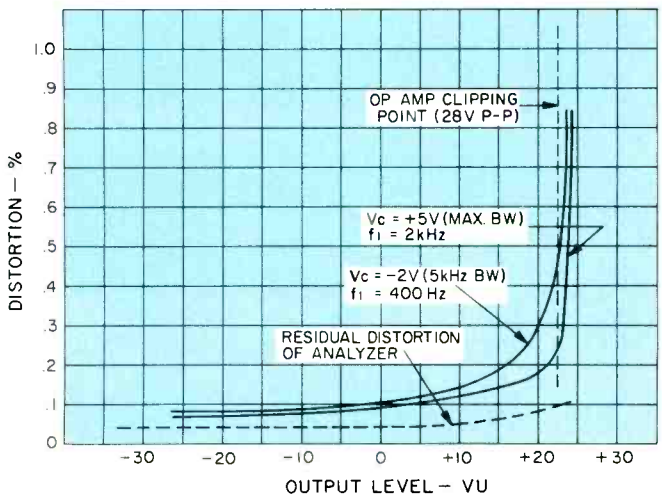


Fig. 13—Overall harmonic distortion of the noise filter for two constant values of bandwidth-control voltage.

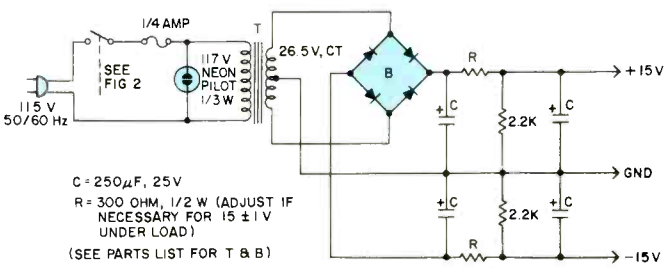


Fig. 14—Power supply. A two-channel suppressor may easily be powered by reducing *R* slightly.

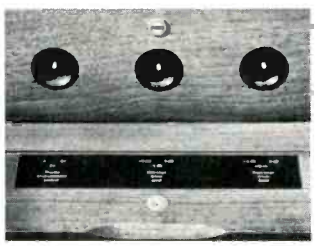
New from Acoustic Research

The AR-10π
A new standard of musical accuracy and an unprecedented degree of placement flexibility

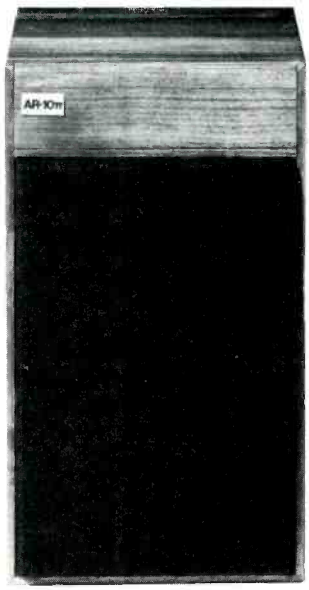
Musical accuracy
The new AR-10π is the most accurate musical reproducer that Acoustic Research has ever built for use in the home. It has been designed to deliver uniform flat energy response in most listening rooms. This means that the musical balance of the input signal will be accurately transmitted to the listener, and listeners in virtually all listening positions will hear the performance in the same way. A new tweeter and crossover network make this new standard of accuracy possible.

Speaker placement
Speaker placement in the listening room is of critical importance to the musical balance of the system. That's why most speaker manufacturers give explicit instructions on exactly where their speakers must be placed for best results. The AR-10π however has been designed for maximum flexibility in this respect. It can operate in almost any location in your room with no sacrifice in accuracy.

The AR-10π can be positioned against a wall, in a corner, or even in the middle of the room.



Simply resetting a single switch will ensure the right amount of bass energy for any position – something that is not possible with conventional loudspeaker designs or equalization techniques.



Acoustic Research has prepared a comprehensive description of the AR-10π speaker system. You can get a free copy by sending us the coupon below.

Acoustic Research
10 American Drive
Norwood
Massachusetts 02062
Telephone: 617 769 4200

AR
Acoustic Research
A TELEDYNE COMPANY

Please send me a complete description of the AR-10π AU–6

Name _____

Address _____

_____

Check No. 1 on Reader Service Card

"truncated" tip (really a smooth transition from a 2- or 3-mil radius to about a 4-mil radius at the very tip) have been used to track the groove sides of 78s properly while avoiding contact with the bottom. (Truncated and other special styli are available from International Observatory Instruments, 5401 Wakefield Drive, Nashville, Tenn. 37220.) Although not a cure-all, these can give dramatic results on selected discs. A 2.5-mil stylus is best for most post-1946 transcriptions. Obviously, the pickup should have adequate lateral compliance and should produce no output for vertical motion. Incidentally, electrical recordings made before the mid-1940s are mostly recorded flat, that is, they have no high-frequency pre-emphasis, while later records have pre-emphasis of as much as 16 dB at 10 kHz.

Edison cylinders (160 rpm) and discs (80 rpm), some Pathé discs, and some early wax transcriptions are vertically modulated. Here the stylus does ride on the groove bottom, and the pickup should have only vertical response. This can be obtained (as can lateral-only response) from a suitably-phased stereo cartridge. Stylus radii of 4 to 10 mils are typical here; as always, experimentation is in order.

Future Development

The experimenter may want to try to improve the performance of the circuit described. Of course, additional types of processing can be added, such as more effective click suppression at the filter input or multi-channel equalization at the output. These would be electrically independent of the noise filter, and beyond the scope of this paper. However, there are some possibilities for improving the noise filter itself. Many of these, unfortunately, would require an incongruous increase in complexity and cost.

Sharper filter cutoffs give a marginal improvement on very noisy material, but setup adjustments become more critical. Dynamic high-pass (low-cut) filtering using a simple 6 dB/octave slope might be a reasonable addition. Since the noise-rejection frequency band of the low-pass dynamic filter should complement the noise spectrum of the signal, a statistical study of record and tape noise spectra might lead to a better shape for the bandwidth-control-signal separation filter of Fig. 7. The separation filter selector could be ganged with the pre-filter cutoff switch to eliminate one control knob. Perhaps a noticeable improvement could be realized by experimenting with the shape of the bandwidth control characteristic, Fig. 9. The attack time constant could be shortened by using a more elaborate filter at the precision detector output; this would improve the response to occasionally encountered wide-band transients.

An obviously desirable change would be to replace the FET bandwidth-control filter with one of the voltage-controlled state-variable type. This would eliminate the need for FET selection, but would increase the cost severalfold. It therefore appears that the original goal of high performance per dollar has been achieved, yielding a practical design which is within reach of the hobbyist.

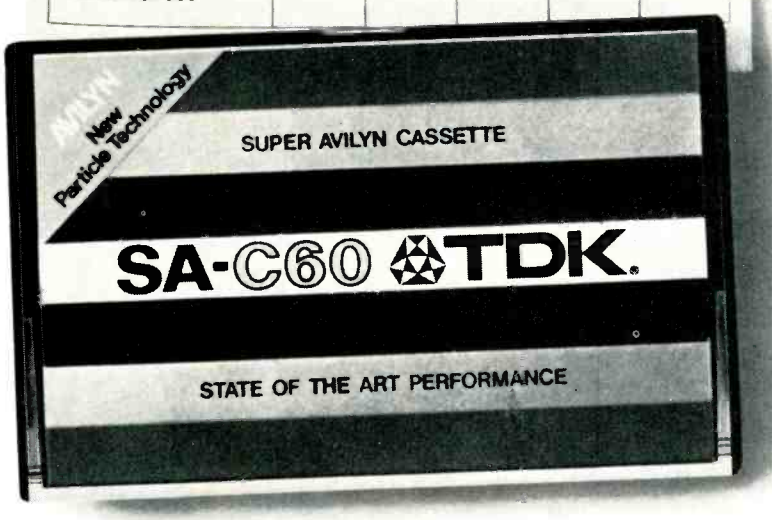
References

1. Burwen, R.S., "A Dynamic Noise Filter," *J. Audio Eng. Soc.* 19, PP. 115-120, Feb., 1971.
2. Mori, T., "Designing Low-Frequency Active Filters," *Electro-Technology*, P. 72, Jan. 1968.
3. Langford-Smith, F., Ed., "Reproduction From Records," *Radiotron Designer's Handbook* (Wireless Press, 1953), PP. 701-774.
4. Scott, H.H., "Dynamic Noise Suppressor," *Electronics*, PP. 96-101, Dec., 1947.
5. Fletcher, H., "Loudness, Masking, and Their Relation to the Hearing Process and the Problem of Noise Measurement," *J. Acoust. Soc. Am.* 9, PP. 275-293, Apr., 1938.

INTRODUCING TDK SUPER AVILYN. IT OUTSOUNDS CHROME. AND THE #1 FERRICHROME.

INDEPENDENT LAB TEST RESULTS

	TDK SA	A	B	C	D
Signal-to-Noise Ratio	1st	4th	1st	6th	7th
Distortion (I.M.)	1st	2nd	3rd	7th	6th
Low-Frequency Response Accuracy	1st	1st	1st	1st	1st
Mid-Frequency Response Accuracy	1st	2nd	5th	5th	2nd
High-Frequency Response Accuracy	2nd	2nd	6th	5th	1st
Maximum Output Level (3% thd)	1st	2nd	4th	6th	5th
Output (0 VU)	1st	4th	5th	2nd	2nd
Surface Abrasiveness	low	high	high	high	low



Seven tapes were tested (TDK SA, TDK KR, Scotch Chrome, BASF Chromdioxid, Advent Chrome, Scotch Classic, and Maxell UD) and ranked 1st to 7th. The chart shows the results for 5 representative tapes tested.

The following tape decks were selected for use in the tests: Nakamichi 500 & 1000, Advent 201, and TEAC 450.

You want the best sound you can get from your cassette recorder without worrying about headwear. And until now, chrome and ferrichrome had the sound—they outperformed ferric oxide tapes in extended high frequency response with lower noise.

Well, TDK has advanced cassette recording to a new standard of high fidelity. It's new Super Avilyn, the cassette that outsounds chrome, the best-selling ferrichrome, and the top-ranked ferric oxide tapes.

Its magnetic particle is new. It soaks up more sound and plays it back with less distortion. That's power and clarity you can hear.

Super Avilyn doesn't require special bias/eq. setting for optimum performance. It is compatible with any tape deck that has the standard CrO_2 bias/eq. setting.

Distortion—that's the big story. Look at these lab test figures.

LEAST DISTORTION—CLEAREST SOUND.

RECORD INPUT LEVEL	TDK SA	A	B	C	D
0 VU	11%	13%	26%	50%	32%
-5VU	4.5%	5.4%	11%	17.5%	5.4%
-10VU	4.2%	4.5%	8.5%	7.8%	4.8%
-20VU	4.9%	5.0%	8.0%	5.2%	6.0%

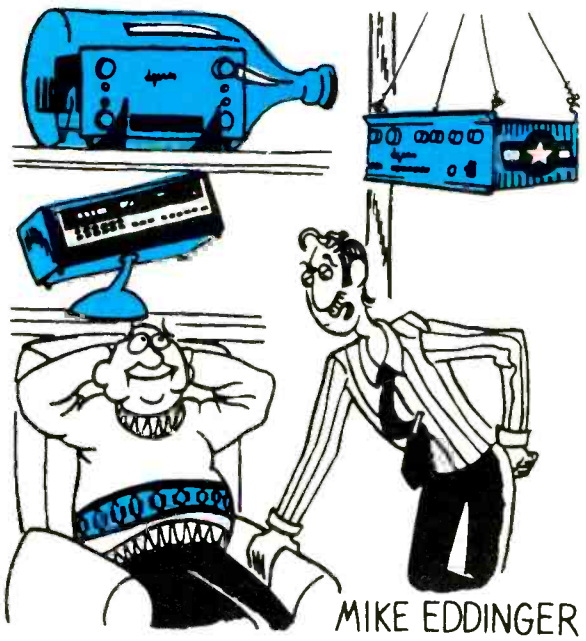
SMPTE METHOD: I.M. DISTORTION—7000 Hz—60Hz, 4:1 ratio.

There's just no contest. Super Avilyn delivered the clearest, cleanest sound. More lifelike sound—and to a discriminating ear, that's the ultimate test. Fact is, Super Avilyn is the new state of the art.

TDK Electronics Corp.
755 Eastgate Blvd., Garden City, N.Y. 11530. Also available in Canada.

TDK®

Wait till you hear what you've been missing.



"YOU'RE MISSING THE **WHOLE POINT** OF BUILDING HI-FI KITS, FRED!"

Parts List

Qty	Part	Mfg. Number	Source
1	Power Xformer*	UTC FT13 or Allied 6K48HF	Newark #2F702 Allied #705-0065
1	Bridge Rect (B)	Allied VE08	Allied #976-3021
4	250 μF, 25V (C)	Allied N-G-500	Allied #710-1356
6	Op Amp (A1-A6)	Fairchild U5B77-41393	Allied #569-2100
1	Op Amp (A7)	Motorola MLM301AP1	Newark (no # req'd)
10	FET (Q1 and Q2)	Motorola 2N4220	Newark (no # req'd)
4	Diode	Fairchild 1N4153	Allied #551-4153
1	VU Meter	Micronta 22-019	Allied #910-4519
3	SPDT Toggle Sw	Cutler-Hammer SF1SBX191	Newark #29F2274
1	Selector Sw (S1)	Mallory 3226J	Newark #22FO56
1	Selector Sw (S2)	Mallory 3229J	Newark #22FO61
1	Selector Sw (S3)	Mallory 3223J	Newark #22FO55
1	Pot, 100K Audio Taper (Level Set)	Mallory U39	Newark #9F221
1	Pwr. Sw. for above	Mallory US26	Newark #9F246
1	Pot, 10K Linear (Base Freq.)	Mallory U20	Newark #9FO89
1	Pot, 10K Audio Taper (Suppr Gain)	Mallory U18	Newark #9FO87

*Allied transformer is larger than UTC, but costs less.

These parts should be available at any industrial electronics supply store. Some electronics parts distributors will also carry. For mail order use Newark Electronics, 500 N. Pulaski Rd., Chicago, Ill. 60624 or Allied Electronics, 401 E. 8th St., Fort Worth, Texas, 76102.

Indulge yourself in epicurean delights by placing a record on the Philips GA 209 fully automated electronic turntable. Then walk away. The 209 takes it from there. It automatically selects the precise speed you've calibrated. And it automatically measures the record size, cueing the tone arm gently to the lead-in groove.

The 209 is the only turntable with three DC motors. One lifts the tone arm. The second transports it. The third, a DC servo motor/tacho generator, spins the platter.

The precision ground drive belt even filters out rumble as well.

Next on the menu is the surprisingly attractive SC 102A stereo control center/pre amp. It gives you top professional quality in your home. Preamp performance specifications like the 102A's could cost over $600. The 102A costs less than half.

For an entrée, we proudly present our Motional Feedback™ System. Known as "Little David," it's more than a match for floor standing giant speakers. That's because it has much more inside its 15 x 11¼ x 8½" cabinet than any other speaker.

There's a three-way speaker system. It rolls off cleanly at 35 Hz and tops at 20,000 Hz. Then there's internal bi-amplification. One power amp for the woofer. Another for the midrange and tweeter. Together they produce more than 103 dB sound pressure level at one meter.

And most important, our Motional Feedback circuitry. Starting in the woofer cone apex, there's a piezoelectric accelerometer. Together with an internal electronic comparator, it corrects any differences between the incoming signal and woofer cone motion. This virtually eliminates distortion ...at the speed of light.

Visit your better audio shop for Philips high fidelity components. Order the complete system. Or a la carte.

PHILIPS AUDIO VIDEO SYSTEMS CORP.
AUDIO DIVISION
91 McKee Drive, Mahwah, N.J. 07430

Gourmet Sound.

If you want delicious sound, just use Philips ingredients.

PHILIPS®
TM—N.V. Philips, Holland

Check No. 22 on Reader Service Card

Equipment Profiles

Heath Model AR-2020
Four-Channel AM/FM Receiver

MANUFACTURER'S SPECIFICATIONS

FM TUNER SECTION

IHF Sensitivity: 2.0 μV. **S/N:** 60 dB. **Selectivity:** 60 dB. **Capture Ratio:** 2.0 dB. **THD:** Mono, 0.5%; Stereo, 0.75%. **I.F. Rejection:** 75 dB. **Image Rejection:** 50 dB. **Spurious Rejection:** 70 dB. **AM Suppression:** 50 dB. **Frequency Response:** 20 Hz to 15 kHz ±1 dB. **Stereo Separation:** 1 kHz, 35 dB minimum. **Sub-carrier Suppression:** 60 dB.

AM TUNER SECTION

Sensitivity: 100 μV/M. **Selectivity:** 40 dB. **Image Rejection:** 75 dB at 600 kHz. **I.F. Rejection:** 60 dB. **S/N:** 35 dB. **THD:** 2.0%.

AMPLIFIER AND PREAMPLIFIER SECTION

Continuous Power Output: 15 watts per channel, all channels driver, 8-ohm loads, with 0.5% total harmonic distortion and 0.5% intermodulation distortion, 20 Hz to 20 kHz. **Damping Factor:** 30. **Input Sensitivity:** Phono, 2 mV; Tuner, Aux, Tape, 200 mV. **Phono Overload:** 35 mV or better (depends on input level setting). **Frequency Response:** 7 Hz to 50 kHz +1 dB. **Power Bandwidth (IHF):** 5 Hz to 30 kHz. **S/N:** Phono, −60 dB (referred to 10 mV); Aux, Tape, −70 dB. **Residual Noise:** −85 dB. **Tape Output Level:** 0.4 volts.

GENERAL SPECIFICATIONS

Power Requirements: 120 or 240 volts, 50/60 Hz, 100 watts (at full output). **Dimensions:** 20 in. W x 5 in. D. **Net Weight:** 24 lbs. **Retail Price:** $279.95, kit.

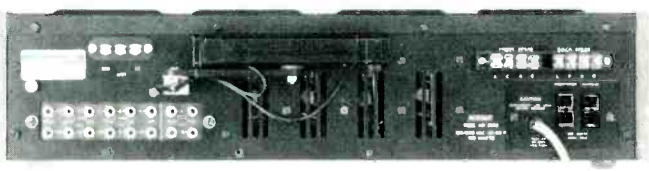


Fig. 1—Rear panel of the Heath AR-2020.

Always at the forefront of audio developments, the Heath Company apparently set out to prove with the AR-2020 that it is possible to "get into" four-channel sound via the kit-building route at such a low, low price that it would attract audio fans who have been reluctant to spend the large sums of money required for "ready-made" four-channel receivers. To a considerable degree, Heathkit has succeeded, in that the power output (15 watts per channel) and overall performance quality of the AR-2020 are certainly the equal of receivers costing $100 to $150 more. While Heath apparently did not set out to attract the ultra-sophisticated quadraphile since the AR-2020 doesn't include a CD-4 demodulator or logic in its SQ decoder, still this receiver's solid, economical performance should appeal to and satisfy both the beginning and moderately sophisticated quadraphile. In addition, a few of the control features, such as loudness compensation and high- and low-frequency filters, have been eliminated in this unit to further reduce cost. The unit thus offers solid basic performance without the complications of the latest technical refinements.

The front panel, pictured here, is all black, set off by two horizontal, chrome trim strips. AM and FM dial scales are invisible until power is applied. The usual stereo indicator light appears to the left of the dial scale when a stereo broadcast is tuned in. The right third of the panel includes the tuning knob, four individual level controls (there is no balance control), master volume control and separate bass and treble controls for front and back channels. Below the dial scale area are 12 identical push-buttons. Six of these select program source, four others choose between four-channel, stereo, mono and matrix (SQ) modes, while the re-

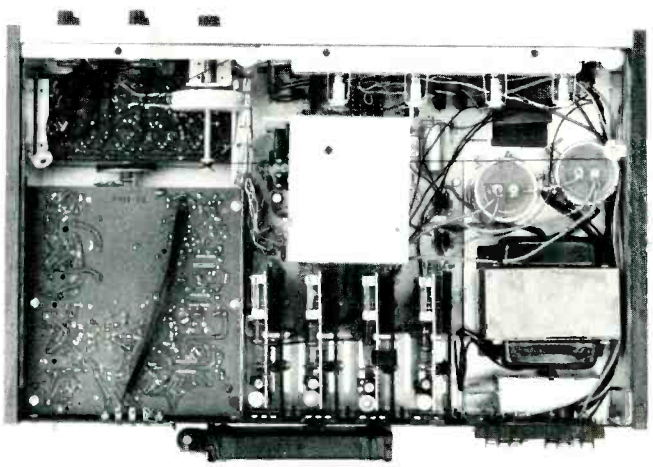


Fig. 2—Interior of the AR-2020.

maining two are for power on/off and for speaker actuation (with the speaker button out, phones-only can be heard). A pair of phone jacks for front and back plugs of four-channel headphones complete the front panel layout.

The rear panel, pictured in Fig. 1, has input and output jacks for phono, four-channel and two-channel AUX inputs, four-channel tape inputs and outputs, a ground terminal, antenna terminals for 300 ohm and 75 ohm connections, and conventional screw terminals for front and back speaker connection. Switched and unswitched a.c. convenience outlets are also provided, as is a fully rotatable and pivotable ferrite-bar AM antenna.

Internal Construction and Circuitry

The AR-2020 is available only in kit form (unlike some other Heath products which may be purchased in wired form as well). Although we did not personally put together this particular receiver, we did have access to Heath's excellent (as always) assembly and owner's manual. It runs to 150 pages and is replete with step-by-step construction details, diagrams, alignment instructions (with and without special test equipment), and even a lengthy circuit-description section for the more technically minded builder. A view of the inside of the chassis is shown in Fig. 2. Ten major p.c. modules are used, the largest of which is the AM/FM tuner module which includes the front-end as well as the multiplex decoder section. Phono preamplification is accomplished by means of a single IC, as is SQ matrix decoding. ICs are also used in the FM i.f. section for amplification limiting and quadrature detection. The multiplex decoder uses a phase-lock-loop IC and requires no tuned coils. Accurate "lock" and separation is set by means of a single potentiometer. Both AM and FM r.f. sections include three gang variable capacitors, and the FM r.f. amplifier uses an FET. Tone control circuits are of the feedback type and each uses a Darlington transistor pair (in one package) for gain. Power amplifier sections are entirely direct-coupled and have differential amplifier inputs and dual plus and minus voltage supplies for the power output transistors. Speaker and output protection is in the form of replaceable two ampere fuses in each speaker feed line. Unfortunately absent from the circuit are any tape-monitor circuit-interruption points—a feature which will be missed by users who own three-head tape decks and also prevents a user from substituting a more sophisticated SQ logic decoder for the basic matrix decoder presently used in the AR-2020 unless wiring modifications are made at a later date. Extensive voltage regulation is provided for all operating voltages except the high voltages used for the power output stages. In all, we counted 56 transistors, 5 1C's, 1 FET, and 22 diodes or diode packages in the AR-2020.

Laboratory Measurements

Because we did not personally build this receiver, we had an opportunity to judge how well an amateur who has no equipment with which to align the finished product will fare. While we generally support the practice of factory or service station alignment of FM tuner circuitry, Heath has intelligently gotten around what could have been trouble for the kit-builder through the use of a phase-lock-loop IC in the multiplex section and careful factory alignment. IHF sensitivity was measured as 1.9 μV, a bit better than the 2.0 uV specified. Mono noise and THD, plotted in Fig. 3, exceeded their specifications, reaching 67 dB and 0.35%, respectively, while just 5.0 μV of input signal strength was required in mono to reach 50 dB of quieting. Noise reduction in stereo FM was slower, as is normal, and reached a maximum value of 57 dB at 1000 μV. THD in stereo was again better than claimed, at 0.5% for mid-frequencies.

