THE B.A.S. SPEAKER

Coordinating Editor: Harry Zwicker
Production Manager: Robert Borden
Copy Editor: Joyce Brinton
Staff: Richard Akell, Stuart Isveck, Lawrence Kaufman, Mark Saklad, John Schlafer, James Topali, Peter Watters

THE BOSTON AUDIO SOCIETY
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In This Issue

Tom Mashey's article on amplifier pricing on the basis of dollars per dB in the December 1975 issue of the BAS Speaker has created a significant reader reaction. This month Dana Craig re-evaluates and extends the tabulation, this time for different headroom reference powers. Craig also offers additional insight into evaluating the dB-purchasing power of our audiophile dollars through a supplementary analysis. (The BAS has now ranked, in one form or another, preamplifiers and power amplifiers. Can tuners or loudspeakers be so listed? As for tuners, we're going to try in the near future.)

And to further help bring order from chaos, member John Gombos' publication describes a filing system for audiophile articles. It requires some effort, but using it, Gombos can locate, with the flick of a few index cards, references to all the information he has read on any listed subject. The next time you are gathering data on Ampzilla versus the Dyna 400, you will wish you were so well organized.

Then getting to the type of article we audiophiles crave with mindless passion, Michael Riggs offers a delightful review of the KMAL tonearm, along with a parade of cueing devices that makes us wish simply for steadier fingers.

Membership dues are $12 per year (October 1 to September 30) or portion thereof. Dues include a one-year subscription to the BAS Speaker. (Note that almost the full amount of dues is allocated to production of the Speaker. The local activities of the BAS are strictly self-supporting.) For further information and application form, write to: The Boston Audio Society, P.O. Box 7, Kenmore Square Station, Boston, Mass. 02215.

For Sale

When you send in want ads, please indicate whether we should include your address as well as your telephone number.

- Epicure Model One amplifier, $550; Realistic Sound Level Meter, $30; Integral Systems 200U amplifier with latest protection circuitry, $175; BSR FEW III equalizers (2), $150 each; Sony SQD2020, $150; JVC 4DD-5 demodulator, $40; Koss K2+2 headphones with case, $50; Whisker record cleaner, $30; Texas Instruments SR-50 calculator, $50; Summit SRM calculator, $25. Prices do not include shipping and are negotiable. J. J. Thompson, 281 Warren Ave., Kenmore, N.Y. 14213
- Quad 33 preamplifier and 303 amplifier, DIN/RCA adapter cables, lots of reviews, original cartons, excellent appearance and performance, $300. Dow Williams, 53 Norman Way, Salinas, Calif. 93901; (408) 449-2220.
- Large Advent loudspeakers, utility cabinets, $175/pair or trade for Smaller Advents plus cash. Large Advent loudspeakers, walnut cabinets, $195/pair or trade for Smaller Advents plus cash. Ken, (617) 646-3427, evenings or weekends.
- Audio Research Magnaplanar Tympani III system, complete, in off-white linen fabric, $800. Charles Philips, (919) 449-4132 (North Carolina).
- McIntosh 2105, mint condition, 140 watts/channel, original carton, manuals, $550. Bob Graham, (617) 944-8738, or P.O. Box 7.
- McIntosh C-28 preamplifier, case, and switcher SCR-2, brand new, cost $750, will sell for $500. Robert Hiatt, (503) 234-3924 (Oregon) after 5 p.m.
- Stereo Review, Jan. 1967—March 1976; High Fidelity, Jan. 1967—Dec. 1975, sell complete years only, $ 3/year or best offer. Dana Craig, (617) 762-4221, evenings.
- Ortofon SL 15E Mk. II phono cartridge, in new condition (without transformer), $65. Rene Jaeger, (617) 899-8090 days or P.O. Box 7.

Wanted

- Revox A77 two-track, high speed (7½,15 ips) deck. Ken, (617) 646-3427, evenings or weekends.
- Blown Dyna Stereo 120's. Dollars for your dead beast; price will vary with condition. Dicker with Joel Cohen, (617) 890-1727 days or P.O. Box 7.