Figure 4 shows stereo FM separation and distortion versus frequency in both mono and stereo FM. Some 39 dB of separation was observed at mid-frequencies, tapering down to 20 dB at 15 kHz and 27 dB at 50 Hz. Mono THD was at approximately at the 0.5% level for all audio frequencies, while in stereo, THD rose significantly at low and high frequency extremes. The rise in THD at high frequencies (2.0% at 10 kHz) is attributable to "beats" between audio and carrier products, but the low-end rise in THD was observed to be primarily third-order harmonic distortion.

Other measurements made in FM included a capture ratio of 1.8 dB, carrier suppression of 63 dB and spurious signal rejections which generally conformed to published claims.

AM measurements were surprisingly good for a unit in this price class. Signal-to-noise ratio in AM measured better than 35 dB and THD for 30% modulation was well under 1.5%.

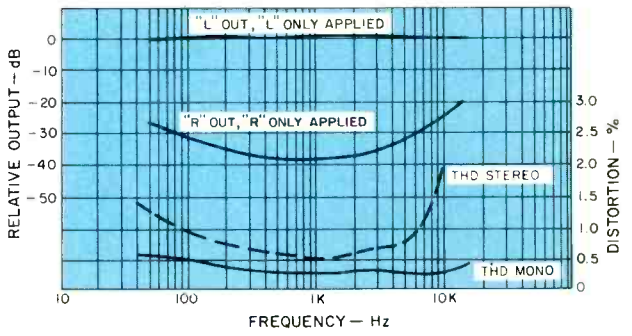


Fig. 4—Separation and distortion versus frequency.

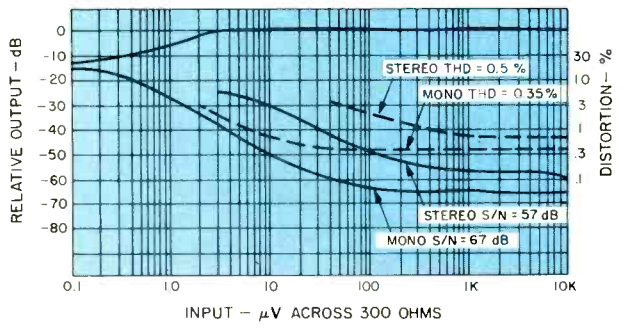


Fig. 3 — FM quieting and distortion characteristics.

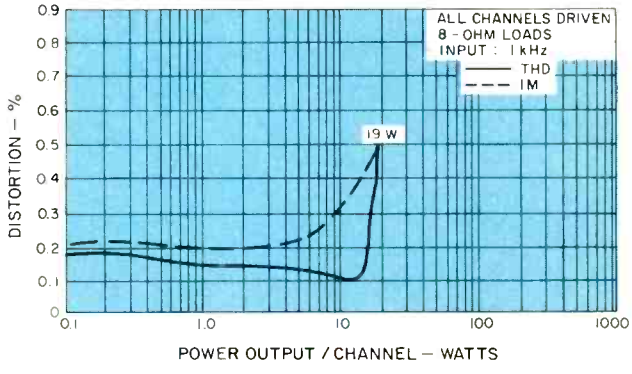


Fig. 5—Harmonic and intermodulation distortion characteristics.

The amplifier sections of the AR-2020 are designed strictly for four-channel applications, since when you switch to STEREO on the front panel, you will then have the same program material played over the back channel speakers as is heard from the fron speakers. Thus, there is no facility for "strapping" power in the stereo or mono modes. Accordingly measurements were confined strictly to four-channel use of the amplifier sections.

As shown in Fig. 5, THD remains well below 0.2% until rated power per channel is exceeded. Rated THD of 0.5% is reached at an output of 19 watts per channel. IM reaches the same rated value at the same output, decreasing to 0.2% for lower power output levels. Power bandwidth, plotted in Fig. 6 extends from 8 Hz to 70 kHz. It should be pointed out that power bandwidth, as defined by the IHF, is the pair of frequency extremes at which power output for rated THD is down 3 dB from mid-band rated output. This definition differs from the new "power bandwidth" defined in the newly adopted FTC power disclosure rules. That newer definition implies that power bandwidth is the pair of frequency extremes at which a product can produce its *full* rated output at rated THD or lower. Based upon this more stringent definition, the Heath AR-2020 would be entitled to a power rating somewhat higher than the 15 watts per channel claimed since, as is evident in Fig. 7, THD is well below the rated value of 0.5% even at the frequency extremes of 20 Hz and 20 kHz.

Tone control range of bass and treble controls on the AR-2020 is graphed in Fig. 8 and is typical of the action of this type of feedback tone-control circuitry. Signal-to-noise ratio in AUX measured 75 dB, and at minimum volume, hum and noise was 91 dB below rated output. We must take the Heath company to task insofar as their phono hum-and-noise spec is concerned. Like many other manufacturers that we have criticized before, Heath chooses to reference their phono hum spec to a cartridge signal input of 10 millivolts, yet, a few lines earlier, they point out that phono input sensitivity is a mere 2.0 millivolts. This discrepancy can easily confuse the uninitiated, and yet the full story is there if the reader knows how to interpret the figures. In terms of 2 mV input, the hum spec should have been published as −46 dB according to Heath's published spec—not −60 dB. Well, in actual fact, the set is a good deal better than that, since we measured −54 dB based on the 2 mV reference. Translated back to Heath's 10 mV reference, that would be −68 dB—a very good reading indeed and one which Heath needn't worry about. Phono overload was 70 mV, much better than claimed though not as high as we have measured on many other units which use discrete transistors in their preamp circuitry instead of an IC. It should be pointed out that since the phono inputs have adjustable sensitivity (level-set controls are accessible through holes in the chassis bottom cover), this need not concern users of higher-output cartridges who will no doubt decrease the input sensitivity so that reproduced levels match those of the tuner or other program sources. As a matter of fact, the presence of phono input-level controls on such a low-priced unit is quite welcome, since it is rarely found even on higher-priced stereo or four-channel receivers these days.

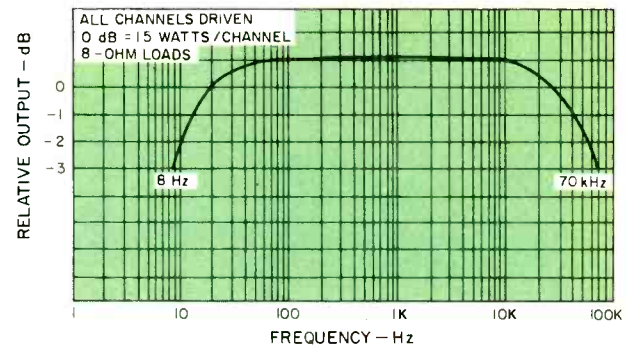


Fig. 6—Power bandwidth characteristics.

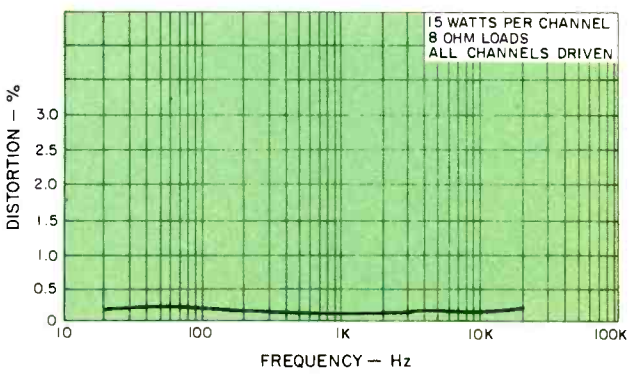


Fig. 7—Distortion versus frequency.

Listening Tests

The AR-2020 performed quite well on both FM and AM. Even using our "standard test" FM stations, which put out relatively weak stereo signals but which aren't bothered by multipath, we were generally able to pick up quite listenable signals. With an outdoor antenna connected, the quality of most of the still marginal signals improved so that they too were listenable.

Power output was sufficient for driving medium to high efficiency speakers, but this is not the receiver to use if you fancy the low-efficiency acoustic-suspension variety of speakers and if your listening room is very much larger than usual. The receiver works nicely with such program sources as discrete four-channel tapes (either from open reel or 8-track), stereo cassette decks, and its own internal radio facilities. Its matrix circuitry is, as we have stated, of the earliest SQ type, so that your enjoyment of SQ and other matrix records will depend to some extent how fussy you are about separation and how willing you are to "stay put" in a preferred listening area in the room. Certainly, the AR-2020 does offer a great deal for its low kit price—plus the joy of building it yourself, and thus is a good answer for those seeking an "easy on the wallet" entry into four channel, though it won't appeal quite as much to those who are seeking the ultimate in four-channel reproduction.

Leonard Feldman

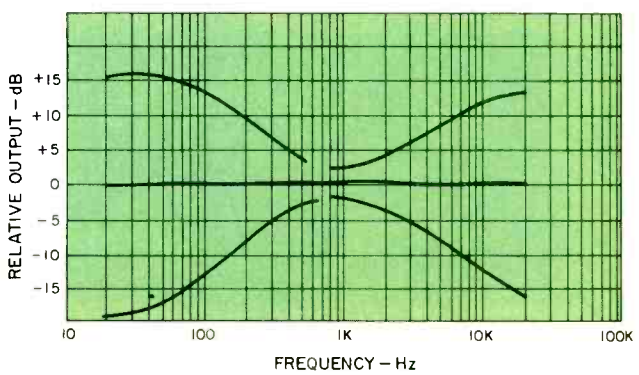


Fig. 8—Tone control characteristics.

INVISIBLE SOUND, SMALL AND BEAUTIFUL.

You probably know ADS for its complete line of high performance home loudspeaker systems. Our top model, the LV 1020 studio monitor, has rapidly become a favorite among dedicated audiophiles and professionals. Now the unmatched open clarity and exact response to the most subtle musical detail, the famous 'Invisible Sound', has been extended into a miniature package!

The new ADS 2001 speaker system brings 'Invisible Sound' into your car, boat, plane, camper, mobile recording van– or wherever music reproduction of the highest quality is needed, space is limited, and only 12 Volt DC is available.

No existing mobile music system can be remotely compared to the high power, bi-amplified ADS 2001!

Engineering breakthroughs begin with the drivers: ADS engineers succeeded in developing a 4" precision woofer, which compares in overall power handling and its ability to move air to a good 6" woofer. This tiny superdriver is matched with a 1" soft-dome tweeter derived from the uniformly excellent model installed in the entire ADS line up to the BRAUN LV 1020 studio speakers.

Sophisticated electronics were necessary to give these speakers their stunning performance. A minimum of 160 W of sinewave power, provided by four independent Darlington power amplifiers, is available for the woofers and tweeters, coupled with electronic crossover networks (active filters), equalizers, and opto-electronic limiters.

The power-supply is a high frequency DC-DC switching converter operating at 25,000 Hz; it provides over 350 watts of electrical power to the amplifiers from an ordinary 12 V battery.

All three components of the ADS 2001 system are packaged in high impact precision metal cabinets, finished in black. The compact power supply/amplifier box can be installed virtually wherever a sufficiently large space is available (trunk, under hood, engine compartment, boat-peak, etc.), and the 7"x4"x4" speaker cabinets have multiple provisions for optimum mounting.

You can experience the 'INVISIBLE SOUND' of the ADS 2001 system at over 200 authorized ADS dealers across the United States. Find out why the ADS 2001 is so powerful yet 'invisible,' just like the legendary LV 1020 studio monitor and all ADS speakers.

For additional information and dealer list write to: ANALOG & DIGITAL SYSTEMS, INC., 377 Putnam Avenue, Cambridge, Massachusetts 02139.

THE ADS 2001

Yamaha YP-701 Automatic Turntable

MANUFACTURER'S SPECIFICATIONS

Motor: Synchronous outer-rotor type. **Speeds:** 33⅓ and 45 rpm. Automatic pick-up and return. **Wow and Flutter:** less than 0.05%. **S/N Ratio:** 50 dB. **Platter:** Diecast aluminum, 12 in. diameter. **Tonearm:** Static-balanced "S" type, gravity center mechanism. **Stylus Force:** 0 to 4 gms. **Shell:** Universal plug-in type; weight, 12 gms. **Cartridge Weight Range:** 5 to 15 gms.

General Specifications

Power Source: Switchable—100,110, 117, 125, 200, 240 V., 50/60 Hz. **Power Consumption:** 15 W. **Dimensions:** 19 in. W. x 16¼ in. D. x 6¼ in. H. **Weight:** 20 lbs. **Price:** $220.00.

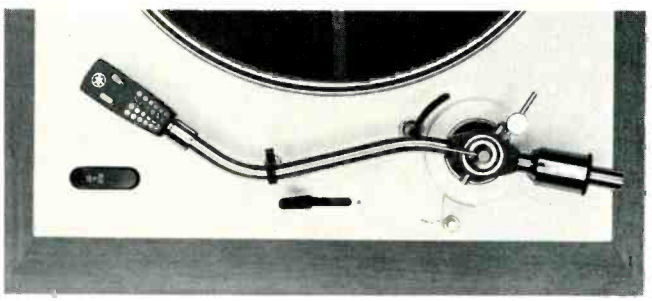


Fig. 1 — Top view of turntable.

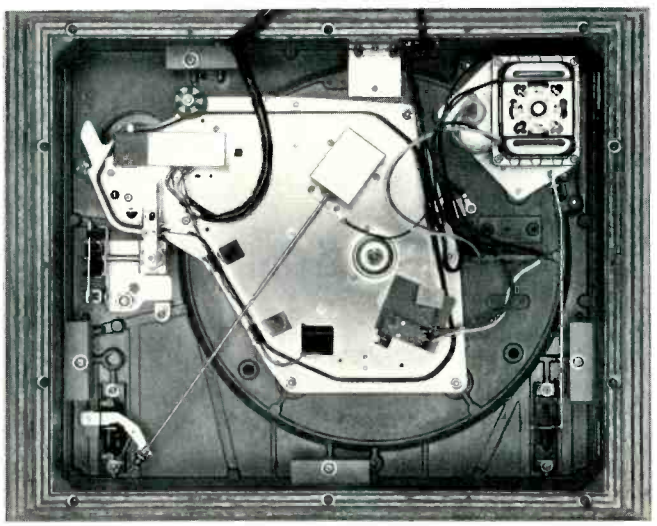


Fig. 2 — Internal view of turntable

It was bound to happen some day. Some company would bring out an automatic turntable that was belt driven—and it finally has. The Yamaha YP-701 has no idler, no stepped pulley on the motor which contacts an idler wheel which in turn contacts the inside rim of the platter to provide the driving power. Instead, the platter is driven by a belt around its rim and around a two-step motor shaft for 33⅓ and 45 rpm, in just the same manner as is often found in professional turntables of the highest quality. (Belt-driven automatic turntables are also being marketed by British Industries Corpration.—*Editor*)

The automatic part of the mechanism is engaged only during the shut-off cycle, and therefore contributes no drag to the platter while it is actually playing the record, which is as it should be. At the conclusion of playing the mechanism is tripped, engaging a nylon gear on the turntable shaft which drives a large gear which goes through the usual cycle to lift the arm and return it to the rest, then shuts off the motor.

The chassis, finished in satin silver, is mounted on a solid plywood base, rubber insulated and damped. The platter is die cast, and fitted with a neatly textured mat. At the left front corner is a toggle which changes speed by shifting the belt from one diameter of the motor shaft to the other, and at the right front corner is another toggle which turns on the motor switch, or initiates a cycle which causes the arm to lift and return to its rest, and then stops the motor.

The arm balancing weight is an unusual feature. Once the actual zero-balance point has been determined, the forward portion of the weight, which turns separately from the rear portion, is set to indicate "O" and then the entire weight is rotated to set the desired stylus force, with the graduations on the front portion of the weight then serving to indicate the actual stylus force, in grams. The arm is shaped in a gentle "S" curve to provide the horizontal balancing which in other turntables is often provided by a separate weight extending laterally from the arm, thus contributing possible confusion as to where it should actually be set for optimum performance.

Anti-skate compensation is provided by a small weight which hangs from a thread over an integral formed-wire support. The cueing lever has a comfortably-sized handle forward of the arm support, and the arm rest has a wire locking device to hold the arm firmly while moving the entire turntable. The perforated light-weight cartridge head is held onto the arm by a bayonet-type locking ring.

Underneath, the chassis is a model of neatness. Of special importance is the well-shielded termination for the external leads which are already prepared for use with CD-4 cartridges, having the low capacitance of 93 pF, in contrast to usual capacitance of the order of 300 pF in turntables not especially set up for CD-4 cartridges.

On the rear of the base is an etched plate indicating the proper orientation of a multi-pin plug which may be inserted for various voltages encountered throughout the world—100, 110, 117, 125, 220, and 240.

A small lever accessible under the platter permits adjustment for frequency—50 or 60 Hz, thus making the unit usable practically everywhere, since 25-Hz line supply is rarely, if at all, encountered anymore.

Performance

Using the CBS BTR-150 test record, wow and flutter was measured at 0.06 %. Separately, wow alone measured 0.05 %, and flutter 9.04%, both of which are excellent. Rumble was measured at -55 dB (NAB weighted) below 3.54 cm/sec at 1000 Hz, also a good figure, even with a high quality turntable.

Since the motor is hysteresis synchronous, its speed was

Today, underdog. Tomorrow, topdog.

We make receivers, tape recorders and speakers.

We're good at it.

Because we've been putting most of our energy into our products. Not our advertising.

After all, if our products weren't any good then you wouldn't want them.

No matter how big our name was.

But the fact remains someone can make the best components in the world and still not sell many of them because not enough people know about them.

That doesn't mean we're going to tell you our components are the best in the world. No one can say that.

What we're saying is this:

We're going to start telling you more about them. But there's going to be no false promises, no empty claims.

We're going to tell you exactly what we make. And how to get the most out of it.

We're going to prove that a sale doesn't end when you walk out of the store.

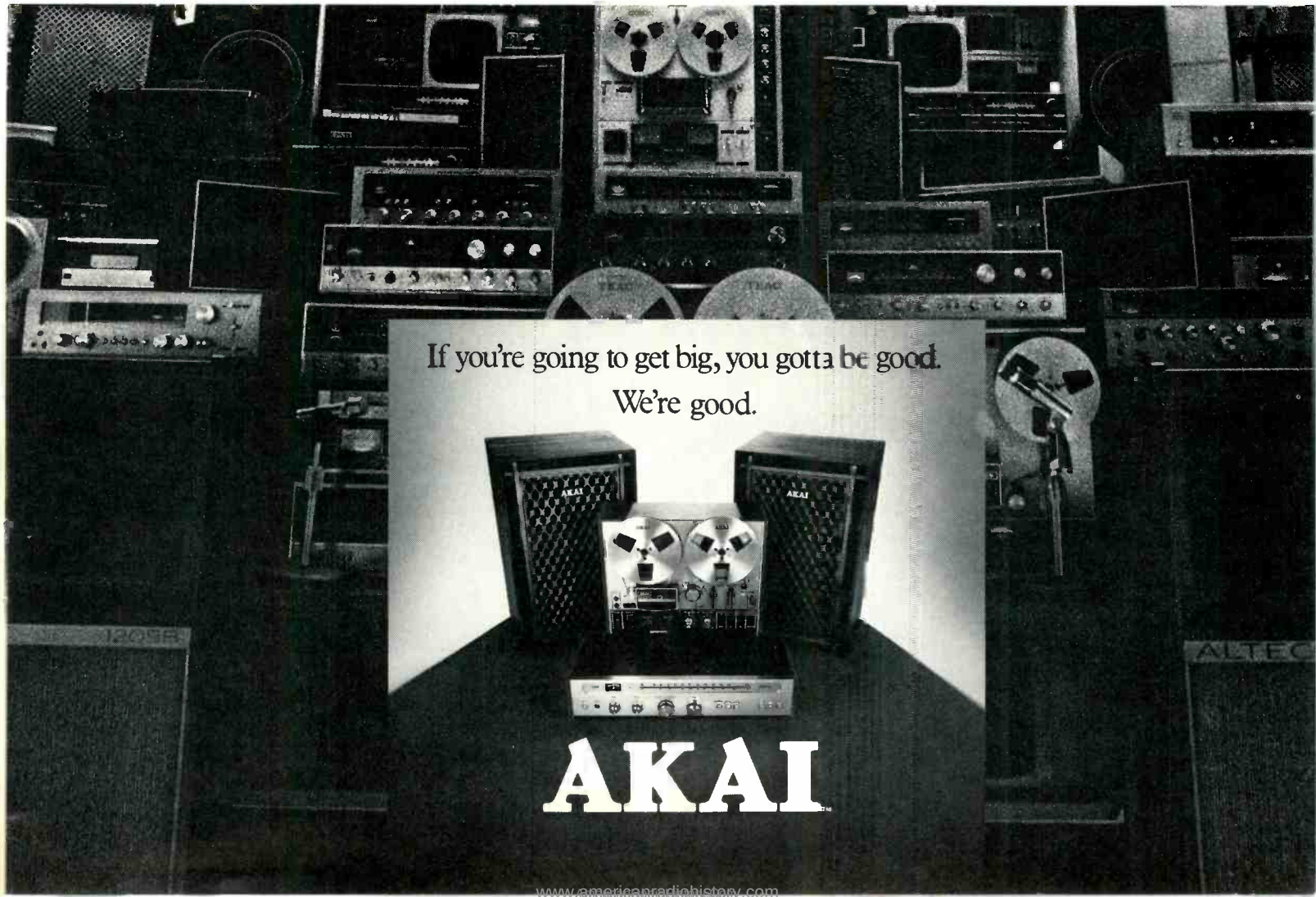
We're going to do some things to shake up this business. And turn a few heads.

We have some big names to compete with.

You know who they are.

So from now on the underdog is going to look more and more like the topdog.

Because that's exactly what we intend to be.



not affected by large variations in voltage, and speed was maintained with the line voltage dropped as low as 30 volts, although reliable operation and the arm-returning cycle required at least 65 volts, much lower than any domestic supply is likely to run.

Operation and handling of this unit was extremely smooth, and while it is not inexpensive, its performance rates high. In order to maintain its high performance, the maintenance kit provided contains an oil dispenser, two screwdrivers, tweezers, two stylus brushes of different types a record cleaner (the usual "cleaning" cloth), and a tube of grease—all in addition to the 45-rpm adapter. With these, the user should be able to maintain the unit's original performance for years. *C. G. McProud*

Check No. 81 on Reader Service Card

C/M Laboratories Receiver RR805

C/M Laboratories of Norwalk, Connecticut, first entered the component high fidelity field some years ago with what were then state-of-the art, basic amplifiers and preamplifiers whose performance and quality was universally acclaimed by the audio fraternity. Many of those early preamps and amps found their way into professional applications, and the name CM Labs has been associated with the superior equipment often found between consumer components and studio-grade equipment. More recently, the company has decided to strengthen its spot in the consumer market by importing consumer products from abroad, and by serving as the sole distributor of recognized high-end products manufactured by others but designed to C/M's exacting standards. Included in the C/M group are Cambridge Audio electronic and speaker system components, LWE speaker systems, and now a line of receivers which includes the Model RR805, a relatively high-powered unit suitable for rack mounting or for installation in an optional wooden cabinet.

The front-panel layout clearly demonstrates that a "professional" look need not be esthetically unappealing in home situations. Major controls are located along the bottom of the panel and include dual-concentric *Bass* and *Treble* tone controls, a *Mode* switch (for *Left-only, Right-only, Stereo, Reverse,* and *L+R*), a six-position *Program* selector, *Balance* control, *Master Level* control, and flywheel-coupled *Tuning* knob. These last two controls use larger-sized knobs for easier grip. A row of 12 push buttons along the center section of the panel takes care of the control functions, *Power* on/off, panel-light dimming, *Speaker* selection (*Main* or *Remote*), *Loudness* compensation on/off, high- and low-cut filters, a pair of *Tape Monitor* circuits, tone-control defeat, and *Audio* and *FM Muting*. To the right

MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Sensitivity: 1.8 μV. **Quieting Slope:** 6 μV for 60 dB quieting. **Selectivity:** 70 dB. **Frequency Response:** 30 Hz to 15 kHz, ± 1 dB. **THD:** mono, 0.3%; stereo, 0.5%. **S/N Ratio:** 70 dB. **Image Rejection:** 100 dB. **I.F. Rejection:** 100 dB. **Capture Ratio:** 1.5 dB.

AM Tuner Section

IHF Sensitivity: 15 μV (external antenna). **Selectivity:** 40 dB. **S/N Ratio:** 50 dB. **Image Rejection:** 75 dB. **I.F. Rejection:** 75 dB.

Amplifier Section

Power output: 54 watts per channel from 20 to 20,000 Hz into either 4– or 8–ohm loads, at maximum harmonic distortion of 0.3%. **IM Distortion:** 0.2%. **Input Sensitivity:** Phono 1, 2.2 mV; Phono 2, 4.0 mV; AUX 1,2, and Tape, 115 mV. **Frequency Response:** Phono, RIAA ± 0.5 dB. **Phono Overload:** 125 mV. **S/N Ratio:** Phono, 65 dB; AUX and Tape, 75 dB. **Residual Noise:** 1.5 mV. **Low Filter:** −10 dB at 20 Hz. **High Filter:** −10 dB at 10 kHz.

General Specifications

Dimensions: 19 in. W. x 5 ¼ in. H. x 17 in. D. (including rack handles, AM antenna extended). **Weight:** 38 lbs. **Price:** $600.00.

Fig. 1 — Rear view of receiver.

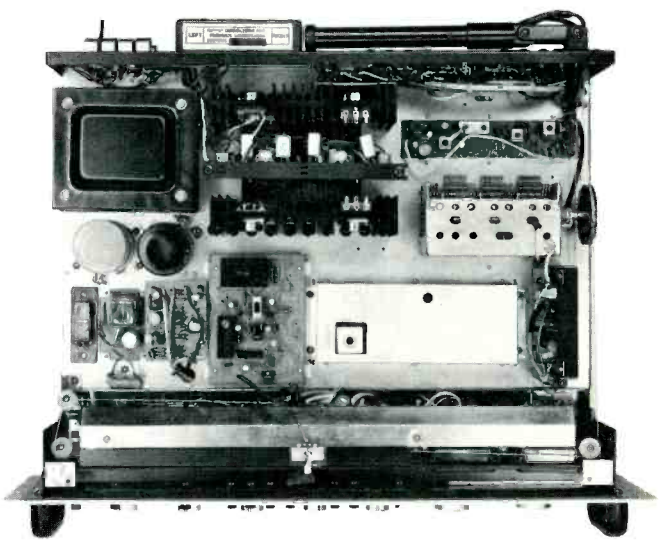
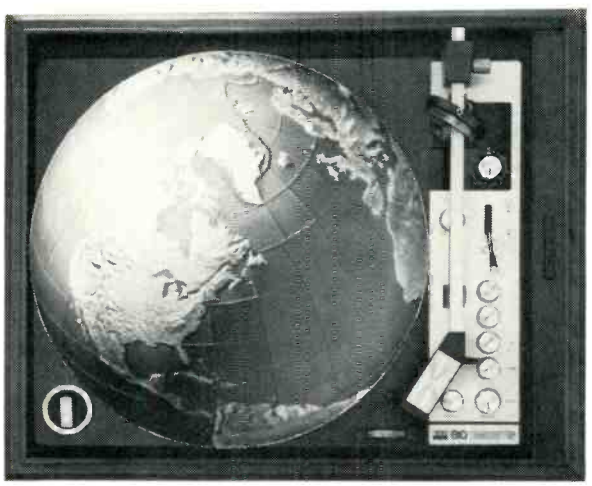


Fig. 2 — Internal view.

4 out of 5
automatic turntables
sold in Britain are BSR.

9 out of 10
automatic turntables
sold in Japan are BSR.

More automatic
turntables sold in the
U.S. are BSR than all
other brands combined.



The fact is, 2 out of 3
automatic turntables
in the world are BSR.

BSR
McDONALD
BSR (USA) Ltd.
Blauvelt, N.Y. 10913

Check No. 9 on Reader Service Card

of these buttons are six tiny lights which indicate the program source selected.

Two normally blacked-out areas of the panel become illuminated only when AM or FM is selected. A linear FM dial scale, a 0-100 logging scale, and an AM frequency scale are then visible, illuminated in soft green, in the larger of the two areas, while the smaller cut-out area to the right discloses signal-strength and center-of-channel tuning meters on either side of the usual stereo indicator light, an LED in this case.

The rear of the unit, pictured in Fig. 1, contains twin pairs of *Phono* and *AUX* input terminals, jacks for *Tape Monitoring* (paralleled by DIN sockets), screw terminals for 300-ohm, 75-ohm, and AM antenna connections, and jumpered *Main Amp In/Preamp Out* jacks for each channel. Speaker connections are made via spring-loaded terminals, which require only that stripped ends of speaker wires be inserted in appropriate small holes which appear when each "key" is depressed. There are individual speaker-line fuses as well as a power-line fuse and a pair of switched a.c. convenience receptacles.

An interesting "first" (for us) is the inclusion of a pair of six-terminal sockets which are identified in the owner's manual as "output connections for feedback loudspeaker systems." LWE speakers systems (now handled by C/M Labs) employ motional feedback and require internal connection to circuit points inside the amplifier with which they are to be used. C/M apparently felt that this requirement discouraged prospective users of these speakers in the past, since few audio buffs have both the technical skill and inclination to get at the innards of their components. By providing these sockets externally, CM will no doubt encourage sales of these companion products. A fully-pivotable AM ferrite antenna completes the rear panel layout.

Figure 2 shows the internal layout of the receiver. Uncluttered in appearance, the receiver's most prominent components are the heat sinks on which the four output transistors are affixed. Two of these output devices have thermal sensing elements, and there is an additional circuit-protecting relay which delays turn-on for a second or two after the power button is depressed. Current limiting is *not* employed, since the designers of the RR805 maintain that it audibly affects performance at high listening levels. One executive of the firm told us, "Our current-limiting circuit consists of two, good, old, reliable speaker-line fuses!"

While no schematic diagram was supplied with our sample, the rather brief preliminary operating instruction booklet spelled out the use of differential amplifier circuitry, and it was obvious from the power-supply configuration and dual filter capacitors that the output circuitry is the direct-coupled type. The driver boards plug in, and may be easily removed for servicing. A four-gang variable capacitor is used in the FM front-end, which is a fully-sealed, separate unit. The i.f. section is also fully shielded, and the stereo multiplex section employs a modified form of phase-lock-loop circuit which requires adjustment of two tuned circuits, as compared with the more usual type which needs adjustment of only a single potentiometer. While the IC-equipped FM i.f. section uses fixed-tuned, solid-state filters, the AM i.f. section employs the conventional interstage transformers and a three-gang variable capacitor.

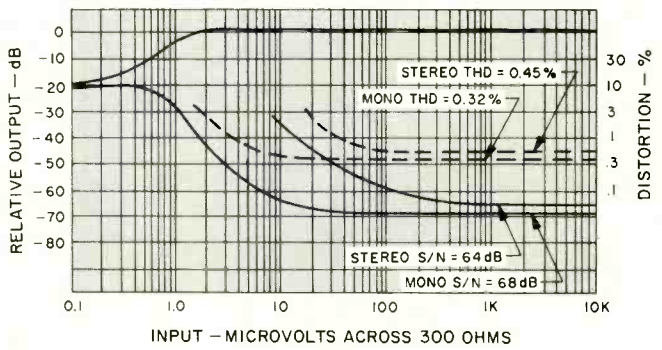


Fig. 3—FM quieting and distortion characteristics.

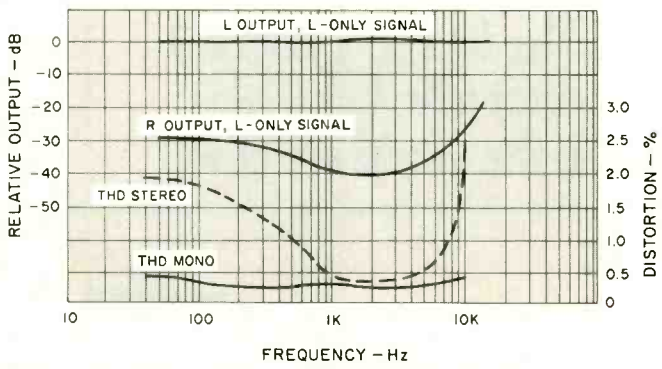


Fig. 4 — FM separation and distortion versus frequency.

Tuner Section Measurements

The FM quieting slope of the RR805 is so steep that 50 dB of quieting is reached with a mere 2.5 μV of signal input in mono. Between 6 and 7 μV produces 60 dB of quieting, though ultimate S/N ratio reached only 68 dB instead of the 70 dB claimed (see Fig. 3). Residual noise measured is not strictly speaking noise at all, but rather a bit of residual hum which at the −68 dB level from 100% modulation has far less audible effect than might be indicated by the −68 dB number alone. If C/M can eliminate this bit of 60 and 120 Hertz hum, our 'scope observations indicate that actual noise might well measure closer to −75 dB. IHF sensitivity in mono measured exactly 1.8 μV as claimed. In stereo, however, automatic switching did not take place until an input signal strength of 18 μV was reached, and there was a transitional region between 10 μV and 20 μV during which reception was "half way" between mono and stereo. The same appeared true of the muting circuit. Muting threshold defeat took place at about 18 μV, and from 10 to 18 μV the

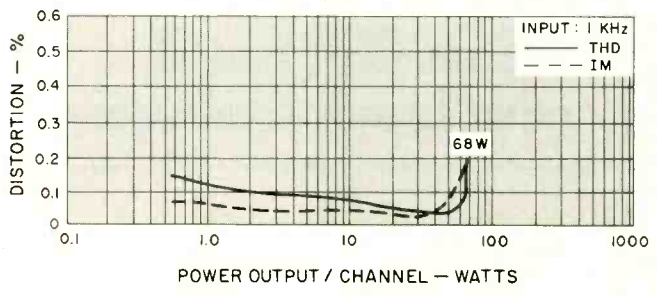


Fig. 5 — Harmonic and intermodulation distortion versus power output.

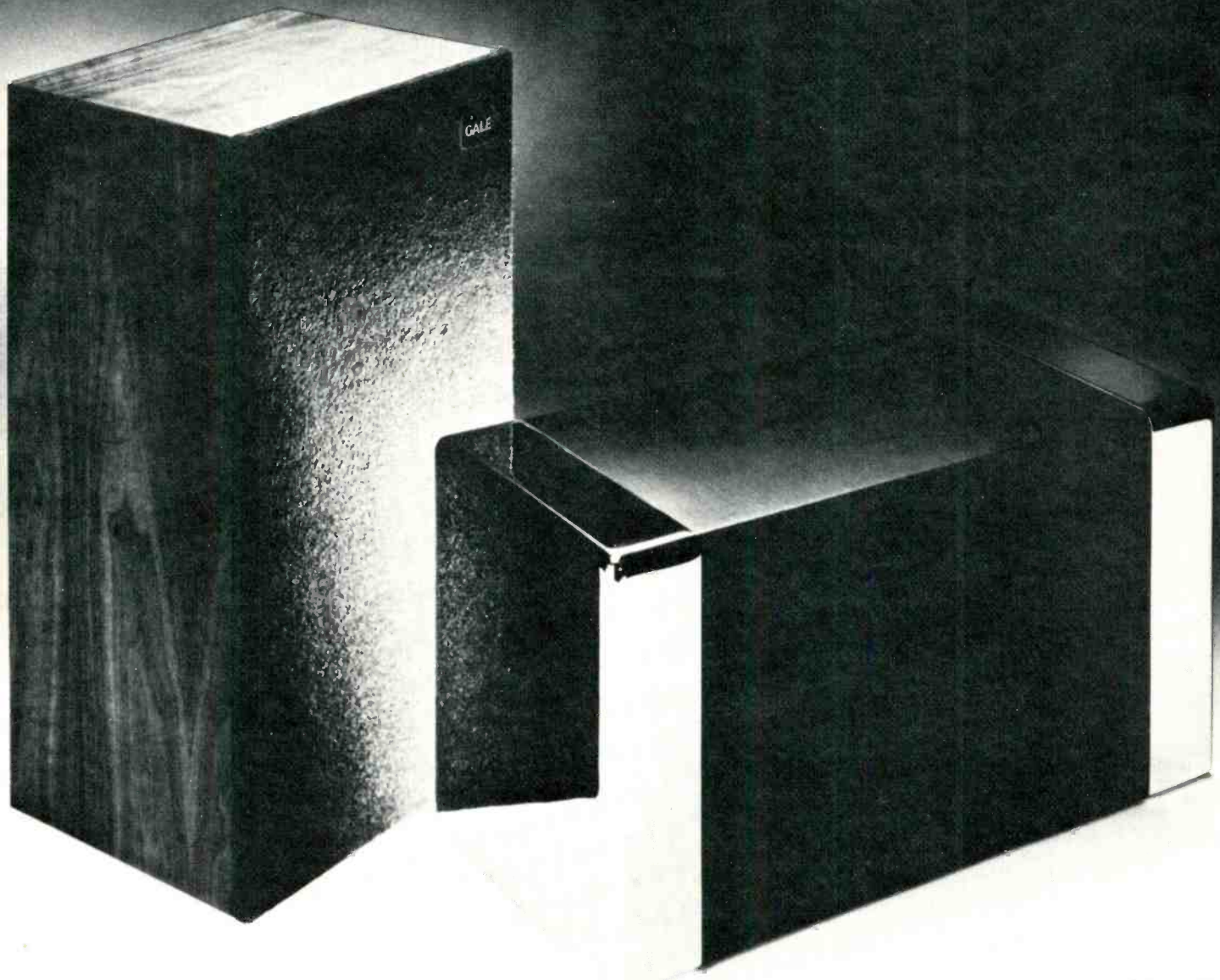
What is the difference between A & B?

Both the Gale GS401A and the Gale GS401B loudspeakers have the same objective: to recreate the most accurate sound possible and still fit into an ordinary bookshelf.

Both combine very low coloration and harmonic distortion with a frequency response extending from 35-25,000 Hertz. Both can handle in excess of 100 Watts in order to generate the high acoustical levels necessary for the realistic reproduction of a large symphonic orchestra or modern rock music.

Both are made in Great Britain and are available from only a limited number of very select dealers.

The only difference is their appearance. The GS401A has an exciting matte black and chrome exterior whereas the GS401B is finished in a hand rubbed walnut veneer and has a more traditional appearance.



For further information and list of appointed dealers, write to Sole Importer / Distributor

Roth/Sindell Box No 49015 Los Angeles California 90049

GALE

Check No. 34 on Reader Service Card

muting circuit was half-activated, producing a fair amount of distortion. We suggest that anyone receiving marginally weak signals with this receiver would be better off disabling the muting with the pushbutton provided.

Harmonic distortion in mono measured 0.3% at mid-band frequencies, as claimed, while in stereo, THD was 0.45%, a bit better than the 0.5% claimed. THD at other frequencies is plotted in Fig. 4. Distortion remained well under 0.5% for all significant frequencies in mono but tended to rise at the low- and high-frequency extremes in the stereo mode. Separation in stereo FM was 40 dB at mid frequencies, as claimed, decreasing to 30 dB at the low end and to about 28 dB at 10kHz.

Capture ratio measured 1.5 dB, as specified, while i.f. and image rejection were 90 dB and over 100 dB respectively. Selectivity measured just over the 70 dB claimed, but we are at a loss to understand the adjacent-channel specification listed in the C/M booklet. It states that adjacent channel rejection is 100 dB — either a misprint or a copywriter's goof. Obviously, if alternate channel selectivity is 70 dB, adjacent channel selectivity (which is the same as adjacent channel rejection and not presently a specification which needs to be published) cannot be any greater! Better print some new literature, C/M!

AM specifications were generally met, though we suspect that C/M engineers may be measuring i.f. rejection at some frequency other than 600 kHz, since at that frequency it came nowhere near the 75 dB claimed. Distortion at 30% modulation was 1.3% on AM.

Amplifier Measurements

If the RR805's tuner section may be regarded as good (and it is), then the amplifier section should be described as superb. It is conservatively rated, even in terms of FTC requirements. It delivered nearly 70 watts of power at mid-frequencies for the rated THD of 0.2%, as plotted in Fig. 5. IM distortion at normal listening levels was even lower than THD, reaching the rated 0.2% level at precisely the same

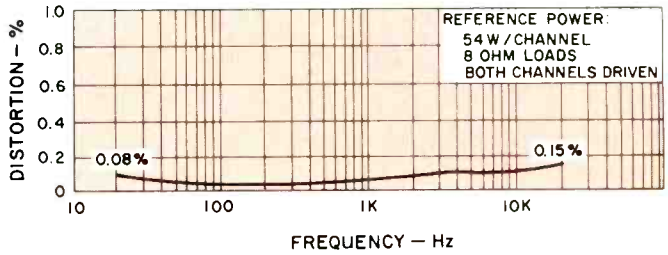


Fig. 6 — Distortion versus frequency.

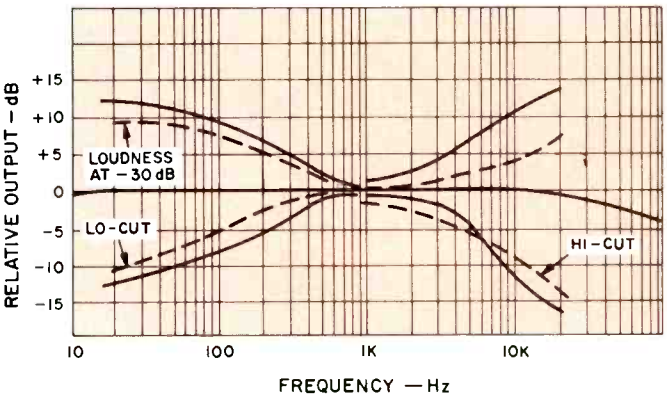


Fig. 7 — Tone-control range, and filter and loudness compensation characteristics.

Your experience has taught you
the things that make a FINE microphone.
Now treat yourself to a
test experience with the FINEST.

ASTATIC 800 SERIES

CARDIOID AND OMNIDIRECTIONAL

MICROPHONES

Ask your nearest Astatic Distributor or
write direct for a trial installation.

THE BIGGEST NAME IN
PHONO CARTRIDGES, NEEDLES, MICROPHONES

THE ASTATIC CORPORATION / Conneaut, Ohio 44030 U.S.A.

In Canada: Canadian Astatic Ltd., Scarborough, Metro Toronto, Ontario

Export Sales: Morhan Exporting Corp., 270 Newton Road, Plainview, New York 11803, U.S.A.

Check No. 3 on Reader Service Card

power output as was the case for THD, 70 watts. At nominal 10-watt levels, THD was a low 0.082%, while at wideband rated power (54 watts per channel), THD was 0.041% at 1 kHz.

Figure 6 discloses that C/M might well have rated the amplifier at more than 54 watts per channel over the spectrum from 20 Hz to 20,000 Hz, since at that power level, THD measured only 0.08% at 20 Hz (the usual limiting frequency for all such measurements) and 0.15% at the high frequency extreme of the audio band.

The measured preamplifier and control characteristics were excellent too. Optional signal input sensitivity (2.2 mV for the *Phono* 1 inputs and 4.0 mV for *Phono* 2) is a welcome feature in view of the rather wide range of outputs available from currently-popular phono cartridges. Of course, this approach rules out the use of two turntable systems equipped with identical cartridges if equal gain is desired from each. Overload distortion occurred at 145 mV for both phono inputs, somewhat better than the 125 mV claimed by the manufacturer, and RIAA equalization was within 0.25 dB from 50 Hz to 20 kHz and was within the stated 0.5 dB down to 30 Hz. Frequency response from high-level inputs to amplifier output, with tone controls set either flat or defeated was within 1 dB from 5 Hz to 20 kHz and within 3 dB from 3 Hz to 90 kHz, indicating that C/M engineers subscribe to the "extra wideband response" philosophy of audio amplifier design. Hum and noise was down 62 dB with respect to input sensitivity for *Phono* 1 (referred to full power output); 66 dB with respect to the *Phono* 2 inputs. *AUX*- and *Tape*-input hum and noise was 73 dB below full putput, referred to nominal 115 mV input sensitivity for these high-level input positions. Residual noise was 83 dB below full output, which corresponds almost exactly to the 1.5 mV of residual noise claimed by the manufacturer.

Figure 7 shows the range of bass and treble tone-control action as well as filter and loudness compensation characteristics. Both low- and high-cut filters have a 6 db-per-octave slope which, in itself, is not objectionable. However the cut-off points for the filters are set too close to the mid-band and thus they are not much more effective than the already-available tone controls. Loudness compensation at the −30 dB setting of the master *Level* control is also plotted in Fig. 7 and affects high-end as well as low-end response.

Listening Tests

The RR805 was hooked up to a pair of acoustic-suspension speaker systems of medium efficiency and produced highly satisfactory performance in phono and generally-creditable results when tuned to our favorite FM stations. Frequency calibration was accurate in both AM and FM, and the zero-center tuning meter was correctly calibrated to indicate proper tuning at the point of lowest distortion. Played at fairly loud listening levels with peaks just below clipping levels for more than two hours, the unit showed no sign of overheating. The same was true for the FTC one hour preconditioning test at one-third rated power with a fixed frequency input. Clearly, distortion levels as measured for the RR805 are not audible in listening tests, so that most of our subjective evaluation of this receiver's performance had to do with its ruggedness of construction, ease of control function and use, control flexibility and features, adequacy of input and switching facilities and overall reliability. From our encounter with the C/M RR805, we rate the unit high in all these qualities. *Leonard Feldman*

Check No. 83 on Reader Service Card

The Column

Fred DeVan

Dragon Fly: Jefferson Starship **Grunt BFD1 0717,** stereo. **BDL1 0717,** CD-4, $5.98.

Sure, the Starship is still playing and singing about riding tigers and such, but I don't think their trip is just nostalgia. They tell us that in the summer of '75 everything is going to come alive. I sure hope they are right. **Dragon Fly** is the best and freshest album to come out of The Airplane/Starship Family in some time, with one exception, that exceptional Jorma Kaukonen beauty titled **Quah (Grunt BFL1 0209).**

I do miss Jack Cassidy, but Pete Sears is no slouch and works just great. Papa John Creach maintains his total mastery of the music of the Starship, even better than does the extraterrestrial Kantner-Slick-Frieberg-Balin family. He is superb throughout the album. The lyrics on **Dragon Fly** are superior, and unusually meaningful for the San Francisco crew. For a change I am glad they are here, though since I happen to like almost everything they do, I am really being hypercritical. If I were able to be this hard on the Starship all the time, I am sure I would not be so satisfied with what they do. The one cut I certainly am not totally happy with is *Come To Life.* In fact it never does what the title says. Well, when you are real superstars, what the hell! The rest, especially *Ride The Tiger, Be Young You, Caroline,* and most of all *Hyperdrive,* are what make it a good album. Grace is Grace and that's fine. What keeps it from being a *great* album is the sound (let's face it—John Barbata is lazy, so let's not pick on him). The sound is anemic, in fact weird. The dynamics are limited, and it mushes together a bit. I was about to throw all kinds of stones at RCA's CD-4 folks, blaming them for poor engineering, but this is the Starship, and what else is new?

Sound: B Performance: B

Temple of Birth: Jeremy Steig. **Columbia KC 33297,** stereo, $5.98.

One of the most notable aspects of any Jeremy Steig album is that when you first hear it, it is always fresher than whatever you have just listened to. In the 12 years that I have known his music Steig never stood still, and here he is really very much in motion. He and his band travel from rock to jazz to a very heavy dose of Eastern, and yet clearly hold on to their very definite identities. All of them easily qualify as stars. They are Jeremy Steig, Richie Beirach, Anthony Jackson, Alphonse Mouzon, Ray Mantilla, and believe it or not, Johnny Winter.