A Recommended Recording: Beethoven by Kleiber

The DGG recording of Beethoven's Fifth Symphony (DGG 2530 516) is among the finest all-around orchestral discs I have ever heard. There are very realistic massed violins at the beginning of side 1, while side 2 offers many notable sounds: a stunning metallic group of horns about 5% into the side, a clear group of cellos at 15% in, and the full blast of the orchestra about 30% in. Other delights are a "picky" pizzicato about 25% of the way through and a very reedy oboe at 85% . This disc offers splendid treble detail with a minimum of harshness, wide dynamic range, reasonably low background hiss, and good reverberation.

The disc has received rave reviews for its aesthetic musical value, but thus far only passing mention of its sonic qualities. I can offer little further to the musical criticisms, but I do note that Kleiber offers a reading not so sophisticatedly fast as Toscanini nor as slow as the schmaltzy Stokowski rendering.

— Dan Shanefield (New Jersey)

Levinson JC-1 at Low Battery Voltages

Members using the Levinson JC-1 pre-preamplifier may find reassurance in this note. Spurred by an article in The Absolute Sound, Vol. 1, no. 4, which mentioned the possibility that the JC-1 might become unstable at low frequencies with low battery voltage, I wrote Levinson to ask if this were in fact the case. A portion of the reply is as follows:

"To the best of our knowledge the JC-1 does not oscillate at low audio frequencies under any circumstances. The battery voltage cutoff point we use is 1.47 volts. Below that point the JC-1 distortion will begin to increase noticeably. One word about battery type; we recommend that alkaline batteries . . . be used with the JC-1. Some less consistent batteries have been known, because of their rapid deterioration, to compromise the sound of the JC-1 more quickly than the alkaline type."

The letter was signed by Timothy Lowery, Domestic Sales Manager.

— Steve Seto (California)

RFI: The Constant Complaint

On the locally broadcast audiophile show "Shop Talk" from WBUR, radio frequency interference with audio equipment is a constant complaint. In the July 1975 issue of the BAS Speaker mention was made of a bill pending in the U.S. Congress that would require manufacturers to install RF rejection devices in their products. This would seem to be the only means of coming close to eliminating interference for those who cannot themselves delve, with bypass capacitors and soldering iron in hand, into their faulty equipment. Although some measures short of such an operation can be effective in reducing RFI (bypass the leads of your speakers, at both the amplifier and at the loudspeaker, with 0.03-μF capacitors; similarly bypass the ac line; ground everything to a cold water pipe; use shielded downlead from the antenna), and although several articles have been written giving assistance (High Fidelity, March 1976; Radio-Electronics, April 1975; the Radio Amateur's Handbook, at any library in multiple copies) RFI continues to be a widespread problem.

The bill mentioned in July is still pending, and the Amateur Radio Relay League (ARRL), the largest organization of U.S. "Hams," is still active in assisting this legislation through Congress, much against the wishes of the penny-pinching equipment manufacturers and the importers. (It must be noted that if you are experiencing RFI, it is quite possibly caused by a Citizens Band operator and not a Ham, especially if the trouble has recently arisen. Every 2 to 3 months or so, more CB licenses are given out than there are Hams altogether in the country, and these operators tend to be less skilled in removing RFI than the much more technically trained Hams.) A new packet of information is now available from the ARRL on the problem, and some of it is of interest to the audiophile. The packet can be obtained from the ARRL, 225 Main St., Newington, Conn. 06111, for a self-addressed stamped 9 by 12 or larger envelope with 45¢ third class postage. The most useful portion of the packet is a listing of about 50 manufacturers and distributors giving the type of service that they provide a customer with an RFI problem. He must, however, be rather certain that the problem is with the unit in question and not with one of the above mentioned sources of RF pickup (i.e., speaker leads). A sample from these pages is given below:

Kenwood Electronics, Inc. "Kenwood asks that customers with RFI problems take the affected unit to an authorized service center where an adjustment will be made at no cost to the customer, if the product is properly registered with Kenwood and within warrantee. It is suggested that prior authorization for the return be obtained ..."

Harman-Kardon, Inc. ". . . Corrective action is provided at no cost to the customer."

Tandberg of America, Inc. ". . . We will do any modification possible to eliminate the RFI."