Except for Johnny Winter, and maybe Alphonse Mouzon, none are exactly household words. All can be described in a word, great. Richie Beirach did the keyboards of **Lookout Farm**: Dave Liebman, **ECM-1039** and he is here, as he was with Leibman, piano perfection. Of all the younger keyboard men around, Richie and Mike Mandel (Larry Coryell's Eleventh House) are the two I admire most. Here he is just splendid; the record could not happen without him (or any of the others). Anthony Jackson is the best young bassist I have heard lately. This is the first recording I have heard him on and it almost lives up to what I have heard in live performance with Michael Urbaniak. He is very solid and funky on this album. Alphonse Mouzon has the biggest set of drums the world has ever seen and uses them better than you can possibly imagine. Always taut and precise, Alphonse cooks flawlessly, with taste and flourish. No matter where or how you hear Alphonse, be it here, with the Eleventh House, on his own solo albums (**Essence of Mystery, Blue Note LA 059-G; Funky Snakefoot, Blue Note LA 222-G; Mind Transplant, Blue Note LA 398-G**), his older recordings with McCoy Tyner, or standing on the corner in front of the Bottom Line club in the Village, he brings quantity and quality, both musical and personal. Alphonse is also a very imposing drummer. Not that he's loud—it's just that there's so much of him.

Ray Mantilla has ten of the fastest fingers ever to touch a conga, though this fine percussionist is, in a way, outpaced by Jackson and Mouzon. He's just enough to bring the rhythm unit to unbelievable tightness, especially on *Ouanga,* where he and Mouzon put a solid floor under the best Johnny Winter solo in recent years! Ray never gets really out in front, he just blends like a silver thread in a fine, old silk Jacquard.

Johnny Winter! Yes, jazz fans this is not a jazz record. Sorry, rock-and-rollers, you won't recognize Winter,

it's not a rock album either. And since there is not a bevy of synthesizers, and no horns, what is it? MUSIC! That's what! And that is all Johnny Winter plays here. Forget who he is and all you hear is a different kind of guitar playing than you'd expect on a crossover album. A bit of competent playing by a guitarist who works hard to keep up with the fine company he's keeping, and succeeds. So what if he wore a top hat during the sessions?

That leaves us with Jeremy Steig. Incredible! There are no limits to the man. He and his flute romp and stomp on *King Tut Strut*. He slides and wails, his notes sing and dance. He starts a line of runs that are completed by Jackson and Winter on that totally unbelievable cut, *Ouanga*. I keep coming back to that cut because it lets everybody work as a unit with each making many individual contributions to a masterpiece. In fact, each one of their performances here are individual masterpieces. This one cut is about the drivingest, richest, totally inventive piece of music I have heard in 1975.

The meek should not try this one; it will make your speakers swat flies with raw acoustic power. The power is not, however, watts, it's musical energy. Jeremy gets into eclectic key-tickling with Winter's acoustic guitar on *Mountain Dew Dues* and just plain romps on *Goose Bumps* where he finds Mouzon and Beirach in really fine form. Steig, Beirach, and Jackson leave all the space in the world for Mouzon by all playing the melody line. With Mantilla taking care of timing chores on *Belly Up*, Alphonse races around like a hundred very musical machine guns. The flash of his drumming technique is secondary to the fantastic musical things he does.

With all this, how can Jeremy lose? He does *Temple Of Birth* and *Repunzel* with Richie Beirach only. Exquisite! Jeremy and company simply pull out all the stops on *Shifte-Telle Mama*, and Steig decides to show us all the things we did not know you could do with a flute. Totally overwhelming.

So there you have it folks. The most musically perfect record, the best performances by individuals and by them all as a unit, so far this year. Not to be forgotten is producer John Hammond, record-maker extraordinary. His production and the sound are utterly flawless. The frequency response and dynamic range are about all that can be put on today's adulterated vinyl. Other than noise (this disc is very quiet), this is the best that ever gets to the turntable. I would like to see an SQ version. It would have to be incredible. Get with it, Columbia, this record is too good to wait for a separate release. After all, it was in my hands for less than 24 hours before this next period was typed.

Sound: A+ Performance: A+

King Biscuit Boy: Richard Newell
Epic KE 32891, stereo, $5.98.

This record has been around my place a long time, and played constantly. It was hard to approach, because of its style, the backup group, and because of "Biscuit" himself. This Biscuit Boy has another name, Richard Newell. He is a Canadian, and this is his first album for Epic. He's been described as the finest harp (mouth harp, or harmonica, if you will) player in the world. He sings pretty well, too.

The style, which had me stymied for a while, could best be described as Rock-a-Billy-Gone-New Orleans. The Rock-a-Billy is Biscuit's, and the New Orleans influence is Allen Toussaint and The Meters. Toussaint is the arranger and producer of this album, and The Meters are a superb support and backup band—all of Dr. John's

band (minus Dr. John himself). I love Dr. John, but this is not just imitation Dr. John. He does *his* thing, King Biscuit Boy does *his*, and they are as different as can be. And The Meters do *their* thing with impeccable agility and flair in making this record hang together for Newell. Above all this soars King Biscuit Boy, his harp playing fine, and his under-rated voice strong and distinctive. He is an impressive artist—you have to be, to coexist with Toussaint and The Meters.

Because I like Newell's work so much I set out to explore his origins. My curiosity turned up more than I thought was there. Biscuit has been around for years, mostly in Canada, and is known well there. He also has three U.S. releases on Paramount, only one of which I've been able to find so far. **King Biscuit Boy With Crowbar** (PAS-5030). Crowbar now has an album on Epic also: **KE 32746** (That not only is the album number—it is also the name of the album!). Crowbar is a good rock boogie band, but Biscuit seems to really come into his own with The Meters.

But back to this album. The first cut on **King Biscuit Boy,** *Mind Over Matter,* is a real winner. The rest of the album, 9 more cuts, keeps up with it just fine—never a dull moment. But I just want to keep hearing *Mind Over Matter* as often as I can. Rock-a-Billy is coming on strong with such artists as B.W. Stevenson, but Biscuit Boy really has the lead in bringing many elements into focus around him and having new form that really allows more of us to appreciate the music he is making. **King Biscuit Boy** is a real winner. I hope you like it as much as I do.

Sound: B Performance: A

Live It Up: The Isley Brothers
T-Neck PZ 33070, stereo, $6.98.

The Brothers Isley have been typecast and mismarketed by almost everybody. Their music does not get played on many radio stations because of their disco, R&B image. Many of us, myself included, almost never hear the Isleys unless we go buy their records. I have waited anxiously for every Isley album to appear and admittedly there was a period of drought, but to me they attained super-star status long ago. Their sales, bank book, and life style turn my attitudes into facts.

They are really a family. They live quietly and away from the madness of the music business, as a true family. They are the only act on their own record label. Their management and activities are family business and con-

cern. Their product is a real one, and it is superb. They are their own producers, arrangers, and much of the time writers. They are one of the most commendable musical resources in the business. You just don't play games with the Brothers Isley. The Isleys don't play games with us. They make music. When you plunk down your inflation-ridden bucks for a record you get back a more than equal chunk of energy, artistry, and class. The Isleys are always the remote, private, elusive wonders of Black music. As a unit they are multi-styled enough to include all at once the best rockers, the best balladeers, the best R&B, the best male vocalist (Ronald Isley), the best rhythm section (everybody), the best young guitar wizard (Ernest Isley) and among the best interpreters and best writers of songs. They have been doing all this for over 20 years. Even though they're among the best-selling groups, they've kept a low profile (visibility). Their audience is a very dedicated group, but since they seldom perform live any more, and this is their first album in 20 months, they are even more invisible (publically) than Led Zeppelin. They are almost in the Carol King performing class. When they do appear, they put on a fantastic performance, one that includes the audience and leaves a room full of smiling people shaking their heads in disbelief from the stunning effect of the Isley's energy and ability to create sheer joy. Alive or on a record, an Isley Brothers performance is always flawless.

Such is the case for their newest album. Unfortunately you can't talk about **Live It Up** without talking about the one before this, **3+3. (T-Neck 2Q 32453).** That was their biggest success, and it even got their names in magazines once in a while. **3+3** is one of the best four-channel records around! Musically and emotionally it is an unending masterpiece. *That Lady* is its star song, but don't let this cut's magnificence deter you from the whole album. **3+3** was an awesome record. It will probably take years for a superior disc to be created. So what do you do in the mean time? The Isley answer is to **Live It Up,** and the title cut itself does just that. It romps and lopes in a repetitious way, doing just what its name says. It is not exactly the best lyric in the world, but it is the only way to deal with today. The rest of the album goes from yesterday through tomorrow. Most of all the album is a showcase for the vocal capabilities of Ronald Isley. Ronald has long been one of the finest male vocalists of any kind, but so has the whole bunch of them been among the finest.

Jimi Hendrix was once an adopted Isley and the Hendrix mark remains on their music as strongly as theirs on his. When the Isleys rock as they do so well on cuts live *Live It up* and *Need A Taste Of Love,* they need take a back seat to no one.

Ronald takes *Hello It's Me* and teaches Al Green a few lessons about how to do what Al Green does best—better than Mr. Green has been doing it lately himself. Ronald's voice is one that many have attempted to copy over the years. His sound is solid, yet smooth and stylistically fluid, his tone rich and mature.

Ernie had flashier moments on **3+3,** but on **Live It Up** he is consistently strong, and, as usual, extremely fast and inventive. The rest of the band is, also as usual, superb.

So forget the disco quality of the Isleys and enjoy the music of the finest practitioners of that music today. The sound quality is perfect. You literally hear everything and everything is as right as it can be. Twist the volume knob as far up as you can stand it and *Live It Up!*

Sound: A Performance: B+

When the Eagle Flies: Traffic
Elektra/Asylum 1020, stereo, $6.98.

A very comfortable, gentle, lovely album from a reborn Traffic—a smaller, lighter group than it was before. This is a very difficult record to review. I have listened to it dozens of times without tiring of it. This album is sure to become a classic of its kind, of the current crop of laid-back English bands.

The new group is a quartet of decidedly bluesish background with a style not reminiscent of anyone or anything else, not even previous Traffic incarnations. Steve Winwood's sparse keyboard work is beyond reproach. His lines are thoughtful and developed to a degree of precision and eloquence uncommon in Rock or Jazz. Jim Capaldi's drums serve well to establish the temper of the band and his economy sets up everybody for the haunting, almost eerie rhythm lines that he, and bassist Rosko Gee use to weave their spells.

Rosko Gee is Traffic's newest member and one of the musical finds of the year. Jamaican Gee's bass playing is firm and smooth, his textures fitting well with Capaldi's drums. The two play together like lilting metronomes. Chris Woods' electronic woodwinds are open, with lots of air and space, sometimes very subdued, melting into the fabric of the music like fine silver threads. It's hard to tell when Chris switches to keyboard, but it's also hard to imagine a quartet such as this, almost symphonic in textures and thematic development, as on *When the Eagle Flies.* The vocals fit notably into the intense instrumental frameworks. There is not a redundant line, an extra word, a misplaced beat, or a drop of superfluous energy anywhere. In short, it's flawless.

Chris Blackwell and Traffic have produced the album to perfection. But the kind of chemistry that brought this about has an eclectic mystery and undulating vitality that is a tribute to sensitivity and musical awareness which is seldom allowed to create so freely. The intelligent free form, modern classical allocation of space and time allows form to seek its own level and is typified in the 11:03 minutes *Dream Gerard. Walking In The Wind* is my favorite (if there is such a thing as favoritism on a record I regard as highly as I do this one) although it would be a hollow bit of trivia, if it weren't that every beat is a stroke of genius. The sound of this disc is as clear, clean, and perfectly balanced as the thoughtful ear of Chris Blackwell could make it. When power is desired it is there in resplendent clarity. When finesse and delicacy is the call, the sound fabric is gossamer.

It plays back perfectly through any kind of matrix decoder. Full-logic SQ and vario matrix QS sound equally rich and clean, though the locations of instruments differ, and the degree of blend between front and rear varies. No two-speaker playback can match the sonics available from this record through a matrix decoder. The information in this "stereo" record is a real ear opener with the enhancement provided by adding matrix quad.

How Traffic will top this one is a real question. Alas, I may indeed be disappointed by the next Traffic album. But then again they may have more of the same waiting in the wings.

Sound: B+ Performance: A+

Snow Flux: Steppenwolf
Mums PZ 33093, stereo, $4.98.

Slow Flux competently displays some good topical material and the group's usual pragmatism shows up well on *Justice Don't Be Slow.* But this album is just not up to the eloquence and distinction of **For Ladies Only** (Dunhill DSX 50110), which is to me *the* definitive Steppenwolf album.

Many single cuts from other albums such as *The Pusher* from their first album, **(Steppenwolf,** Dunhill S 50029) are incredibly good, but it will be hard to find another record that holds together as well as **Ladies.** *Slow Flux* is an example of the basic problem, how do you top a fantasticly good record? Steppenwolf did not do it this time, but it's really good to see them back again, and sounding fine.

Sound: B+ Performance: B

First: David Gates
Elektra 75066, CD-4, $6.95.

One of Elektra's first CD-4 Quadradisc releases, this is unquestionably the best CD-4 recording since Carly Simon's **No Secrets.** David Gates was once a part of the **Bread** group, and on the basis of this recording, I'd say he can fly solo with complete confidence. He has a pleasant voice; quite smooth, with good articulation. His big-scale orchestral accompaniment is very well arranged, with obvious forethought for the medium. Plenty of clean impressive sound here, and good separation with room-filling spatial presence. Levels were apparently normal, bass almost gut-thumping. This is CD-4 at the zenith of its present technology.

Advertising Index

Canby's Capsules

Edward Tatnall Canby

Clazzics?

Two Sides of William O. (Bill) Smith. Concerto for Jazz Soloists & Orch., Variants; Mosaic. Orch. U.S.A., Gunther Schuller; R. Suderberg, pf. **CRI SD 320,** stereo, $6.98.

Bill Smith is a "third stream" jazz-clarinet powerhouse, right in with all the contemporary-music power centers. The jazz concerto is hard-modern, tough, complex tone-row jazz but good. The other works, NON-jazz, exploit strange clarinet double tones, solo and with piano. I found them ultra-ugly but you may not. He's some clarinet!

Scott Joplin—His Complete Works. Richard Zimmerman, pf. **Murray Hill 31079** (5 discs), stereo-QS. *(419 Park Av. South, NYC 10016)*

Well, this ought to hold 'em! The works, and Zimmerman is OK, playing straightforward, non-fussy, solid Joplin, rather slow but nicely massive to make up for it. Good piano sound and *this* QS (?) sounds good on QS.

Rags, Blues, the Boogie Boogaloo . . . And A Sweet Goodnight Amen! Montgomery and Lytle, duo pianists. **Klavier KS 533,** stereo, $6.98.

Such a title! Fat, two-piano rag arrangements (mostly, and the first side is mostly Joplin), not unlike Zimmerman's one-piano sound, above—steady, slowish, solid and non-precious. Good. And good recording, too—NOT from piano rolls! dbx processed, and a dbx coded disc is available if you have a decoder.

Dick Wellstood and His Famous Orchestra Featuring Kenny Davern. Chiaroscuro CR 129, stereo, $6.98.

Well, *this* is no clazzic, but I thought I'd better let you know. The "famous orchestra" is Mr. Wellstood (sitting) at a solo piano and the "feature" is a potent saxophone. Sax & piano throughout, in old favorites. Take it away.

Old Songs Deranged. Charles Ives Music for Theater Orchestra. Yale Theater Orch., Sinclair. **Columbia M 32969,** stereo, $6.98.

These humorous but biting little pieces, high satire ("Gyp the Blood or Hearst!? Which is Worst?!") were fragments left more or less unfinished, here newly "realized" for practical performance. Fun, and plenty original, but not very profound stuff as music. All the Ives favorites—*Star Spangled* (Mangled) *Banner,* old-timey dance tunes, gospel, maybe a Stephen Foster or two—you name them, mostly addled to a fair-thee-well in three keys at once.

The Greatest Sound on Earth! The Fantastic Philadelphia Orch. . . . Fabulous Virgil Fox, etc. Saint-Saens: Symphony # 3 for Organ and Orch. RCA ARL-1 0484, stereo, $6.98.

A circus cover tries awful hard to make this into pop music, just as the Great Virgil himself pops his way through Bach and all; but what we have here is no clazzic but straight, pure *classic*—even the Rodgers Touring Organ, 4000 lbs., 144 speakers, which sounds like, well, an organ. What else? It isn't a bad performance by any means, and very, *very* classical. I suppose it'll sell another million copies to the kids.

The Great Exhibition 1851. Apollo Society; History Reflected. Various readers. **Argo ZPR 109/110** (2 discs) stereo, $13.96.

A curious blind spot here—this is strictly a literary recording, though you'd never know it from the colorful cover. The Exhibition as talked, or written, about by British poets, authors, letter writers (Queen Victoria. . .). Very poetic and all that, but scarcely a word about the Exhibition itself! Dickens, Wordsworth, etc. Classical-music bridges. Actorish readers.

Beethoven: Violin Concerto Op. 61. Henryk Szeryng; Concertgebouw Orch., Haitink. **Philips 6500 531,** stereo, $7.98.

The broadest and most leisurely of Beethoven's big works after the *Eroica* (the first movement takes a full side) gets a fine, unhurried, ultra-clean treatment here, solidly Dutch, vibrant in sound; Szeryng plays along beautifully. No heroics, and the music is the better for it.

Beethoven: Piano Sonatas Op. 53 ("Waldstein"), Op. 109. Antonio Barbosa. **Connoisseur Society CSQ 2068,** SQ quadraphonic, $6.98.

South America is sending us superbly trained European-style pianists—this one a protege of Claudio Arrau. He is excellent, a thoughtful, highly musical player and easily up to these big works. Connoisseur's usual resonant big piano in SQ ambience is a pleasure to hear.

Classical Reviews

Edward Tatnall Canby

Bartók: Concerto for Orchestra. Boston Symphony, Kubelik. **Deutsche Grammophon 2530 749,** stereo $7.98.

Here is the now-familiar Bartok tour de force for orchestra played by the orchestra for which it was originally commissioned by Serge Koussevitsky in 1943, and in the very same hall where the premiere occured in December of 1944. As I listened, I kept wondering how many of the present BSO players actually "created" their roles in this work in that first performance just over thirty years ago? Surely a few of the older members! History marches on.

Koussevitsky is long since departed and now it is Raphael Kubelik, of the central European tradition. No longer that Russian-French aura, out of Paris, which brought so much colorful new music to Boston in the pre-war years. In contrast to Koussevitsky, Kubelik is somehow rather sober; I miss much of that crackling electric tension which is the vital element in Bartók. (Maybe I was spoiled by the gigavolts of the Fritz Reiner version for RCA in Chicago, on early stereo.) Nothing is really *wrong* here. It's just that things get started rather slowly and in a perceptibly leisurely fashion, with much attention paid to the marvelous details of Bartok's orchestration (aided by ideal recording).

Yet Kubelik does have a plan. By the time the later and shorter movements come along, the voltage has definitely moved up and the celebrated Intermezzo, a sort of scherzo with its central portion a bitter take-off on Shostakovitch's Seventh Symphony, complete with raucous orchestral laughter, is done with as great intensity as I have ever heard. The finale comes to a rousing climax at a much-more-than-sober pace. Definitely, this is one way to do the music. And there has never been a recorded version which brings out so much of the inner orchestral texture.

Beethoven: Sonata Op. 106, Hammerklavier; Diabelli Variations, Op. 120. Webster Aitken, pf. **Delos DEL 24101/2.** 2 discs, stereo, $13.96.

Webster Aitken was a familiar name among American pianists a dozen years ago. He hasn't been playing much lately, though it seems he is still around, now in his later years. These recordings, made "live" at a series of

recitals at the University of Illinois in 1961, explain why, perhaps. The man simply burnt himself out, or almost.

Such incredible intensity you have never heard from any other piano! Not only speed to burn, recklessly accurate, but white hot emoting, absolutely raging. How could one human being produce it? Like cramming 10 years of life into a few moments.

Since that, in effect, is exactly what Beethoven did in these enormous late works, the effect is extraordinary. Man meets music, conquers all. There have been more controlled, more dispassionate, more architectural performances, of course. But these are memorable to a degree that perhaps old Artur Schnabel alone could reach—though his playing was totally different.

The sound is unusually good for a live recording. No interfering applause at beginnings and ends, and the inevitable coughs and sputters have been removed with extraordinary care. You are not aware of the audience at all, until the end of each piece, when it comes in like thunder—as indeed it should.

Handel: Arias from "Rinaldo" (transcr. for harpsichord). Edward Smith, harpsichord. **Musical Heritage MHS 1855,** stereo (mail order). 1991 B'way, NYC 10023.

Jacques du Phly. Piece de Clavecin. Edward Smith, harpsichord. **Musical Heritage MHS 1967,** stereo.

Edward Smith is solidly American in his rather high tension playing, though it is admirably controlled and shaped. The MHS recording is for my ear a bit too close to the machinery of the harpsichord, making it somehow more boisterous than pure and undefiled. Matter of choice. The Babell-Handel transcriptions are highly interesting, having been published in 1717 when Handel was still youthful and relatively new in England—he died in 1759 and the **Messiah** came in the 1740s. Already, his first opera in England, **Rinaldo** was famous enough for the tunes to get around.

These are highly ornamented versions, perhaps somewhat as the actual singers sang them in that freely improvising time, but more or less standard harpsichord fare as we now know it. There is a lot of virtuoso in a good many of these, and one especially, *Vo' Far Guerra,* turns out to be an immense solo concerto piece of extraordinary impact, on the scale of Bach's **Italian Concerto** or the big cadenza in the **Brandenburg Fifth.** Evidently Handel himself improvised this sort of bravura music between the

segments of his own concerts and operas, to enormous acclaim, and rightly.

As for the curiously named du Phly, he was born into the French school of Couperin and Rameau, a minor teacher and composer on the Paris scene who writes first like Rameau himself—who else?—then, as time passes and styles change, transforms himself into a near-*galant* composer, heading towards the Mozart-Haydn style. Right up to date! But pleasant music, whatever style he is borrowing. Oh yes—a lot of Scarlatti too. He took what he found, this man. Just like most people.

Tchaikovsky: Symphony No. 4. Philadelphia Orch.; Ormandy. **RCA ARD1 0665,** CD-4 quadraphonic, $6.98.

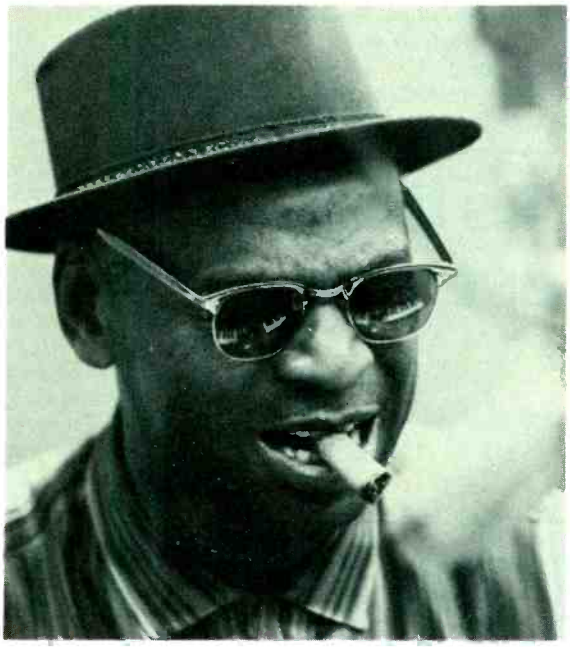
Tchaikovsky: Symphony No. 6 ("Pathetique"). London Symphony Orch.; Stokowski. **RCA ARD1 0426,** CD-4 quadraphonic, $6.98.

The Fourth Symphony, which to me is the composer's best by a lot, receives one of Ormandy's all-out performances here and it is excellent. When Ormandy *believes,* he gets the finest out of his players. The RCA quadraphonic sound is very much on the ambience kick, which to my way of thinking is entirely right for such music as this. There is so much instrumental color and drama in Tchaikovsky's astonishingly brilliant orchestration that any spacing but the right one, the orchestra more or less before you, from side to side, only adds confusion to what is absolutely clear as is, in musical terms.

The cyclic loud trumpet proclamations in the first movement (each a minor third higher) are very acid tests for your CD-4 equipment. These trumpets showed up my year-old cartridge with a presumably somewhat worn stylus—they blasted unmercifully. The stylus is still quite OK on standard stereo or SQ. Using a replacement stylus the trumpets were entirely clean. See also other Tchaikovskys in the Ormandy series from Philadelphia.

Number Six, the better known "Pathetique," gets a far lower rating from me, much as I respect old Stokowski. Anyone who has followed his recordings for the last fifty (!) years knows that he can be superb, or eccentric as all get-out. This is one of those eccentric times. All sorts of mannered slowing-down, great pauses, and so on—distracting and not good at all. The sound, moreover, is less reverberant, less dramatic, than the Philadelphia quadraphonic, quite OK but not *that* exciting.

Jazz & Blues



The Essential Earl Hines
Olympic Gold Medal 7125, mono, $4.98.

Seventy-year-old Earl Hines, one of the greatest pioneering jazz pianists, suffered a period of neglect from the late Forties through the Fifties, followed by a decade of rediscovery in the Sixties (sparked when Dan Morgenstern brought him East for Hines' *first concert* appearance). During the Sixties he seemed overexposed by too many recordings that spread his prodigious talent thin. But this exhilarating Olympic set, taped in 1957 during Hines' long stay in the Bay area with this group, sheds light on this period when he was a most important part of the traditional jazz scene there.

These cuts were recorded at San Francisco's Hangover Club in what purported to be Dixieland music. Hines had surrounded himself with top Dixieland and New Orleans musicians—cornetist Muggsy Spanier, trombonist Jimmy Archey, clarinetist Darnell Howard, and bassist Pops Foster. But Hines remained unconfined by the Dixieland format. His playing was, as always, consistently challenging, full of surprises, of unexpected, sometimes startling twists and turns.

The bubbling, effervescent Spanier is outstanding as he sparks performances of *Baby Won't You Please Come Home, Monday Date, When The Saints Come Marching In,* and *Won't You Come Home, Bill Bailey.* There's also a splendid reprise of Spanier's classic *Relaxin at the Touro,* a growling muted blues written to commemorate the cornetist's near-fatal stay at New Orleans' Touro Infirmary. Spanier's marvelous ability to transmit the excitement of his instrument to fellow players and listeners is dazzlingly apparent.

Jimmy Archey's trombone adds punch and vigor to the proceedings, and Hines, at the top of his form, has plenty of room to stretch out, particularly on *Mood Indigo, Caravan, Ugly Child,* and a splendid *Pop's Blues.* The pianist's choruses have all of the stinging brilliance, rollicking verve, vivid imagination, monumental strength and flexibility that has made him endure through all the eras and styles in jazz. Every tune Hines tackles is a joust with the rhythm and melody, and Hines is always the winner. *John Lissner*

Sound: B Performance: A+

Blackland Farm Boy: Bill Neely
Musicians: Neely, vocals, guitar; Larry Kirbo, guitar; Mary Egan, violin; R. Powell St. John, harmonica; John Moyer, bass.
Selections: *Satan's Burning Hell, Crying The Blues Over You, Austin Breakdown, Lonely Mansion, Pflugerville Boogie, Law and Justice, Don't Waste Your Tears Over Me, Blackland Farm, Big Yellow Moon Over Texas, My Tennessee Home, Deep Elm Blues, Sun Setting Time In Your Life.*
Arhoolie 5014, stereo, $5.98.

The interaction between the various strains that make up American music (and what fine fruit it has borne) has occurred on many levels. Country music is only now beginning to enter the general consciousness—until recently sneered at by self-styled sophisticates as "hillbilly," it is now (in some of its many forms) heard day and night on New York radio, not to mention the rest of the North. Most jazz fans yet have to discover Bob Wills and the Texas Playboys and the whole Western swing tradition, but it will come.

To the point: If you like Jimmie Rodgers, you'll like Bill Neely. He's his own man (he composed almost all the songs on this album), but that's where he comes from. Nearly 60 now, he was not quite 13 when Rodgers showed him a C-chord on the guitar, and gave him a photo and a ticket to the show. Neely sings about it in a touching and quite unsentimental manner in the autobiographical *Blackland Farm.*

There's a strong blues flavor to some of Neely's work, as in the delightful instrumental *Pflugerville Boogie,* a duet with Kirbo that recalls the spirit of the Lonnie Johnson-Ed Lang classics. There are also fairly straight country songs here, and the album opens and closes with a gospel piece. *Law and Justice,* the last testament of an uncle executed for a crime he did not commit, is a powerful statement.

Neely sings and plays well. This is his first record; he's made his living at all kinds of hard and honest work, singing and picking whenever he had the chance. One can only hope that mass-marketed music isn't choking all the potential Bill Neelys of the future.

Dan Morgenstern

Sound: Variable Performance: B+

King Biscuit Time: Sonny Boy Williamson
Musicians: Williamson, vocals, harmonica; Dave Campbell, Clarence Lonnie, piano; Willie Wilkins, guitar; Cliff Bivens, bass; "Frog," drums.
Selections: *Do It If You Wanna, Cool Cool Blues, Come On Back Home, Stop Crying, Eyesight To The Blind, West Memphis Blues, I Cross My Heart, Crazy About You Baby, Nine Below Zero, Mighty Long Time, She Brought Life Back To The Dead, Stop Now Baby, Mr. Downchild, Sonny Boy's Christmas Blues, Pontiac Blues, Too Close Together.*
Arhoolie 2020, mono, $5.98.

These are Williamson's first recordings, made for the Trumpet label of Jackson, Miss. in 1951. A late starter where recording was concerned, he had been a musician (and probably many other things) in and around his native Mississippi, in Texas and in Arkansas, when he was asked in 1938 to perform regularly on the "King Biscuit Radio Show" out of Helena, Ark. He was Rice Miller then, but soon became "Sonny Boy"; the Williamson was apparently added after the original Sonny Boy Williamson, a famous "race" artist on the Bluebird label, was murdered in 1948.

Sonny Boy No. 2, as he is sometimes identified, insisted vehemently that *he* was the original; he also made himself out to be younger than he quite obviously was. But there was nothing unoriginal or untrue about his playing and singing. His high-

pitched, somewhat reedy voice may be an acquired taste, but his harmonica playing needs no period of adjustment. I'd rank him as one of the all-time best on this modest instrument, capable of so much expression in the right hands.

Sonny boy never caught on with the U.S. "folk blues" crowd, though he's come North in 1955 and recorded regularly for Chess in Chicago, often in such company as Muddy Waters, Otis Spann, and Willie Dixon. But in '63, he toured Europe with the American Folk Blues Festival (organized by German promoter Horst Lippman) and made a big hit. He appeared on TV, recorded in Copenhagen (even sitting in on a Roland Kirk date), jammed in London with The Yardbirds, and stayed in England on his own for a while. He returned the next year, again to great acclaim, then went back to Helena, the King Biscuit Show, the juke joints, and the life he sang about. He died suddenly in May 1965.

These are some of Sonny Boy's best blues on record. His accompanists are the regulars from King Biscuit, the material is mostly his own, and there are no concessions of any sort. In Europe, he proved himself quite a showman, and his strong personality shines through here as well, but with no excesses. His self-accompaniment is sometimes astounding, as harmonica fills follow vocal phrases seamlessly (no splicing could have improved on his timing), and his solos (he often exhorts himself with a, "Come on Now!") drive the blues down deep.

My own favorite is *Christmas Blues* (wonderful lyrics and great spirit), but every track is worthwhile, and there is much variety in tempos and moods (another marvel is the haunting *Mighty Long Time*, accompanied by a vocal bass line so expert it would have fooled me if the well-annotated liner hadn't made it clear).

Transfer from 78 originals is not as good as it could have been (my original—just one—sounds better), but blues freaks are generally not fussy about that. A fine album from one of the best blues labels around.

Dan Morgenstern

Sound: See above Performance: A

Things Are Getting Better: Eddie Jefferson
Musicians: Eddie Jefferson, vocals; Joe Newman, trumpet; Billy Mitchell, tenor sax, flute, bass clarinet; Mickey Tucker, piano, electric piano, organ, saw; Sam Jones, bass; Eddie Gladden, drums; Mildred Weston, Conrad Buckman, vocals.
Songs: *Bitches Brew, Things Are Getting Better, Freedom Jazz Dance, Night in Tunisia, Trane's Blues, I Just Got Back in Town, Billie's Bounce, Thank You—Falletinme Be Mice Elf Again.*
Muse 5043, stereo, $6.98.

Most people who enjoy the Pointer Sisters don't realize that the group which first popularized the practice of vocalizing melody lines and instrumental solos was Lambert, Hendricks, and Ross (and later, France's Swingle Singers) in the Sixties. They were preceded in the Fifties by King Pleasure. And, surprise, surprise . . . Eddie Jefferson started the whole thing off in the Forties. He is still going strong.

Naturally few people today could know that Jefferson writes his own lyrics, fitting them to the exact notes of well-known instrumental solos. It was he who transcribed the classic solo of saxophone giant Coleman Hawkins' *Body and Soul* (available on RCA's album of the same name, LPV-501) and several of Charlie Parker's solos. His most notable credit is his masterminding the lyrics for *Moody's Mood For Love*, based on saxophonist James Moody's solo on *I'm In The Mood For Love* (in turn based on the chord changes of *I've Got Rhythm*). The vocal version of *Moody's Mood* is

usually associated with Jefferson's old friend King Pleasure, who had a hit record with it. But the archetypal figure all along this avenue of music is Eddie Jefferson.

Things Are Getting Better is certainly one of Jefferson's best outings on record. His two Prestige recordings, **Body and Soul** (Prestige 7619) and **Come Along With Me** (Prestige 7698), 1968 or '69, also contain excellent material *(So What, Yardbird Suite, Filthy McNasty)* and superb sidemen in James Moody and pianist Barry Harris. His five-year recording absence has been quite a disappointment, especially since Jefferson was in such impeccable form during a tour he made with Moody in 1973.

In any case, **Things** is certainly recorded and mixed better than his previous releases. As with the Rudy Van Gelder engineering of CTI records, the recording, mixing and mastering here favor eliminating excessive highs in favor of warm bass lines. (In the case of CTI, bassist Ron Carter achieves superb sound by miking the speaker of his bass amp as well as the bass viol itself.) It's good that Sam Jones' bass work was so well recorded here, because the bass line marks the chord changes precisely. I once heard that after a recording session producer Orrin Keepnews said of Jones, "Everyone should record at least once with Sam." Hearing Jones' flawless time here, one can understand Keepnews' pronouncement.

Things includes material as varied as the musicians themselves. *Trane's Blues* and *Billie's Bounce* get into a medium groove that gets the whole band smokin'. The ballad *I Just Got Back in Town* is reminiscent of *This is Always,* something King Pleasure did 'way back, and which is available on the Prestige reissue **King Pleasure** (PR 24017).

I'll bet no one thought a tune like Miles Davis' *Bitches Brew* could accommodate a vocalist. Jefferson, in keeping up with the times, and anticipating upcoming vocal styles, has put words to this tune. Preserved in Jefferson's arrangement is Benny Maupin's bass clarinet solo including his *ostinato* figures.

Some of the most talented (and underrecorded) musicians in the business serve as sidemen here, including two former Count Basie stars. They are reedman Billy Mitchell and trumpeter Joe Newman (who's also president of New York's Jazz Interactions, Inc., a group which promotes jazz in many ways.). Drummer Eddie Gladden whose style draws on Elvin Jones' strengths, makes his own original statements on the tubs here.

I hope this is only the first in a series of new releases showcasing Eddie Jefferson's unusual vocal talents and lyrics. His voice is a composite of the power and stamina associated with the brass, and the facility and smoothness of a saxophone section. **Things Are Getting Better,** and this is solid evidence. *Eric Henry*

Sound: B+ Performance: B+

Soundways: Marion Brown, Elliot Schwartz.
Musicians: Marion Brown, alto sax, clarinet, piano, percussion; Elliott Schwartz, piano, ARP synthesizer, percussion, miscellaneous instruments.
Bowdoin College Music Press 41746, stereo, $6.00 (Moulton Union Bookstore, Bowdoin College, Brunswick, Me. 04011)

For well over a half-century, "classical" composers and "jazz" musicians have attempted all manner of fusions between their separate but increasingly equal art forms. With several noteworthy exceptions (ranging from Milhaud's **La Creation Du Monde** to Yusef Lateef's **Symphonic Blues Suite**), the results have too often been academically intriguing, but dreadfully boring.

In the past decade though, avant-garde elements of both camps have challenged time-honored defining concepts to such an extent that the two traditions have developed an untapped body of shared techniques and attitudes. Though many academicians still refuse to acknowledge it, several artists who grew up in the jazz tradition have developed an improvised music so visionary, so creative, yet so firmly rooted in the Black experience that it has clearly become a non-European-originated "serious" music. In the meantime, the post-war avant-garde which grew up in hallowed academic surroundings has become so dependent on the outrageous, the grotesque, the whole "happening" syndrome, it has boxed itself into a corner, virtually relinquishing the appellation "serious music."

Soundways, a collaboration between a "Black classical" artist, Marion Brown, and a "European-derived classical" composer, Elliott Schwartz, suggests a practical solution to the academic avant-garde's dilemma (a way out which is not "way out"). It is a completely spontaneous, unplanned, 38-minute dual-improvisation, which uses the free approach of jazz and techniques associated with modern classical artists to obtain a result somewhere in between "Black" and "European" classical musics.

Though Brown and Schwartz are both faculty members at Bowdoin College and are contemporaries (Schwartz is 39, Brown 40), their artistic backgrounds are notably dissimilar, but not incompatible. Brown began as one of the more restrained voices in the mid-60's free jazz underground, and soon developed a pensive style of freely expressive improvisation within a highly flexible and rhythmic compositional framework (hear his **Geechee Recollections,** for example). Schwartz, on the other hand, is a member of the aleatory school of post-war composers. As an example of his methods, his **Concert Piece For Ten Players** (1965) supplies predetermined pitches, but leaves rhythms and tempi to the performer's discretion. This is hardly the same type of improvisation Brown and his colleagues employ, where only a theme statement is agreed on in advance. Therefore it is not surprising that Schwartz' approach to unplanned interaction is audibly more rigid, with more disjointed phrases, less fluent rhythms, and less expressive feeling.

It is not the case, however, as one chauvinistic jazz critic implied, that Brown initiates *everything* of interest, for Schwartz to merely follow. In all fairness there are occasional moments when the listener cannot be fully certain of who's doing what, as there are two pianos, apparently one shared battery of percussion, etc. The stereo separation takes into account the placement of the instruments on the stage, not the musicians' individual contributions, though most of the time the two are easily distinguished. Still, it is obvious that Schwartz is more attuned to counteracting Brown than setting up a true interactive situation. Nonetheless, both musicians contribute a great deal to the music's interest.

In any event, the result is a rich interplay of sounds, an ever-changing (but not evolving, as the sections do not usually follow from what came earlier) tapestry of timbres and textures. It's rather quiet, often reflective (Brown's alto is quite Debussyesque at times), sometimes humorous, thoroughly intelligent yet humanistic, pointillistic and dissonant yet rarely harsh. It owes much to the peaceful aesthetic of Brown's recent work, while it also satisfies Schwartz' desire to make the "classical" avant-garde more meaningful to the modern listener.

The engineering is a bit distant at times, but not lacking in definition. *Tom Bingham*

Sound: A− Performance: B−

Classified

FOR SALE

CASSETTE LABELS

Plain white cassette labels, Norelco cleaners, paper mailer boxes hold Norelco type plastic box, famous brand cassettes. "Like new" 10-½" metal reels. Send for open reel and cassette discount catalog.

	1-9	10-99	100	1000	10M
Cassette Labels (Multiples of 10)		.02	.015	.01	.007
Norelco Cassette Cleaner	.65	.60	.55	.50	.45
Cassette Paper Mailer boxes	.03	.025	.022	.02	.018
*Scotch Cassette SC90HE	2.72	2.55	2.44	2.39	2.34
10-½" Metal, NAB Hole, Used	1.00	1.00	.90	.80	.75

*Buy 10, SC90HE, get 5 free

Plus Postage by Weight and Zone **Minimum Order, $5.00**

OPEN REEL STEREO TAPE BUYERS!

At last! An open reel catalog, including titles, songs, etc. of 95 long play, 2-3 hour albums, by American Airlines or Ampex 4 track stereo tapes. Send $1.00 — and we will also mail you a 140-page Harrison stereo tape guide — so you'll get both for $1.00 — and this $1.00 is refundable on your first $10.00 purchase of open reel stereo tapes at our 30% discount.

SAXITONE TAPE SALES 1776 COLUMBIA ROAD, N.W., WASHINGTON, D.C. 20009

RECORDING TAPE CLOSEOUT: Dozen reels 2400', $12.00. Dozen 1200', $8.00. 24 reels 900', $6.00. 24 600', $5.00. Postpaid! Guaranteed. Mitchell, Box 132A, Flushing, N.Y. 11367.

CROWN D1200 & M2000 on demo in our showroom. The cleanest amp ever made, driving RTR STUDIO MASTERS. Cyberacoustic Laboratory, 503 Haverford Ave., Narberth, Pa. 19022. 215-667-3048.

N. CALIFORNIA'S CUSTOM IMF DEALER is now offering:

IMF SMALLER MONITOR - Smaller version of the world-acclaimed MONITOR!

IMF MODEL R!! Flat to 20 Hz. Stunning transient attack! Uses new version of KEF flat woofer. At $330 - extraordinary!

IMF SUB-WOOFER KIT - Dual transmission line system flat to 6 Hz - $200!!

STUDIO IIIB and **MONITOR MK IV** - Both newly "impulse" revised!

Custom demonstrations in The IMF Listening Room. For information and/or listening appointment, write or call Russ Goddard, **CUSTOM IMF DEALER**, 1171 W. Latimer, Campbell, California 95008. (408) 374-4697. **Mail order customers**: For your convenience, all orders are shipped **prepaid and insured, by air!**

OPERA TAPES. Historical performances of past 40 years. Unbelievable treasures and rarities. ALSO LP RECORDS. Free catalog. Ed Rosen, 66-33 Saunders St., Rego Park, N.Y. 11374.

LOW NOISE RESISTORS - ¼W, 5%, carbon film from 10 - 3.3 Megohm for 3½¢ each. Fifty of one value for $1.25. 1N4148 diodes for 6¢. Ceramic capacitors. Free samples/specifications. COMPONENTS CENTER -A, Box 134, New York, N.Y. 10038.

FOR SALE

CONNECTICUT: Yamaha, Celestion, IMF, Infinity, Braun, Revox, Stellavox, Thorens, ESS, Mark Levinson, Supex, BGW. Will ship prepaid. AUDIOCOM, 177 Sound Beach Avenue, Old Greenwich, Conn. 06870. (203) 637-3621.

WANT TO GO BI-AMP?

DeCoursey Electronic Dividing Networks are available from $89.10 (Monaural bi-amp) to $205 (Stereo tri-amp). Price includes plug-in Butterworth filters; 6, 12, or 18 db per octave at any desired cutoff frequency. Write for brochure. DeCoursey Engineering Laboratory, 11828 Jefferson Blvd., Culver City, California 90230.

FLASH—WORLD'S FIRST HIGH OUTPUT MOVING-COIL CARTRIDGE WITH REPLACEABLE STYLUS is now in stock! The revolutionary new **SATIN M-15L** series easily surpasses ALL other cartridges in clarity, separation, and ultra-low distortion. Has rock-solid bass definition, and the realism heard from solo or massed violins is incredible. $265., with choice of conical, elliptical, or Shibata-type stylus; cartridge with all three (interchangeable) styli purchased together, $450. Sister models with similar qualities, $145. and $215. At better dealers, or direct from exclusive U.S. distributor, **AUDIOPHILE IMPORTS**, 8 East Erie, Chicago, IL 60611.

LOWEST DISCOUNT PRICES ANYWHERE on audio equipment. All major brands discounted. Write for quotes, K&L Sound Services, 75 N. Beacon St., Watertown, Mass. 02172.

DIAMOND NEEDLES and Stereo Cartridges at Discount prices for Shure, Pickering, Stanton, Empire, Grado and ADC. Send for free catalog. LYLE CARTRIDGES, Dept. A, P.O. Box 69 Kensington Station, Brooklyn, New York 11218.

SPEAKER SPECIALIST. TOBY Corporation of America, 4620 Camp Bowie, Fort Worth, Texas 76107.

THE MONEY SAVER! Write STEREO SPECTRUM, Box 1818, Miami Beach, FL 33139.

ARP SYNTHESIZERS!

Pro-Soloist $920, Odyssey $1230, String Ensemble $1385, #2600 $2385. Dickstein Distributing, 1120 Quincy Avenue, Scranton, Pennsylvania 18510.

TWO NEW 15" ALTEC 604-E duplex speakers with dividing networks, 16 ohms, $150.00 each, $275.00 pair. One mint 12" Stevens Gold diacone speaker, 8 ohms, $45.00 R.E. Bennett, 1460 W. 20th St., Long Beach, Calif. 90810.

QUOTES ON 60 POPULAR BRANDS. Specializing in "high end" and hard to find equipment—Ace Audio, Cizek, Fulton, Phase Linear, Phillips—much, much more. Sound Center, 219 E. 17th, Bloomington, Indiana. (812) 332-4252.

FOR SALE

STEREO AND QUAD COMPONENTS. Low discount prices; major brands. Write for free brochure, quotes. Reply Box A55-1, c/o Audio Magazine.

NORTHWEST'S FINEST AUDIO DEALER—Audio Research, Dayton Wright, IMF, Fulton, Hartley, Mark Levinson, Dahlquist, Infinity, Radford, Crown, BGW, Quad, Decca, Supex, Phase Linear, Braun, Tandberg, Linn Sondek, and Many More. HARTLEY ELECTRONICS, 1502 Butternut, Richland, WA 99352 (509) 947-5026 after 5:00 PM weekdays, all day weekends.

TUNED ROCK P.A.'s. Customized high intensity touring/permanent installation sound systems, including narrow band (5'hz!) feedback suppression, detailed regenerative response, Acousta-Voicing/environmental equalization (±dB at your ears), room design/measurement/treatment, <15% articulation loss of consonants. 1000's of customized professional products including ... fiberglass horns, consoles, comp/rms/peak limiters, 18db continuously variable electronic crossovers, digital/acoustic delays, omnipressors, phasors, reverb, echo, doubling/tripling effects. P.A. noise reduction, piezo transducers, frequency shifters from ... J.B.L./Altec Pro., Tascam, U.R.E.I., Eventide, Gately, Schoeps, Beyer, Crown, Community Light/Sound, Mom's Audio, McIntosh, Bozak, Allen Heath, Gauss, Cetec, Langevin, Electrodyne, etc., etc. All shipped prepaid/Insured. Music & Sound Ltd. 11½ Old York Rd., Willow Grove, Pa. 19090 (215) 659-9251.

FLORIDA AUDIOPHILES! Phase Linear, IMF, Linn Sondek, Klipsch, RTR, B&O, Revox, Quad, Thorens, Sony, Marantz, Barzilay cabinets. Sales & repairs. **INTERIORS PLUS SOUND**, 3038 N. Federal Highway, Ft. Lauderdale, Fla. 33306. (305) 566-3511.