Note that in the full list provided with the RFI packet, many responses are not nearly so positive as the above, and that many audio manufacturers are not listed; many of the manufacturers that are listed are TV, organ, and mass-market component manufacturers. Note also that, with the bill hanging over their heads, many manufacturers will be bending over backwards to be helpful. They would rather be able to show Congress that they are solving all of the complaints for free, and that no law is required, than fall into another FTC-type ruling.

If you are really interested in solving your RFI problem, write to: The Honorable Torbert H. Macdonald, Chairman, Subcommittee on Communications, Room B331, Rayburn House Office Building, U. S. House of Representatives, Washington, D.C. 20515.

If not quite so interested, drop the SASE to the ARRL for their information packet. Otherwise, if you do have an RFI problem, write to the manufacturer. Chances are steadily improving that he will be helpful. — Harry Zwicker (Massachusetts)

Feedback on Service: Satisfaction with EV

Words of praise for the service people at Electro-Voice and to Harry Arnold and assistant "Andrea" in particular. Recently the voice coil of a 20-year-old T-25A midrange driver opened. For $21.50, EV rebuilt and returned it via UPS. Alas, it was lost in transit. EV scoured its shelves and promptly sent me another of this long deleted speaker.

A 21-year-old EV crossover network has also failed. The company has promised to repair it for no more than a nominal fee, if not for free. This kind of service on units so long out of warranty is, I think, remarkable. Even more so is the first letter I received regarding the T-25A: EV regretted having to charge anything for the rebuilding job, but they stated that the recent surge of superpowered amplifiers has forced a change of repair policy. — Richard A. Wolf (Texas)

Cable Capacitance

To supplement the cable capacitance data recently published in the Speaker, I would like to contribute the following. Calrad makes a "4-Channel Low Loss Coax Jumper Cable" (no. 55936), which is a 46-inch dual cable set with a ground wire running between the two coaxial cables. Each cable of the pair measures 61 pF, or about 15.9 pF per foot. By contrast, the 18-inch Switchcraft jumper cable (no. 25AC25P1) measures 62 pF (total), while the 36-inch cable (no. 25AF25P1) measures 124 pF. The average capacitance per foot of the Switchcraft cable is thus almost three times as large, at 41.3 pF/foot, with the phono plugs contributing negligible capacitance to the total. All capacitance measurements were made on a Philips PM6302 RCL bridge at Jonas Miller Sound in Los Angeles.

From a quality standpoint, the Calrad product seems pretty good, although I would prefer more robust phono plugs. I am sure that most people are familiar with Switchcraft, which is always very good mechanically and electrically. — Steve Seto (California)

Domestic Power MOSFET

The spec sheet for the Siliconix VMP-1 provides the following information: no thermal runaway or secondary breakdown; switching time, 5 nsec (200 MHz !); high input impedance; drain-source voltage, 60 volts; current, 2 amps (not simultaneously); power dissipation, 35 watts; transconductance, 200 millimhos; internal impedance, 2.5 ohms (which implies low damping factor if used singly). A normally off device, it must be biased into linear operation. Price, $7.80 each to $5.50 in quantity. Delivery: on the shelf. — Ira Leonard (Massachusetts)

A-B Testing and "Golden" Versus "Tin" Ears

[Although the work of Fletcher and Munson is vulnerable to criticism (the subject of an article to be published next month), John Sprague's provocative comments that follow remain essentially valid despite that criticism.—Ed.]

The Fletcher-Munson curves are average curves for normal hearing based on tests of many subjects. They do not represent any particular individual's hearing at any age, although many individuals probably have sensitivity curves fairly close to the average. Of those whose hearing is notably different from the average, there are probably some whose curves would be more nearly linear in comparing different sound levels [the correct definition of linear—Ed.] and some whose curves are even further from linear than average.

Assume that two such individuals have equivalent discrimination based on experience as performing musicians, as spectators attending live concerts, and in listening to a variety of source material and equipment. Which will hear the most differences due solely to changes in playback levels, and which the least?

Does this mean that the self-appointed golden ears among us, who hear differences that elude others, may actually have poorer [unusually phon-nonlinear—Ed.] than average hearing? And conversely, do those who claim to hear few differences among good equipment have better than average hearing?