AUDIO RESEARCH MAGNEPLANARS and Electronics, ESS, Infinity, Ohm, Dahlquist, EPI, Audionics, Radford, Crown, Citation, BGW, Transcriptor, Linn-Sondek, Keith Monks, ERA, Connoisseur, SME, Supex, Decca, Grace, Sony, Spectrum Scanning Tuner, Epicure Amplifier, Marantz 500, DBX, ADC, Nakamichi, B&O, Tandberg, Celestion, Marc Levinson, Stax, Dayton-Wright, others. THE GRAMOPHONE LTD., 757 Asp St., Norman, Okla. 73069. 405-364-9477.

FIREWORKS NEWS MAGAZINE—Covering Commercial — Display Fireworks, Sources, Construction, Black Powder, Fuse, Literature. Firecrackers To Bombshells! Interesting Catalog—25¢. With Sample—$1.00 Pyro Press, Box 12010-P, Lexington, Kentucky 40511.

THORENS 150AB TURNTABLE, Shure M93E cartridge with new stylus. $100.00. Call (815) 729-3279 after 6 P.M.

Rates: 35¢ per word per insertion for noncommercial advertisements; 60¢ per word for commercial advertisements. Frequency discounts as follows: 3 times, less 10%; 6 times, less 15%; 12 times, less 20%. Closing date is the FIRST of the second month preceding the date of issue. Payment must accompany all orders. Use the handy self-addressed, postage paid card at the back of this issue. When replying to Audio box number ads, send letters c/o Audio, 134 North 13th Street, Philadelphia, Pa. 19107. For more information about classified advertising, circle Reader Service Card #135.

FOR SALE

QUINTESSENCE, PHASE LINEAR, Bang & Olufsen, Ortofon cartridges & speakers, Infinity, Bozak, TAPCO, Technics by Panasonic. A.C. Recording, 7 US Hwy. 206, Raritan, N.J. 08869. (201) 526-1777.

ADVENT, CROWN INTERNATIONAL, McINTOSH, REVOX, THORENS, SME, IMF, JBL, EPI, CITATION, BEYER. FULL SERVICE ON ALL EQUIPMENT!!!

STEREO SOUND
320 Route 10,
East Hanover, New Jersey 07936
(201) 386-0050

ORTOFON — SUPEX CARTRIDGE OWNERS; our Micro-Preamp outperforms any transformer. Free literature. Huntington Electronics, Box 2009-A, Huntington, Conn. 06484.

C/M PRE-AMP CC2 $200.00. Pr. Infinity Monitors $640.00. Koss ESP-6A $85.00. (201) 356-0004.

ELECTRONIC CROSSOVERS—ALL TYPES. Definitive booklet describes applications; how to improve speaker systems; $5.00, credited to first purchase. Huntington Electronics, Box 2009, Huntington, Conn. 06484.

AUDIO EXCELLENCE from Advent, Audio Research, BGW, B&O, Fulton, Grace, Dahlquist, Levinson, Infinity, Quintessence, Phase Linear, SAE, STAX, Supex, RTR, Revox 700, Nakamichi, Tandberg, Technics, Magneplanar. "Certified Audio Consultant," STEREO SHOP, 107 Third Ave. SE, Cedar Rapids, Iowa 52401. 319-365-1324.

THE SS-3 PORTABLE MIXING CONSOLE provides unmatched performance in remote recording applications. Available in 2, 4, 8, 16 and 24 track configurations. Write for specs. Reply Box No. A47-1.

STEREO CO-OP. Now purchase stereo components directly from a manufacturer co-op, and realize substantial savings. Members include Advent, Bose, EPI, Pioneer, Sansui, Dual, Garrard, and others. Write for specific price quotations. Stereo Co-op, 1629 K St. N.W., Suite 5088-Dept. A, Washington, D.C. 20006.

KLIPSCHORN-KLIPSCHORN-KLIPSCHORN Only the finest in Audio. Superior Sound Stereo Center, 2780 Erie Blvd. E., Syracuse, N.Y. 13224.

CASSETTE LABELS—Custom designed. Pressure sensitive. 24 only $1.25. Courted Creations, Dept-C, 306 Busse Hwy., Park Ridge, Ill. 60068.

INFINITY 200A speakers $190. each. Citation 12 Amplifier $200. Kenwood Audio Scope $150. Braun Changer $200. Stax Headphone $95. Electrovoice Outdoor Speakers $50. pair. Dr. D.S. Konicoff, 120 W. Palmetto Park Rd., Boca Raton, Fla. 33432.

MAGNEPLANAR TYMPANI IU (new May '73), black, with feet: $675.-; Marantz 250 Amp: $285.-; Miracord PW-50H with Stanton 681EE (almost new): $120.-; Teac AN-80 Dolby unit: $125.-; University C-15W Woofer: $40.. After 5 PM Call: (201) 542-8399.

REMOTE YOUR SYSTEM ON-OFF VIA UNIQUE ULTRASOUND WISTLE—HANDLES 500 WATTS FROM 50 FEET—$19.95. F.O.B. DESTINATION. RAVEN ENT., P.O. BOX 81966, SAN DIEGO, CALIFORNIA 92138.

ONE STOP for all your professional audio requirements. Bottom line oriented. F.T.C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505.

DON'T PAY THE HIGH MAIL ORDER PRICES. THIEVES WAREHOUSE OF SARASOTA, 6564 GATEWAY AVENUE, SARASOTA, FLORIDA 33581.

FOR SALE

BUILD YOUR OWN SPEAKERS AND SAVE UP TO 50%. You can assemble your own high quality, multi-element stereo speakers in a few hours and save up to half the cost of comparable speakers. Send for our free 32-page catalog of speaker kits, raw speakers and accessories. SPEAKERLAB, Dept. A2, 5500—35th N.E., Seattle, WA 98105.

CANADIANS — DYNACO COMPONENTS AT TREMENDOUS DISCOUNTS. Write En-Jay Sales, Hornepayne, Ontario.

CYBERACOUSTIC LABORATORY: only one of its kind! Featuring Crown, IMF, AKG, UREI, RTR, DBX, Infinity, Rabco, Decca, Mark Levinson, more. Crown warranty service. Featuring Crown tape recorders. Audiomodtronics by our engineers. Barclay—503 Haverford Ave., Narberth, Pa. 19072, 215-667-3048.

MAXELL TAPES. AKG microphones, Stax headphones at DISCOUNT prices. Box 3065, Seattle, Washington 98114.

WESTCHESTER AND FAIRFIELD COUNTY AUDIOPHILES TAKE NOTE! THE AUDIOPHILE, 231 BEDFORD STREET, STAMFORD, CONN. specializes in equipment for the connoisseur. Audio Research, ADC, Citation, Crown, Dahlquist, IMF, Infinity, Janszen, Philips, SAE, SME, TEAC, Technics, Thorens and many more. (203) 348-3551 (Closed Mondays).

COMPETENCE IN AUDIO SINCE 1928!
Qualified service, custom installations
Klipsch, Sequerra, SAE, McIntosh, Levinson, SME, Ortofon, Fidelity Research, Ampex Professional, Tandberg.
We buy and sell quality used gear.
THE MUSIC BOX, INC., 58 Central Street, Wellesley, Mass. 02181. (617) 235-5100.

NOW AVAILABLE . . . . FAMOUS REFLECTING SYSTEM'S 4½" REPLACEMENT DRIVERS. $7.98 POSTPAID. BIG QUANTITY DISCOUNTS. FREE SPECIFICATIONS. AURATONE, BOX 580-20A, DELMAR, CALIFORNIA 92014.

MAGNECORD TAPE DECK 1024, $500.00; Ampex tape deck 1260, $200.00; Concord tape deck Mk-III, $175.00; Kenwood AM/FM stereo tuner KT-7001, $250.00; Fisher AM tuner AM80, $45.00; Paco AM/FM tuner ST45W, $35.00; EICO stereo power amp HF87, $50.00; EICO mono power amp HF30, $30.00; 2 JW Davis speakers, $50.00. (713) 485-1735. Rt. 4A, Box 203, Pearland, Texas 77581.

TRANSMISSION LINE PLANS $5.00 - foam damping material available. Wide assortment of drivers. E&E Audio, 2816 Church Ave., Brooklyn, N.Y. 11226.

NEUMANN MICS & ACCESSORIES. DBX Gately Pro kits and mixers. Most models in stock. Immediate prepaid shipment. Mastercharge. Write or call Dick McGrew Recording Service, 902 N. Industrial Blvd., Dallas, Texas 75207. 214—691-5107.

THE AUDIO RESEARCH ROOM. The complete line of Audio Research equipment on display under ideal listening conditions. AUDIO SYSTEMS & DESIGN, 5421 South 84th St., Lincoln, Nebraska 68516 (402) 489-9888.

AMPEX TAPE—NEW 1800' on 7" reel 12 for $18 POSTPAID; 1200' 12 for $13 POSTPAID—free list—WIDE RESPONSE, 6114A SANTA MONICA BLVD., HOLLYWOOD, CA. 90038.

JBL AMPLIFIER SE-400-S, perfect, $250.00. Write Box 2009, Huntington, Conn. 06484, or phone 203-929-5255.

ELECTROENCEPHALOPHONE: brainwave monitor, Professional biofeedback instruments. J&J 8102-A, Bainbridge, WA. 98110.

FOR SALE

LOGIC MICRO/MINI-COMPUTER NEWS

LOGIC NEWSLETTER ©
SAMPLE COPY $1.00
LOGIC NEWSLETTER
POB 252
WALDWICK, N.J. 07463

SOUND SYSTEM CLEARANCE
Several used systems consisting of FIBERGLASSED FOLDED HORN WOOFERS, MULTICELLULAR HORNS in FIBERGLASSED CASES, and CROWN POWER AMPS. Systems are BI-AMPED and include various mixing equipment. All components are ALTEC or JBL, and will be sold at a fraction of their original cost.
Stanal Sound, Ltd.
P.O. Box 518, Kearney, Nebraska 68847
Telephone (308) 237-2207

AUDIOPHILES! Quality Sounds of Maryland has come to your rescue. Write to me for system quotes you won't believe! Send requests for equipment prices to Quality Sounds of Maryland, Gerard White, Sales Manager, P.O. Box 63, College Park, Maryland 20742.

OREGONIANS WITH UNCOMMON EARS: Hear Magneplaner, Dayton-Wright, B&W, Audionics, Infinity Servos, Braun, Quad, Ohm, Crown, BGW, Radford, Quintessence, Yamaha, Mark Levinson, Linn-Sondek, Transcriptors, Vestigal, SME, Thorens, Philips, Ferrograph, Stax, Decca, Supex, Ortofon, KMAL, Passive Crossovers, Transmission-Line Speaker Kits, Basic Drivers. Shipped Pre-paid in most cases. AUDIO-Uncommon, Inc. 8600 N.E. Sandy Blvd. Portland, Oregon 97220. (503) 254-6202.

PRESTO 6N RECORDING TURNTABLE, PRESTO 1-D RECORDING HEAD, PRESTO 92-A AMPLIFIER, 1948 MODELS, OWNERS MANUALS INCLUDED, BEST OFFER (301) 724-8423.

JAPANESE TRANSISTORS, Kit $23.44 contains 24 most widely used transistors, including 14 power transistors. Over 500 types available. Free catalog **WEST PACIFIC ELECTRONICS,** Box 25837, W. Los Angeles, Calif. 90025.

BAY AREA AUDIOPHILES: AUDIO RESEARCH, AUDIONICS, BRAUN, CONNOISSEUR, CROWN, DAHLQUIST, DECCA, DYNACO, FERROGRAPH, F.M.I., GRACE, KMAL, LINN SONDEK, MAGNEPAN, MARK LEVINSON, NAKAMICHI, PANASONIC (SP-10), QUINTESSENCE, RADFORD, R.T.R., SEQUERRA, SHURE, SUPEX, TANDBERG, WIN LABS, McINTOSH (USED). Compare any of our products through our switching device using 1/1 Mark Levinson master tapes at GARLAND AUDIO, 2960 Stevens Creek Blvd., Suite D, San Jose, Calif. 95128 (408) 244-6724.

SONY SQD 2020 full logic decoder, case. $190.00. Ed Hastie, 848 Celia Lane, Lexington, Kentucky 40504.

DYNACO KITS, big discounts, AllKits, Box 864, Destin, Florida 32541.

KLH-9's, MINT - original factory cartons. $800.00 pr. Stephen Bruenn, 3609 N.W. 4th Ct., Boca Raton, Fl. 33432.

INFINITY SERVO-STATIC 1A speaker system, as new in factory pack with warranty, includes: 2 electrostatic screens, bass system, 100 watt R.M.S. bass amplifier/crossover, cables, owners manual, and more. Price $1,350. Call (516) LY9-7311 ask for Steve.

MARK LEVINSON—PHASE LINEAR—McIntosh — Dahlquist — Nakamichi — Braun — JBL — Supex — Linn Sondek — Tandberg — B&O — Quatre-Technics. Hear the Supex cartridge with the Levinson cartridge preamp at Stereo One, 1229 Post Rd., Fairfield, Conn. 06430. Phone 203-255-5939.

Listen to TELEVISION IN STEREO

The TE-200 TELEDAPTER EASILY CONNECTS TO ANY TV & STEREO SYSTEM. Using our coupling and matrix circuit, teledapter takes a low impedance output from the television and delivers two HIGH IMPEDANCE CHANNELS OF SIMULATED STEREO, to drive any amplifier. Frequency response is maintained so you can hear the tinkle of bells or booming bass sounds as it happens on TV. With service warranty and hookup instructions $16.95 ppd. Guaranteed to make your TV 100% more enjoyable.

OUR NEW TE-300 VHF-UHF HI-FI TUNER IS NOW AVAILABLE. A complete and self contained 110 volt tuner. VHF-UHF antenna connections. Recording and amp output jacks. Five year service warranty $149.95 ppd. From our factory.

SEND ☐ CHECK ☐ MASTER CHARGE NO. for ☐ TE-200 ☐ TE-300 or ☐ $5.00 for C.O.D. TO: RHOADES NATIONAL CO. DEPT. AD

P.O. BOX 817 HENDERSONVILLE, TENNESSEE 37075

NAME_____

ADDRESS _____

CITY STATE ZIP

☐ SEND COMPLETE CATALOG

FOR SALE

10½" **RECORDER SPECIALISTS**: Fresh new Scotch L/N 3600 ft. on new ¼" NAB metal reels five for $35.00. New Ampex GRANDMASTER tape on 10½" metal reel, six for $73.00. New 4 channel 8-track blank cartridge loaded with 40 minutes Scotch L/N tape, $23.00 per dozen. Reconditioned NAB metal 10½" reels, $24.00 per dozen. 10% on above for postage. Soundd Investment, POB 88338, Dunwoody, Ga. 30338.

CENTRAL NEW YORK HI-FI ENTHUSIASTS—Britain's finest loudspeakers on demonstration—THE IMF STUDIO AND ALS40—as well as Marantz, Pioneer, Revox, Beyer, Epicure (3 lines), Thorens, Ortofon, XLM, Discwasher. THE SOUND SHOP, 96 Seneca Street, Geneva, N.Y. 14456 (315) 781-0215.

AMPZILLA. Available at Creative Audio. Call (517) 799-6013 for appointment 6:00 - 11:00 PM or write 5877 Ambassador Drive, Saginaw, Mich. 48603.

YOUR ROOM IS THE MISSING LINK

A state of the art system is usually junk in the typical poor listening environment, and therefore a rip-off. Our acoustical consulting division will have a calibrated "reverberation curve vs. frequency" measurement performed in your room, and our engineering dept.'s plan of correction, loudspeaker placement, and room equalization, all at no cost with your purchase or upgrade. Music & Sound Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251

CONSIDER YOUR SOURCE FOR SOUND

I. Credentials
College instructors in audio/acoustics, Inventors/graduate electrical engineers, Recording & disc mastering engineers,
Members: United Inventors & Engineers
Acoustical Society of America
Institute of Electronic Engineers

II. Facilities
Anechoic Chamber: **>.9ā working floor**
$50,000 research laboratory
Factory authorized "A" warranty stations

III. Our Distinguished Suppliers
Audio Research, Sequerra, Satin, Transcriptors, F.M.I./R.T.R., Linn Sondek, Nakamichi, Dayton Wright, Dahlquist, Crown, Infinity, I.M.F., London Decca, Quad, Rogers, Spendor, Stax, B&O, Grace, Supex, Micro Acoustics, Custom Rabco, Braun, Revox A-700, Ortofon, Damped S.M.E., Scully, dbx, Mark Levinson.

+

1000's of **PROFESSIONAL** products (see Tuned Rock P.A. ad)

Music & Sound Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090 (215) 659-9251

Whom Would You Trust?

THOUSANDS OF LIKE NEW LP's and prerecorded tapes. Catalogue $1.50. House of Records, Hillburn, New York 10931.

FOR SALE

RTR EXCLUSIVE PHILA. SHOWROOM All RTR Speakers on demo including the new 1600E, 280DR/ESR15's. Two and three way electronic cross overs. Don't buy any speaker until you've heard RTR. Appointment 215-667-3048; 503 Haverford Ave., Narberth, Pa. 19072.

AUDIO RESEARCH, AUDIONICS, BANG & OLUFSEN BOZAK, CROWN, DBX, KLIPSCH, KMAL, LINN SONDEK, NAKAMICHI, PHASE LINEAR, RADFORD, REVOX, SEQUERRA, STAX, TANDBERG, BEYER, SENNHEISER, and other fine instruments for the reproduction of music. Send for list of top-grade used equipment AUDIO SYSTEMS AND DESIGN, 5421 South 84th St., Lincoln, Nebraska 68516 (402) 489-9888.... and 4408 Capital Ave., Omaha, Nebraska 68131. (402) 556-7559.

CONN. AND WESTERN MASS—FRED LOCKE STEREO offers Accuphase, Epicure, Crown, Quatre, Audio Research, Phase Linear, SAE, Citation, Mark Levinson, Soundcraftsman, ESS (including bi-amped Towers), Magneplanar, Thorens, Technics, SME, Ortofon, Supex, Fidelity Research, Revox, Tandberg, Teac, Transcriptors, DBX, Beyer, Stax, AKG, Nakamichi, Sequerra, Burwen, Hartley woofers, and others. Avon 203-678-1797; East Hartford 203-528-9479; New Haven 203-787-0183; Waterbury 203-757-9296; Fairfield 203-366-5246; Springfield, Mass. 413-782-7111.

ATTENTION ALL AUDIO BUFFS: Big selection of fine quality, slightly used audio equipment. For example: Marantz 1070 Amp; Thorens TD125 Turntable; 3-4, TEAC 3340's; 2 Phase Linear 750 Amps; Phillips RH-525 Speakers; Marantz 112 Integrated Tuner. Will bargain—must sell. Max T. Bischkopff, c/o L116 Griggs Hall—Audio Research Dept., Univ. Minn., Duluth, Minn. 54812.

THEATRE PIPE ORGAN RECORD—Stereo LP—Pop. Music from the 1930's and 40's. Send $5.50 ($7.50 outside the U.S.)—Mich. residents add 4%—to MVX Records, P.O. Box 2060, Fort Dearborn Station, Dearborn, Michigan 48123.

COMPONENTS FOR THE CONNOISSEUR LOUDSPEAKERS: Audio Research T-3A, 1B, Braun LV 1020, Dahlquist DQ10, Dayton-Wright XG-8 MK11B, ESS, Fulton J Modular System, Hartley Concert Master, Hegeman 1A, & 2, IMF Monitor, Studio, ALS 40, Magneplanar MG2167-F, RTR 280 DR, ESR 6, 15. COMPONENTS: Audio Research, BGW, Burwen, Connoisseur, Dayton-Wright, Hervic, Linn-Sondek, M&K super woofers and crossovers for T-3ATM, 1B, etc., Mark Levinson Products, Ortofon, Panasonic SP 10, Quad, Quintessence, Radford, SAE, Shure, SME, Supex, Thorens Transcriptor and SEQUERRA. Brochures available.

PAUL HEATH AUDIO
354 STATE STREET
ROCHESTER, N.Y. 14608
(716) 232-2828

HONG KONG, TAIWAN, JAPAN, Asia Directory. World products information. Mail-orders, bulk-orders. Listings. Directory and Information $1.00 today. World Trade Inquiries. Box 6224, Spokane, Wash. 99207.

MIDDLE & NORTH JERSEY AUDIOPHILES - Stereo Sound of East Hanover offers personal, friendly service and "state-of-the-art" equipment: Quintessence, RTR, SAE, Ortofon, Transcriptors, Stax, Bang & Olufsen, Phillips, Crown, McIntosh, IMF, JBL and more. Full demo & service facilities for our customers!!!

Stereo Sound
320 Route 10
East Hanover, N.J. 07936
201-386-0050

FOR SALE

HIGH PERFORMANCE HIGH FIDELITY WITHOUT THE "HYPE". Suffolk Audio takes a rational, no nonsense viewpoint on high performance audio equipment. Our advice and opinions are based in objective fact, not mythology and folklore. All equipment is pre-tested for maximum performance. Our distinguished suppliers include: Allison Acoustics, Bowers and Wilkins, Quad, Linn Sondek, Decca, Mark Levinson, Revox (incl. A-700 series), KMAL, Ortofon, BGW Systems, Radford, Beyer, Connoiseur, and much, much more. Call or write for information.

SUFFOLK AUDIO, INC.
1105 Mass. Avenue
Cambridge, Mass. 02138
Ph. (617) 868-1080.

PROTECT YOUR LPs. Poly sleeves for jackets 8c, round bottom inner sleeves 6c, Poly lined paper sleeves 15c, White jackets 30c, Postage $1.00. House of Records, Hillburn, New York 10931.

HIGHEST QUALITY USED EQUIPMENT: Crown CX-824, case, remote, $1695; Revox A77 I, $400; A77 III, $675; Bose amp, $700; McIntosh MC-2105, $550; McIntosh ML-2C, $425 ea.; McIntosh ML-1C, $260 ea.; McIntosh MQ-101, $175; Phase Linear 700, $550; Braun TG-1000, $650; Braun L-710 & stands, $170 ea.; ESS-9, $125 ea.; Quad FM-3, $180; Tandberg 3300X, $365; Thorens 150/Rabco arm, $175; AR amp, $175; Sony TA-1120, $225; Heath AR-15, $250; Marantz 500, $860; Teac 360S, $275. All guaranteed 90 days parts and labor. Audio Consultants, 517 Davis St., Evanston, Ill. 60201. (312) 864-9565.

STEREOPUS—New quarterly audiophile publication devoted to thorough subjective equipment review and comment. Issue I features Infinity Monitor I and II, Grace and Micro-Acoustics cartridges, Phase Linear 400 and Citation 12, and more. $9.00 year (First class $2.00 additional), $12.00 foreign. StereOpus, P.O. Box 269, Fort Walton Beach, Florida 32548.

DKL SOUND LAB

THE DKL SOUND LAB IS THE ONLY "STATE-OF-THE-ART" DEALER IN THE ENTIRE WASHINGTON DC, SUBURBAN MARYLAND, NORTHERN VIRGINIA AREA. COME SEE AND HEAR THE WORLD'S FINEST SOUND COMPONENTS AT:

DKL SOUND LAB
943 BONIFANT ST.
SILVER SPRING, MARYLAND 20910
OR CALL (301) 588-6257
MONDAY, WEDNESDAY, THURSDAY, SATURDAY 2-8 PM
(A DIVISION OF THE DKL LABORATORY, INCORPORATED)

IN STORE DEMONSTRATION and appointment only showroom with Audio Research, Audionics, FMI, Radford, ESS, RTR, Magnepan, Dynaco, Quatre, SME, Supex, Transcriptors, Teac, Sony Corp., Thorens, Soundcraftsmen, Stax, and more. Audio-Tronics, Ltd. E. 120 Wellesley Ave., Spokane, Wash. 484-1300.

SAVE 25% to 50% on most popular stereo components. For specific quotes, free illustrated guide to high fidelity, and catalog featuring special closeouts and systems, write: Eastern Audio Specialists, P.O. Box 72, Amherst, Mass. 01002.

KEITH MONKS MERCURY CONTACT Tonearm. Perfect condition. $95.00. (317) 787-8525.

ANTI-SKATING FOR AR TURNTABLES! Proven counterweight design of nickel steel & aluminum construction. Install yourself in minutes. $7.00 postpaid. (Dealer inquiries invited.) AUDIO INNOVATIONAL PRODUCTS, P.O. Box 137, Ballardvale Station, Andover, Mass. 01810.

FOR SALE

TRANSMISSION LINE SPEAKERS. True, wool-filled lines. Two and three way high definition systems, $115 to $310; kits, $45 to $200. Subwoofers, $90 to $200. FET electronic crossovers, $55 to $125. Raw speakers, capacitors, coils, wool, veneer. Buy direct from the designers and manufacturers at TRANSLINE SOUND, 2209 Rose, Lincoln Park, MI 48146. Phone (313) 386-0744 or (313) 646-4959.

CROWN IC-150, D-150 in portable rack. Best offer over $500. Julian Vrieslander, 364 Trumbull Corners Rd., Newfield, N.Y. 14867.

SUPER SYSTEM—all or part—consisting of: Hartley Concertmaster III speaker systems—new configuration with latest tweeters and supertweeters. Perfect, $325 each. BGW 500R super-amplifier, as new. 200 watts per channel into 8 ohms; 300 w/p/c into 4 ohms Dayton Wright SPM preamp, perfect. DKL Labs' modified Rabco SL8E with Decca London Export cartridge, never used, perfect. Call (215) WA2-1547, *weekdays* only.

AUDIO RESEARCH D75A: $550, D51: $375, TYMPANI 111's: $1025, PHASE LINEAR 700B: $530, BGW 500R: $495. K. Clark, 1502 Butternut, Richland, WA 99352. Phone: (509) 947-5026 after 5:00 PM.

HIGH DEFINITION SUPERWOOFERS - The world's finest woofer systems-The Hartley 24 inch and 18 inch high power woofers in an optimized transmission line. Available only through Hartley Electronics, 1502 Butternut, Richland, WA 99352. Phone: (509) 946-4459 and 947-5026 after 5:00 PM.

INFINITY MONITORS - mint. $275 each. Quad 33 control $125. (515) 278-0566.

BIG DISCOUNTS ON L.P.'s, cartridges, cassettes, "singles." Stereo and Quad, all labels' all artists. No fees, no gimmicks. Same-day service, postpaid. Send stamp for free details and Schwann Basic Record Library pamphlet listing 1000 pieces of classical music arranged by musical period and composer. Or, send $1.00 each (refundable) for Schwann Record and Tape Guide; Harrison Tape Catalogue; or "Golden Oldie" singles catalogue (listing over 5000 45 RPM's). DISCO-TAPE UNLIMITED, Mail Order Dept. AO, Box 817, LaPlace, La. 70068.

PIEZO SUPER HORN TWEETERS $7.95 P.P. Cont. U.S.A. Daily Mfg. Co. (Mfr. of quality loudspeaker systems since 1951), 100 Liberty St., Rockwell, N.C. 28138.

SANSUI Au555A—$95, like new (with original factory pack, etc.) G. Hall, 93 Morgan Rd., Binghamton, N.Y. 13903. (607) 772-9522.

MCINTOSH: Pair ML2C, MQ101—$1000.00, Pair ML1C, MQ101—$500.00. TEAC: 3340S, AN300—$1000.00. SONY: SQD2020 Decoder—$100.00. Nick Venice, 33-19 24th Ave., Astoria, Long Island City, New York 11103.

CANADIANS: Shure M91ED $24.88. Dynaco A25 $68.00; Pioneer SX424 $179.95; Dual 1216 $119.00; Leak Delta 75 $289.00. Garrard Mini changer $13.99. Free Hi-Fi discount catalog. Etco (Au), Box 741, Montreal H3C 2V2.

NAME BRAND RECORDING TAPE, custom loaded. Available in cassettes, reels, and cartridges. Huge savings direct from manufacturer. MJS, 516 Brooks, San Jose, Calif. 95125.

AUDIO RESEARCH SP-3 and **EC-3**, $450 each - Mint. 866-4798 Olympia or 693-7283 Vancouver, Wash.

DISCOTHEQUE MIXERS from $325, equalized speakers with built-in power amplifiers, biamped systems, and complete portable discotheque systems. Write us for literature. Dealer inquiries invited. GLI, P.O. Box 2076, Dept. A, Brooklyn, New York 11202.

FOR SALE

AUDIOPHILES WANTED !! Put your knowledge to use, earn an excellent spare time income. We need campus representatives to sell name brand stereo equipment at substantial discounts in your area. High commission, bonuses. No investment necessary. For information and application please write: James Wetherill c/o I.C.M. Associates, Box 28-SMC, Storrs, Ct. 06268.

DEALERS: We will buy your excess stock. ALL lines, no quantity too large or small. Cash paid immediately. Call M. Gasman 617-924-0561.

FOR SALE: One pair of Ohm F speakers, radical design—natural sound for only $400.00. Also ElectroVoice Interface A speakers with equalizer $300, demo. Marantz 500 stereo amplifier with rack mount & fan only $380.00. Sony 7065—$280.00. Pioneer SX1010—$300.00. Advent (large)—$68.00. All sales limited to quantities available. Hurry! Going out of business! Reply to Audio Box A56-2.

BUY DIRECT FROM GERMANY. REVOX, BRAUN, DUAL, MIRACORD-ELAC, OTHERS CARRYING WORLD-FAMOUS "MADE-IN-GERMANY"-TAG BECAUSE WE ARE LOCATED RIGHT THERE WHERE IT'S MANUFACTURED. PRICES ARE LOWER THAN YOU'VE DREAMED POSSIBLE. EVERYTHING SHIPPED IN FACTORY-CARTONS. FOR QUOTATION WRITE TO: GLOBAL AUDIO, P.O. BOX 1372, D-5020 FRECHEN, WEST GERMANY.

FAMOUS MAKE PIANOS AND ORGANS shipped prepaid anywhere at tremendous saving. State make and model wanted for our quotation. File this advertisement for future reference. Greenwich Music Center, Greenwich, N.J.

RABCO/DKL ARM OWNERS: Our oiled redwood cartridge shell is sturdy, streamlined, elegant. Adds no additional weight. Data sheet. AUDIOETC., Box 55, Lansing, Iowa 52151.

SUPEX SD900E, Perfect—$75.00. Dyna PAS-3x new $75.00. (919) 467-9198.

MCINTOSH C-26 Pre-amp. New—AR 3A's. New—EV 3 way speakers. 201-991-6904.

ESS TRANSTATIC I's—matched pair. Excellent condition. $700.00. Phone 9-5: (212) 363-6276.

SAE MK XXXI $135.00. (404) 964-6213.

THORENS TD-125, AB Mk II, TX-25 dust cover, Stanton 681EE and 681A cartridges—$350. Pair KLH fives—$240. (201) 696-1028.

FULTON J MODULAR SPEAKERS. Dr. Johnson, San Diego, Calif. (714) 274-6613.

TYMPANI III's, $950; EC-2, $175; D-75A, $675; Rabco SL-8E, $75; factory modified Levinson JC-1 and Music & Sound hand-picked Supex, under 10 hrs. use, $200; SAE Mk IIB, $225. HAT, 1313 Twin Towers East, Marshall University, Huntington, W. Va. 25701.

CITATION 12 DELUXE Amplifier $225. List $340. Michael Cheluk, 7719 Evergreen, Goleta, Calif. 93017. (805) 968-0997.

MUST SELL AKAI GX280DSS Tape Deck. Original carton and manufacturer's warranty. Never used. No reasonable offer refused! Larry Riley, 4A Couch Street, Plattsburgh, N.Y. 12901. (518) 563-2102.

DON'T LET VOLTAGE TRANSIENTS ZAP YOUR HI-FI. Solid State Equipment Protector. Plugs into outlet. Check or money order $6.95. Kopp Sales & Service, 1650 William, Buffalo 14206. Free brochure - send SASE.

2 ESS AMT-1 SPEAKERS, must sell, $400 or best offer, mint condition. (215) 383-3216—8 to 5.

FOR SALE

STEREO NEEDLES AND CARTRIDGES—ADC, B&O, GRADO, EMPIRE, MICRO-ACOUSTIC, PICKERING, ORTOFON, SHURE, STANTON, SUPEX, SONY, PANASONIC, RCA, BSR and others. NEEDLE IN A HAYSTACK, INC., P.O. Box 17436, Washington, D.C. 20041.

NOW IN PRODUCTION: World's heaviest 12" woofer. 17Hz resonance. Over 200 watts RMS. Sand cast frame. $59.00 delivered U.S.A. Rockwell Systems, Inc., 100 Liberty St., Rockwell, N.C. 28138.

"FIDELITY FIRST (an unrehearsed experiment)" Average records don't make it on quality stereos. Quality records don't make it on average stereos. Many companies are working on the paradox. We're working on quality. We invite your opinion. $6.50 prepaid per disc. INSIGHT RECORDS, dept 1A, 7726 MORGAN Ave. South, Richfield, Minnesota 55423.

MINT USED EQUIPMENT - Audio Research Tympani III's, $1200; SP-2 $400; SP-3 $525; SP-3A $625; D51 $600; Bose 1801 $750; 901's $375; Infinity Monitors $650; SAE MkIVC $350; Marantz 7c $300; Crown IC-150 $250; Citation 11a $275, and more. All equipment inspected and guaranteed. We accept trades. SOUND ADVICE, 536 State Road, Emmaus, Pa. 18049.

SHOT GLASS GLASCONE LOUDSPEAKERS. Transcriptors turntables. PML microphones. Leak Troughline tubed FM-Tuners, $175. Hartley loudspeakers. Brown Auditorium headphones, pigskin case, $60. Sheffield recordings. IMF Monitor loudspeakers. Leak Stereo-20 tubed amplifier, new $200. Newcomb Classic tubed AM/FM Tuner, mint $100. Jensen Fives speakers, mint $290 pair. McIntosh MC-3500 amplifier, pristine $995. Trades accepted. **WANTED**: Marantz—Futterman—McIntosh tubed equipment. Audiocraft, South Rockwood, Michigan 48179. (313) 379-9945.

WESTCHESTER HEADQUARTERS for the great sounds in the world. Quad, Ohm, Cambridge, Dahlquist, Bose ESS, Braun, SAE, EPI, Crown, Phase Linear, Tandberg, Thorens, Yamaha, Nakamichi, Technic, BGW, Dual, Revox, Kenwood, Pioneer. The Listening Room, Inc. 590 Central Ave., Scarsdale, N.Y. 10583 (914) 472-4558.

QUOTATIONS on all major components and musical instruments. No fair trade in Nevada. Lowest Prices. Southern Nevada Music Co., 2295 E. Sahara Ave., Las Vegas, Nevada 89104. (702) 457-4558.

NEW YORKER S—WE ARE COMMITTED! Consult with us about your audio needs. We have what you want, we offer FULL service. IMF, BGW, SAE, OHM, INFINITY, KLIPSCH, ORTOFON, KENWOOD, THORENS, SME, TECHNICS, ALLAN-HEATH, SOUNDCRAFTSMAN, HECO, INTERFACE-A, PIONEER, LEVINSON JC-1, RADFORD, AUDIONICS, and many others.
INNOVATIVE AUDIO
129 DeGraw Street
Brooklyn, N.Y. 11231
(212) 596-0888
Call for appointment

AUDIO RESEARCH SP3-A (N), converted to SP3-A-1. $500. (919) 449-4132, 449-6912.

STAX SRX & SRA-3S tube amp $275. Hartley 24" woofer $200. Hartley 18" $325 (pair). Yamaha CA-1000 amplifier $475. All-test phono preamp $100. ADC-XLM $35. Stanton 681EE $25. 1-1/2" soft dome midranges $12.50 each. Heath IP-17 power supply $55. (612) 426-4457.

CUSTOM SPEAKER ENCLOSURES, systems, kits, foam grills. Low prices. CSS, 8460 Marsh, Algonac, Mich. 48001.

FOR SALE

ORIGINAL TRANSCRIPTOR HYDRAULIC REFERENCE TURNTABLE (do not confuse with smaller "Skeletal" table/Vestigal arm package from Ireland) now available direct from U.S. importer. Magnificent turntable complete with silicone-damped Unipivot arm. $498.00 freight prepaid. Without arm, including blank arm-mounting board or one cut for SME. $398.00. Send $100.00 down for COD shipment. Audiophile Imports, 8 East Erie, Chicago, 60611. (312) 787-0754.

DON'T PAY THE HIGH MAIL ORDER PRICES. THIEVES WAREHOUSE OF BETHESDA, P O BOX 34251, WEST BETHESDA, MD 20034

MILWAUKEE & WISCONSIN'S only audiophile dealer. Specialists in components by Crown, Dahlquist, Transcriptors, Integral Systems, Epicure, Nakamichi, Bozak, Citation, Ohm, SME, Ampzilla, DBX, Infinity, SAE, RTR, ESS, Revox, Phase Linear and 50 others. Wisconsin's only Audio Research dealer with the entire product line on demonstration. WACK ELECTRONICS INC., 5722 W. North Ave., Milwaukee 53208. 414-442-3441.

DAYTON WRIGHT XG81 Revox F36(4); Stax SRX; PL700; Quad AM11; Decca 4RC. Robinson, 1707-8888 Riverside, Windsor, Ontario.

CUSTOM PREAMPLIFIERS, ELECTRONIC X-OVERS, MIXERS, etc. Engineered to meet most stringent performance parameters. Call or write for additional information: OHRWERKE, 40 High Street, Guilford, Conn. 06437, (203) 399-7367.

IN PURSUIT OF EXCELLENCE WE OFFER: Infinity, Crown, Revox, Fulton, Sennheiser, Philips, Ortofon, ESS, SAE, Beyer, DBX, Altec, Technics direct drives, RTR, McIntosh, JBL, Transcriptors, Klipsch, Citation, Decca, SME, Sequerra, Micro/Acoustics, Lamb, Dahlquist, Tannoy, Yamaha, Soundcraftsmen, Marantz, and more . . . Also custom room equalization, individually damped Altec & JBL Monitors and an ongoing equipment evaluation program. The House of Sound, 821 Kent Ave., Baltimore, Md. 21228.

NEW PRODUCTS: Allison Acoustics; Koss Full Range Electrostatic loudspeakers; G.A.S. (Ampzilla) amps, preamps; Quatre; Rabco's ST-7 turntable; Muntz Home Theatre Color Television (30"x40") screen. **USED MINT:** ARC-D75A, 50F1B; Burwen 1201; Citation 12; Crown IC150, D-60, 300; C-M Labs; Hervic receivers; Hewlett Packard amp; ESS amp; Paoli 60M's; SAE Mark 1M, IIIC; BGW 500R; Radford SC242, SPA60; IMF Monitors, IIIA's; Hartley Concertmasters; ESS AMT-1; RTR 400E, RTR ESR-6, 15; FMI 80, 120; Teac 7030 GSL. **Paul Heath Audio, 354 State Street, Rochester, N.Y. 14608. (716) 232-2828.**

ATTENTION
WESTERN NEW YORK AUDIOPHILES
The word is getting around!! Our personalized, honest service and quality equipment make a winning combination. In addition to the incomparable AUDIO RESEARCH line, (T-1B's black/natural in stock), we carry AMPZILLA, SAE, Phase Linear, Yamaha, Quintessence, LEVINSON, B&O, IMF, MAGNEPAN, M&K Subwoofers, Hegeman, Infinity, RTR, ESS, DAHLQUIST, Fulton Music, QUATRE, Onkyo, Connoiseur, Technics, Thorens, Dynaco, Transcriptors, Cerwin Vega, Soundcraftsman, Supex, Ortofon, ADC, Micro-Acoustics, Damped SME, Linn Sondek, KMAL, Naim Audio, etc. The Stereo Emporium, 3407 Delaware Ave., Buffalo, N.Y. 14217. (716) 874-3372.

TRANSIENT OUTPUT MONITOR for audio amplifiers. L.E.D. readout indicates ¼ to 1000 watts average and transient power output. Hand assembled, calibrated, tested. $100. Free literature. Analogic Design, P.O. Box 7753, Phila., Pa. 19101.

FOR SALE

SAN DIEGO, CALIFORNIA
ADC, Advent, AKG, AR-LST, Audio-Research, BGW, Citation, Crown, Dahlquist, DBX, Dynaco, FMI, Janszen, Linn Sondek, Magneplanar, Marantz, Micro-Acoustics, Ohm, Phase Linear, Philips, Quintessence, Rabco Revox, RTR, Sennheiser, SME, Stax, Supex, Tandberg, Yamaha.
Sound Company
4701 College Ave., (714) 582-4148
3675 Sports Arena Blvd., (714) 224-2844

CAN YOU IMAGINE a magazine that recommends components in four categories from no-holds-barred to best-for-the-money? The **Stereophile** does it. For info write Box 49A, Elwyn, Pa. 19063.

THE FIRST (1962) UNDERGROUND audio publication of them all, the **Stereophile** is the subscriber-supported perfectionist's magazine the others are trying to imitate. Free dope sheet explains why. Box 49A, Elwyn, Pa. 19063.

IF YOU BUY AUDIO EQUIPMENT, you can't afford not to read the **Stereophile.** Write Box 49A, Elwyn, Pa. 19063 for free blurb sheet.

ALLISON ACOUSTICS LOUDSPEAKERS have stabilized Radiation Loading. Years of intensive research by Roy Allison (formerly of Acoustic Research, Inc.) on the interaction between loudspeakers and room boundaries has yielded a new high standard of uniform bass performance. New Convex Diaphragm Mid-Range and High Frequency drivers achieve phenomenal wide dispersion (−3db 90 degrees off axis at 20kHz!) Literature and price information available upon request.
SUFFOLK AUDIO, INC.
1105 Mass. Avenue
Cambridge, Mass. 02138
Ph. (617) 868-1080

BALTIMORE-WASHINGTON AREA AUDIOPHILES REJOICE! At last a store for you. Come to Myriad Sound and hear the finest in state of the art audio equipment. Featuring the complete Audio Research line, Polk Audio Model Nines, ESS Heils, Janszen, S.A.E., Altec, Citation, R.T.R., B&O, Thorens, S.M.E. etc. all accompanied by Fred Huggins himself. Main store at 9619 Reisterstown Rd., Garrison, Md. 21055 (2 miles North of Balt. Beltway exit 20) (301) 363-1733.

WESTCHESTER AND FAIRFIELD COUNTY AUDIOPHILES TAKE NOTE! THE AUDIOPHILE, 231 BEDFORD STREET, STAMFORD, CONN. specializes in equipment for the connoisseur. Audio Research, ADC, Citation, Crown, Dahlquist, IMF, Infinity, Janszen, Philips, SAE, SME, TEAC, Technics, Thorens and many more. (203) 348-3551. (Closed Mondays).

INFRA WOOFER™ world's largest, deepest, most powerful sub-woofer system can be had only at Music and Sound, Ltd. 50 dB per octave crossover, bandpass 16 hz . . . $1295

F.M.I. & I.M.F. SUB-WOOFERS, for the closest approximation to dipole definition—$180-$350! Also, the rave five-way Fulton/R.T.R. super speakers. Shipped prepaid/insured. Music and Sound, Ltd., 11½ Old York Road, Willow Grove, Pa. 19090 (215) 659-9251.

AKG, ALTEC, AUDIO RESEARCH, Beyer, CROWN, DAHLQUIST, DBX, DECCA, INFINITY, KLH 9s, Koss, Mark Levinson, Nakamichi, Ortofon, PHASE LINEAR, PML, REVOX, SAE, Sennheiser, Sequerra, Sony, Stanton, Stax, Supex, Tandberg, TASCAM, Technics, Thorens, etc.
HI-FI HAVEN
28 Easton Ave.
New Brunswick, N.J. 08901
201-249-5130

TARZAC CASSETTES: C-1 thru C-90. CUSTOM CASSETTE LABELS. Free samples. 638 Muskogee Avenue, Norfolk, Virginia 23509.

FOR SALE

ARE YOUR TAPES IN DANGER . . . Playback on magnetized equipment can ruin them. Now you can measure and eliminate danaging magnetic residuals. Standard Audiophile Han-D-Kit $29.75. Delux Han-D-Kit $51.00, delivered in USA on prepaid orders. Free data on request. Annisco, 1103 N. Delaware, Indianapolis, Indiana 46202.

TEXAS AUDIOPHILES! On demonstration: Dahlquist, Nakamichi, Transcriptors, Linn-Sondek, Infinity, Braun, Advent, Crown, Phase Linear, Ortofon, Levinson, Supex, Quad, Klipsch, IMF, Keith-Monks, ESS, Decca, B&O, Radford, Stax, Audionics, Philips, Revox, Citation and many others. Audio Concepts, 2021 Guadaloupe, Austin, Texas. Phone 512-478-7421.

HI-FI ENTHUSIASTS WANTED!! Earn more than just spare money in your spare time. We need campus representatives to sell name brand stereo components at discount prices in your area. High commission, no investment required. Serious inquiries only, please. Contact: Mike Santillo K&L Sound Services Co. 75 N. Beacon St., Watertown, Mass. 02172.

ROGERS B.B.C. MONITOR, B&W Ltd., Celestion, Radford, Decca, ERA, Connoisseur, Audionics TL-90, Goldring, Revox, Beyer, Lamb and more. Custom design and modifications. SUFFOLK AUDIO, INC. 1105 Mass Ave., Cambridge, Mass. 02138 (617) 868-1080.

DAHLQUIST DQ-10, RTR, INFINITY, BOSE, ESS, KLIPSCH, SAE, CROWN, PHASE LINEAR, HERVIC, CITATION, YAMAHA, QUINTESSENCE, BURWEN, BEOGRAM 4002, THORENS, LINN SONDEK, TECHNICS, TRANSCRIPTORS, PHILLIPS, CONNOISEUR, A&D, SME, REVOX, SONY, ADC, ORTOFON, SHURE, MUCH MORE.
STEREO CENTER,
2539 VESTAL PKWY. EAST,
VESTAL, NEW YORK 13850
(607) 729-6191

PROPRIETARY CUSTOMIZED MODS reduce tonearm friction, damp spurious resonances, minimize torsional forces, improve tracking, and reduce record wear. For **S.M.E.'s—$30.00. For Rabco SL-8(E)—$100.00.** For Transcriptors—free* (*with purchase).
NOW
LISTEN to our calibrated Satin Ortofon/Supex moving coils. B&O/Grace/Micro-Acoustics. From the laboratories of Music & Sound Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090 (215) 659-9251.
+Levinson Cartridge Preamp+

SOUND ADVICE MAGAZINE—the new one with the bi-amped approach. Our listening panel utilizes, first, the subjective. We share with you our careful research into improved AB listening test methods. For example, these surprising conclusions: a well known cartridge sounds like it has more detail and transparency because it overshoots on transients; and a well known amplifier seems grainy because it's revealing more of your program source which already has distortion. In straightforward language, they'll inform you, sometimes indelicately, of the sound qualities of supposedly similar products. We've already discovered a $500 amplifier that's better than half of the $1200 high end jobs. Lab tests? Yes, but one of the most perplexing problems facing audiophiles is that similar equipment which measures almost perfectly sounds dramatically different. So, while we do both, our listening panel is the ear-heart of Sound Advice Magazine. If you are planning to purchase high or medium priced audio gear, you cannot afford to be without the penetrating equipment reviews of Sound Advice. Honest to our name. Four issues for $9 ($12.50 foreign). 225 Kearny Street, San Francisco, Calif. 94108.

FOR SALE

NORTHERN N.J.'S FINEST AUDIO STORE, 20 minutes from NYC. Bozak, B&O, Magneplanar, Marantz, Phase Linear, DBX, IMF, Dahlquist, Ortofon, Quintessence, Thorens, Pioneer, Kenwood, Dual. Write or call - University Stereo, 57 E. Ridgewood Ave., Ridgewood, N.J. (201) 447-5700.

BERKELEY, CALIFORNIA

Audio Research	M & K
Mark Levinson	Quad
Quintessence	Braun
Radford	Fulton
Citation	Klipsch
Quatre	Dahlquist
Hervic	Magnepan
Revox	Audionics
Grace	Keith Monks
Supex	Linn-Sondek
Dbx	Connoiseur

STEREO WORKSHOP
2985 College Avenue
Berkeley, California 94705
(415) 843-5836 open 2-8 TWThf, 12-6 Sat

LOW PRICES on stereo components. List of brands, plus "special" sheet 50¢. Refundable. Custom Audio, 4226 Robert St., Red Wing, Minn. 55066.

CURRENT AND RECOMMENDED:
CAMBRIDGE AUDIO P70 and P140 integrated amplifiers with toroidal power supply and state of art preamp. $350 and $550. Also TL100 and TL200 transmission line speakers. $400 and $500 each.
GRACE BL and 8C stereo moving magnet cartridges. We feel the 8C is the finest cartridge available which does not require a transformer or peamp or damped tone arm. Amazingly uncolored. $80 and $95.
FIDELITY REASEARCH cartridge and transformer. The best moving coil yet. Highly regarded even by resident Decca freak. Great depth of image and smoothness. $280 with toroidal transformer.
DECCA BRUSH. Over a million conductive bristles eliminate need for liquids and reduce static. $15.
C/M LABS RR805 receiver. Unusually quiet, low distortion tuner. Fully complementary power amplifier. "C" panel 19 in. rack mount. $600.
also: Radford, Audionics, BGW, Yamaha, Sony, Revox, FMI 80, Celestion, Braun, IMF Monitors, Micro Seiki headphones, ERA, Transcriptors, Connoisseur, Dual 601, 701, damped tone arms, Decca export, Supex, Ortofon, ADC, Sennheiser, Beyer.
Shipped free anywhere in U.S. and Canada
GREENWOOD SOUND, INC.
5331 S.W. Macadam
Portland, Ore. 97201
503 224-1776
the Water Tower at John's Landing

MIXER MODULES- Modules designed to provide an economical route to studio-type mixing consoles. Modules have plasic element slide faders and a module for E.Q. At last there is a bridge between the high-cost pro gear and components for the audio enthusiast Send for free info to Wall of Sound, Box 239, Glen Burnie, Maryland 21061.

DON'T PAY THE HIGH MAIL ORDER PRICES THIEVES WAREHOUSE OF TAMPA, 1531 SOUTH DALE MABRY, TAMPA, FLORIDA 33609.

LOOKING FOR HIGH QUALITY "PREVIOUSLY OWNED" MERCHANDISE? Referral/resale service for industrial and professional audio equipment. All merchandise guaranteed to meet manufacturer's specification for 12 months (parts, labor, and round trip shipping included). Call or write OHRWERKE, 40 High Street, Guilford, Conn. 06437, (203) 399-7367.

FOR SALE

HEATHKIT AA-2010 4 channel amp. Perfect, in cabinet, best offer over $200. (215) 383-3216—8 to 5.

BOSE 901 speaker system, two years old—$375. R.L. Leffert, RFD 2, Lancaster, N.H. 03584.

MOVING COIL CARTRIDGE OWNERS: Your alternative is here! Our MCP-1 Moving Coil Cartridge Preamp, featuring audible superiority at a reasonable price, is now available. For information write R B AUDIO, P.O. Box 574, Eatontown, NJ 07724.

SERVICES

HIGH FIDELITY SPEAKERS REPAIRED
AMPRITE SPEAKERS SERVICE
655 Sixth Avenue, New York, N.Y. 10010
212-CH3-4812

TAPE RECORDER HEADS brought back to spec. Wear removed. Brilliant finish. $10.00 each. One day service. E. Maher, 5 Evans Place, Orinda, Calif. 94563.

DON'T PAY the high mail order prices. Thieves Warehouse is coming to your area. Franchises available. Thieves Warehouse, P.O. Box 8057, Pensacola, Florida 32505.

NASHVILLE RECORD PRODUCTIONS WILL PRESS HIGH QUALITY PURE VINYL RECORDS FROM YOUR TAPES. SEND FOR SAMPLE RECORD AND PRICE LIST. ALSO FINEST DISC MASTERING. 1819 BROADWAY, NASHVILLE, TENNESSEE 37203.

CUSTOM RECORDING SERVICE, Tape and disc. Stereo and mono. Live and copies. Editing, Masters and pressings. High quality at reasonable rates. Joseph Giovanelli, Audio-Tech Laboratories, 2819 Newkirk Ave., Brooklyn, N.Y. IN 9-7134.

CUSTOM TAPE DUPLICATION 8 track and cassette. We specialize in small runs. CUSTOM AUDIO c/o Dick Walen, 4226 Robert St., Red Wing, Minn. 55066.

AUDIOPHILES! Your technical questions answered—reasonable rates. Sound Advisory Service, P.O. Box 34045, West Bethesda, Maryland 20034.

STEREO SOUND LABS
FACTORY SPECS OR BETTER BY 10% ON ALL REPAIRS ON MAJOR BRANDS. WARRANTY 90 DAYS PARTS AND LABOR. SHIP US YOUR GEAR PROPERLY PACKED AND INSURED. 4419 JOHN MARR DRIVE, ANNANDALE, VIRGINIA 22003. (703) 941-5707.

SERVICE FOR YOUR COMPONENTS. Having trouble getting satisfactory service on your equipment? Write for details on our guaranteed service. The Audiophile, 582 N. Frederick Ave., Gaithersburg, Md. 20760.

ANTIQUE PHONOGRAPH RESTORATION
Antique phonographs repaired and restored by specialist. Edison, Columbia, Victor, etc. By appointment only. Evan Blum, 21 Brook Lane, Great Neck, N.Y. 11023. (516) 482-0371.

STEREO MASTERS, RECORDS AND ALBUMS. Check our prices. Newest type high level cutting equipment featuring: Neumann VMS 70 Computer control lathe, Parametric Equalization, Dolby, DBX, and the new SX74 Cutting System by Neumann. Special package prices on album and single record production. Stereo LP masters $30.00/side. 7" stereo masters $10.00/side. 1000 45 RPM stereo singles $217.50 including mastering. Write or call for brochure. Dick McGrew Recording Service, 902 N. Industrial Blvd., Dallas, Texas 75207. 214-741-2027.

RECORDS

SHOW ALBUMS—Rare Out of Print LP's. 52 page list 50c Broadway/hollywood Recordings Georgetown, Conn. 06829.

OLDIES—45 RPM Original hits Catalog 50c C&S Record Sales. Box 197, Wampsville, N.Y. 13163.

WHILE YOU WERE LOOKING for out-of-print records, you should've been looking for us. Discontinued, 216 N. Rose, Burbank, California 91505.

FILM-STAGE SOUNDTRACKS. Large free list. A. Lutsky, Box 557342, Miami, Fla. 33155.

CATALOGS. Broadcasts, soundtracks, Personalities of Thirties, Forties. Box 225, New York, N.Y. 10028.

SOUNDTRACK, CAST PERSONALITY list 20¢. Don, 2914 Westerland, Houston 77042.

FREE 200-PAGE CATALOG. 1,400 New Stereo Recordings Renaissance, Baroque, Classical, Romantic, Modern Music. Not sold in stores. Not listed in Schwann's. Highest quality! Budget label prices! Available only by mail. MUSICAL HERITAGE SOCIETY, Box 932 AU, New York, N.Y. 10023.

SOUNDTRACKS/OC, JAZZ/PERSONALITY — FREE NEWSLETTER! RTSA, 3700 S. Plaza Drive, Bldg. F/211, Santa Ana, California 92704.

QUADRAPHONIC RECORDS AND TAPES - World's largest selection - all labels, over 1000 titles - at discount prices! For your free illustrated quad catalog, write: SOUND CONCEPTS, 2713 West Radan, Dept. C6, Peoria, Illinois 61604.

FOR DISCOUNTS on records and tapes, send 25¢ for catalog to K.D. Flenrich, P.O. Box 123, Hayes Center, Neb. 69032.

COLLECTORS "MIDWEST GROOVE" newsletter and record exchanger is here. Subscription info send 10¢ Hydra Productions, Box 792, Palatine, Ill. 60067.

WORLD'S LARGEST 1950's Record Auction—FREE. Vintage Records, Box 2144, Anaheim, Calif. 92804.

SOUNDTRACK RECORD ALBUMS—Mail Auction. Free List—Whalon, 2321A Hill—Redondo Beach, Calif. 90278.

TAPE RECORDINGS

RENT Open Reel or Cassette Prerecorded tape. All labels. Catalog $1.00. Tape & Time, P.O. Box 740, Hopkins, Minn. 55343.

EVERYTHING ON OPEN REEL! Prerecorded classical/popular tapes. Latest releases Dolby Quad. 96-page catalogue $1. Barclay-Crocker, Room 857A, 11 Broadway, NYC 10004.

LIVE OPERA TAPES. Professional reel, cassette copies. Extensive sound coded catalogue. Quality guaranteed. Also records. A. Fischer, Box 83 Fordham Station, Bronx, N.Y. 10458.

HALF TRACK STAGGERED stereo tapes wanted. Bel Canto, etc. sell/trade - ¼ track copies. R. Brewster, Box 90, Oak Ridge, Tenn. 37830.

SHORTWAVE

HEAR POLICE FIRE Dispatchers. Catalogs show receivers exclusive directories of "confidential" channels. Send 10c stamp Communications, Box 56AU Commack, New York 11725.

POLICE-FIRE MONITORS. Scanners. Crystals. Discount Priced. Box 19224, Denver, CO 80219.

EQUIPMENT WANTED

A-R 1 SPEAKERS with 8 inch top end. Realistic electrostat 3 tweeters (or similar Lafayette SK-150 or Rystl). University crossovers N2B (or similar Realistic 91L534, Lafayette KT128). Please state condition—price to N. Pagani, 612 Timpson Street, Pelham Manor, New York 10803. (914) 738-4773.

WE MUST HAVE YOUR USED COMPONENTS
Premium Trade or Cash for:
McIntosh tube (pre) amps & tuners, Marantz tube (pre) amps 7 tuners, Marantz 7(T), 15, 16 (B). Futterman H-3, J.B.L. 400, 500, 600 series electronics, J.B.L. Hartsfield, L-101, Metrogon, Minigon. Music & Sound Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.

CASH FOR Mint Ips & prerecorded reel tapes. Records, Box 323, Hillburn, New York 10931.

MARANTZ 7C, 9: McIntosh C22. John Fong, 1238 Green St., San Francisco, Calif. 94109.

ELECTRO-VOICE 15W & 15WK, T-250 mid-range drivers, 6HD horns. G. Ognibene, 903 Charity St., Abbeville, La. 70510.

WANTED—CROWN IC150, D150, SAE XXXIB or Citation 12. Gary Hall, 93 Morgan Rd., Binghamton, N.Y. 13903. (607) 772-9522.

AMPEX 200, Magnecorder SD-1, or pre-1946 wire recorders, literature. Layer, AV-SFSU, 1600 Holloway, San Francisco, CA 94132.

PAIR QUAD ELECTROSTATICS—serial numbers 28500 or higher. Will pay $400. 1-203-227-6705.

WANT TO BUY CASSETTE TAPE DECK and reel to reel tape deck both by Soundsign H. Woods, P.O. Box 375, Sylacauga, Ala. 35150.

WANT TO BUY 1970 KENWOOD Model KA-6000 amplifier and matching audio oscilliscope unit. Name any reasonable price. 1264 Straka St., Pittsburgh, Pa. 15204—(412) 921-2888.

WANTED: NEW OR USED ALTEC Barcelona, JBL L101, Olympus, McIntosh C22, C28. Mr. Kazuhiko Murota, 1-67-203, Tsurumaihigashi, Nara City, Japan.

DOES ANYBODY HAVE a Marantz 10B wood case, a 7 rack panel, or a 10B rack panel they would like to sell? M.S. Wilkouski, 5252 N. California, Chicago, Ill. 60625. (312) 561-4056.

I WANT TO BUY any used CB equipment. Will pay up to 75% of original price. Call (213) 429-0746 collect, if necessary. Roberta Hanra, 2862 Heather, Long Beach, Calif. 90815. Or write to Audio Box A56-3.

WANTED - Pioneer SX-1010 & SA-9100, ESS-AMT series, Garrard Zero 100 SB or 100C, Sony & Tascam tape equipment; cartridges new or top condition only. Send specs, lists & prices to: Louis Sonier, 139 Dawes Road, Toronto, Ont. M4L 501.

BLACK-OUT
Black-out represents the latest innovations in the Electronic Industry. 100 new items cover: speakers, visual—physical—amps, record players, tape players, cassette players, 8-track players, pre-amps, modulators, furniture and accessories. Send one buck for complete 100 item catalog to Box A56-1.

HIGH FIDELITY

DYNAKITS, IAD, lowest prices. Underground HI-FI Sales, 324 Broadwater Road, Arnold, Md. 21012. (301) 647-0919.

NOW AVAILABLE . . . FAMOUS REFLECTING SYSTEM'S 4½" REPLACEMENT DRIVERS. $7.98 POSTPAID. BIG QUANTITY DISCOUNTS. FREE SPECIFICATIONS, AURATONE, BOX 580-20, DEL MAR, CALIFORNIA 92014.

TAPE & TAPE RECORDERS

SCOTCH RECORDING TAPE, lowest prices. TAPE CENTER Box 4305B, Washington, D.C. 20012.

SPECIAL OFFER!
Free tape to introduce you to our invaluable service. No obligation to buy anything. Send 25¢ to cover costs of postage and handling. Specify rock, country or classical. Also specify 8-track, cassette or open reel. Send to Hartley, 2015 Shore Parkway, Bklyn, N.Y. 11214.

SCOTCH, CAPITOL. Blank cassettes, cartridges, reels. Discount prices. Lawson's, Box 510, Livermore, CA 94550.

SCOTCH AND MAXELL TAPE discounted. Write and save. N.A.B. Audio, Box 7, Ottawa, Ill. 61350.

AUTO ACCESSORIES

SANDBLASTERS - $39.50-$839.50. Free Catalog. Truman, 1330A Market, Youngstown, Ohio 44507.

RADIO PROGRAMS

1930-1962 RADIO PROGRAMS, Reels, $1.00 hour! Cassettes, $2.00 hour! Mammoth catalog $1.25. AM TREASURES, Box 192M, Babylon, New York 11702.

OLD RADIO PROGRAMS on tape and cassette. Catalogues 50¢. 30 minute sample tape with catalogue $1.25. Satellite Broadcasting, Box 512, Miami, Florida 33165.

GOLDEN AGE RADIO—your best source for radio tapes. Box 25215-D, Portland, Oregon 97225.

OLD RADIO PROGRAMS ON TAPE. Thousands available. Low prices, finest quality, immediate service. Catalogue 25¢. Nostalgic Radio, Box 29K, Peoria, Il. 61601.

VINTAGE RADIO IN QUALITY SOUND ON REELS, 8-TRACK, OR CASSETTES. BUY FROM PROS IN THE BUSINESS WHO KNOW SOUND! THOUSANDS OF PROGRAMS AVAILABLE. CATALOGUE: $1.00; SUPPLEMENT: 50¢ (REFUNDABLE) TO: THE VINTAGE VOICE, BOX 687, TIBURON, CA. 94920.

YESTERDAY'S RADIO PROGRAMS ON TAPE. Reels, cassettes - fast reliable service. Catalog $1.00 refundable with first order. ADVENTURES, 1301-A North Park Avenue, Inglewood, California 90302.

GOVT. SURPLUS

PROFITS IN GOVERNMENT SURPLUS. How and where to buy. Directory of Surplus Offices. Sale terms. Satisfaction guaranteed. Only $1.50. Castle, Box 3395-GA, Albuquerque, New Mexico, 87110.

MANUALS FOR GOV'T. SURPLUS Radios, Test Sets, Scopes. List 50¢. Books, 7218 Roanne Drive, Washington, DC 20021.

MONEY

HISTORIC PAPER MONEY OFFER!! 10,000 (ten thousand!) German Marks yours to treasure for just $5. Terrific collectors' items. Immediate delivery. Send to: Finkelstein, 2056 Cropsey Avenue, Brooklyn, New York 11214.

PHOTOGRAPHY

PHOTO BUTTONS made from your photograph or any slogan, advertising, picture, etc. Only $1.25 postpaid. Arcan Products, Rt. 1, Box 278, Waldorf, Md. 20601.

50 PAGES OUTSTANDING SUPER 8 AND 16MM MOVIES; PROJECTORS; LENSES. GAINES (AM), 15207 STAGG, VAN NUYS, CALIFORNIA 91405.

BOOKS

ELECTRONICS BOOK DISCOUNTS. Save! Free selected, reviewed list. **T/DOC,** Box 340, Centerville, VA 22020.

MUSICAL INSTRUMENTS

UP TO 60% DISCOUNT. Name brand instruments. Catalog. Freeport Music, 455R Route 110, Melville, N.Y. 11746.

PLAY 5 STRING BANJO Amazingly Easy. No Music. Country-Bluegrass. $2.98. Hillis, Box 124M Signal Mountain, TN 37377.

SAVE 40%-50% on strings and amplifier tubes. International brands. Postpaid. Listing-25¢. Ace Electric Co. 2010 Edgewood Rd., Harrisonburg, Va. 22801.

PLANS & KITS

TELEPHONE BUGGED? Don't be Watergated! Countermeasures brochure $1.00. **NEGEYE LABORATORIES,** Box 547-AM, Pennsboro, WV 26415.

SPEAKERS

MUSICAL SPEAKERS REPAIRED
ALTEC WARRANTY STATION
Hughes Electronics Service
45 Dunn St., Asheville, N.C. 28806

CONSTRUCT YOUR OWN speaker enclosure. Send $1.00 for drawing to:
Creightney Sounds,
140-25 169th Street,
Jam., N.Y. 11434.

INSTRUCTION & EDUCATION

DIGITAL ELECTRONICS! Design and understand Digital Circuits. Increase technical competence. Complete and guaranteed course is highly effective. $10.00. Free literature. DYNASIGN, Box 60AM, Wayland, Mass. 01778.

SELF-STUDY CB RADIO REPAIR COURSE. There's money to be made repairing CB radios. This easy-to-learn course can prepare you for a career in electronics enabling you to earn as much as $16.00 an hour in your spare time. For more information write: CB RADIO REPAIR COURSE, Dept. 6-A, 531 North Ann Arbor, Oklahoma City, OK 73127.

EARN B. A. Theology. 1425 N. Rockwell, Oklahoma City, OK 73127.

UNIVERSITY DEGREES BY MAIL. Bachelors, Masters, PhD. Free Revealing details: Counseling, Box 1425-AM, Tustin, California 92680.

"The Marantz 1070 integrated amp is close to optimum in performance and the low price makes it an even better value."

In December, 1974, sound engineers and audiophiles were invited to examine and discuss the new Marantz Stereo Console Amplifiers featuring models 1040 and 1070 and the new Marantz 112 AM/FM Stereo Tuner. The following comments were taken from that taped discussion.

The 1070 Stereo Amp

"As far as good basic features are concerned, it's comparable to units costing twice as much."

"It maintains all the features of the Marantz 1060, plus it adds a number of its own. For instance, it now has graphic slide-type tone controls, two tape monitors and a versatile tone mode selector switch."

"With the 1070 you have a full range of tone controls like bass, mid range and treble slide controls plus preamp out and main in jacks."

"I feel strongly about the preamp out jacks. You can re-equalize tape recordings, insert equalizers or even add electronic cross-overs into the chain."

"One major feature that I like in the 1070 is its ambience circuitry. Essentially it's a speaker matrix or pseudo 4-channel. This means you can get into simulated 4-channel sound by just adding a second pair of speakers."

"In addition to the step up in power to 35 watts continuous power per channel at 0.3% total harmonic distortion, 20 Hz to 20 kHz both channels driven into an 8 ohm load, the circuitry is direct coupled."

"The circuitry is now full-complementary direct coupled to the speaker terminals. As a result, the damping factor is much improved at low frequencies where it counts."

"The output circuitry now includes a speaker protection relay circuit and turn on delay."

"There's improved thermal stability. This buys long term reliability as well as improved performance."

The 1040 Stereo Amp

"The new 1040 integrated amp is rated at 20 watts continuous power per channel at 0.3% total harmonic distortion. 20 Hz to 20 kHz, both channels driven into an 8 ohm load."

"It also has the ambience circuitry for simulated 4-channel. Most all of the features of the 1070 are on the 1040."

"It's an excellent performance component for a modest price."

The 112 Tuner

"It's got phase lock loop, a Dolby* de-emphasis switch and a number of other high-performance features. There're no gimmicks in it. Every feature is practical."

"A complete system including the 112 tuner plus either the 1070 integrated amp or the 1040 integrated amp gives performance you couldn't get in most receivers and still costs less than $500."

The Marantz 1070 Amp, 1040 Amp and 112 Tuner are just part of the exciting new Marantz component line starting as low as $199.95. Each of them reflects the kind of technical expertise and engineering excellence that has made Marantz the choice of professionals world-wide. Stop by your local dealer and see the entire Marantz line featuring an exclusive three-year guarantee** on parts, labor and performance specifications.

Marantz. Ask an expert.

*Dolby is a trademark of Dolby Labs, Inc. **Marantz Co., Inc., guarantees to the original registered owner that all parts will be free from operating defects and that performance will be within printed specifications for three years from purchase date, except oscilloscope tubes which are guaranteed for 90 days. Product will be repaired or replaced free of charge in the sole discretion of Marantz Co., Inc., provided it was purchased in the U.S.A. from an authorized dealer. The serial number cannot be altered or removed. Product must be serviced by authorized Marantz repair technicians only. © 1975 Marantz Co., Inc., a subsidiary of Superscope, Inc., P.O. Box 99, Sun Valley, CA 91352. In Europe: Superscope Europe, S.A., Brussels, Belgium. Available in Canada. Prices and models subject to change without notice. Consult the Yellow Pages for your nearest Marantz dealer. Send for fee catalog.

Don't buy any receiver until you compare its price, power, and specs to these.

Technics' four new stereo receivers. All with impressive specs. And a lot more.

All four have direct coupling. To give you a tighter, cleaner bass.

All with reserve power to float through complex, high-level musical passages without distortion or clipping. Because all have large capacitors, conservatively rated transformers, and bridge rectifiers in the power supplies.

SPECIFICATIONS	SA-5150	SA-5250	SA-5350	SA-5550
Price*	$229.95	$299.95	$349.95	$479.95
Min. RMS Power per channel into 8 ohms	16 watts	23 watts	28 watts	58 watts
Bandwidth	40Hz-20kHz	20Hz-20kHz	20Hz-20kHz	20Hz-20kHz
Total Harmonic Distortion (Max.)	0.8%	0.5%	0.5%	0.3%
FM Sensitivity (IHF)	1.9μv	1.9μv	1.9μv	1.8μv
Selectivity (IHF)	70dB	70dB	70dB	70dB
FM Stereo Separation at 1 kHz at 10 kHz	40dB 30dB	40dB 30dB	40dB 30dB	40dB 30dB

*Suggested minimum price, which is the fair trade price in states where Technics products are fair traded.

All with a Phase Lock Loop IC and flat group delay filters in the tuner section. For clean, well-separated highs as well as lower distortion on FM. And about 20% less wiring. To reduce hum.

All with Technics' exclusive linear dial scale.

For effortless tuning on *both* AM and FM. Negative feedback low distortion tone controls. And all the inputs and outputs you'd expect from Technics.

Whichever Technics receiver you choose, you get all the advantages of Technics' sophisticated engineering, good power, and good specs. And all at a good price.

The concept is simple. The execution is precise. The performance is outstanding. The name is Technics.

FOR YOUR TECHNICS DEALER, CALL FREE 800 447-4700.
IN ILLINOIS, 800 322-4400.

Technics
by Panasonic

Check No. 31 on Reader Service Card