This will indeed be the case if we believe that many apparent differences are caused simply by changes in A-B playback level. The tin ears will claim to be golden, and the true golden ones will be considered by others to be tin. Hopefully reviewers will be careful to avoid these playback level effects, and their judgments will reflect accurately the actual differences in equipment or source material, or their ability to discriminate, but many an A-B comparison has gone astray when such care was not taken.

Now suppose that the same source material is used for two tests, one by the "tin"- and one by the "golden"-eared audiophile. Suppose that the same listening room is used and that both testers sit at the same location and thus are subject to the same effects from reflections, reverberations, and standing waves. If, from differences in personal preference, the two parties use different volume control settings, this can be a source of differences in their hearing characteristics. Both listeners may believe they hear objective differences which actually are totally subjective. And even if the same playback level is used, but if that level is not exactly appropriate (i.e., what they would have heard at the live performance, assuming ungimmicked recording), they may still hear such subjective differences.

Whose opinion are those of us with "average" hearing to believe? Should all audiophiles have a good set of audiometer tests, and should the reviewers be persuaded to have similar tests and publish the results?

Meanwhile, work on your discrimination. When going to live performances, take your sound level (or survey) meter along with a copy of the score and make notes. The recording you play of the same music may be of a different group in a different hall and from a different acoustic perspective, but you may be able to more closely approximately a suitable playback level after taking this effort.

Better still, do some live recording, and do it in the same room used for playback. Then use that source for equipment and/or listener comparisons. [We at last have perfection: make all judgments for yourself, and never again listen through a reviewer's ears.—Ed.]

— John F. Sprague (New Jersey)

Stereo Woodworking

Depending upon how you feel about woodworking, one of the greater or lesser pleasures of owning stereo equipment is finishing wood component cabinets. Traditionally, I have always oiled and then waxed my cabinets to achieve a smooth surface and rich color—but sometimes it takes forever to get enough wax on to do the job.

I have recently discovered a wood preparation that speeds up the job tremendously. It is called "Watco Danish Oil Finish," and curiously enough the can label claims that it is ideal for "stereo cabinets." Even more curiously, it seems to be true.

The Watco oil pours from the can as a thin oil, which is applied directly to the wood. After an hour it thickens to the consistency of heavy motor oil, at which time one wipes off the excess. It simultaneously stains (slightly), oils, and fills the wood. Let it dry overnight and you're set to wax. The number of wax coats required is reduced to well below the threshold of pain.

One cautionary note: like any liquid applied to wood, Watco oil will cause it to swell. Normally the swelling will disappear when the oil dries, but not always—so apply it sparingly near joints or where the wood or veneer surface is broken, such as along the rear edge of most cabinets. — Steve Seto (California)

Letters

Ionovacs and Electrostatics

Referring to Robert Graham's review of the Janszen and Ionovac loudspeakers in the January 1976 issue of the BAS Speaker, readers may note that an ionic tweeter under the tradename IonoFane was, at one time, produced by Fane Acoustics Ltd., England. One such Fane tweeter was used in the Bowers and Wilkins model P2 monitor loudspeaker produced in the 1960's. It suffered somewhat from limited high-frequency power-handling capacity.

With respect to the mention of the Fane 701 ribbon tweeter, note that this is not the only such driver around. The Decca DK-30 has been around for some time and has now been joined by the Decca "London" ribbon unit, which can cover the spectrum above 1 kHz with high power-handling capability and good dispersion. This extremely attractive tweeter, incorporated in a loudspeaker system from Mordaunt-Short of England, has impressed me greatly. Like the electrostatic, the ribbon tweeter has the advantage of being driven over its whole area. Decca ribbons are manufactured by Decca Special Products, Ingate Place, Queens-Town Road, London SW8 3NT, England.

Finally, not all electrostatics are as beamy at the high end as might be assumed. Readers should either examine the polar response curves of the Quad electrostatic or simply listen to a pair. — Stanley P. Lipshitz (Ontario)

Comments: Unfortunately, the IonoFane has also been discontinued, although the American importer (Ercona Corp. in New York) may have a few left . As I recall the review of the P2, the power capacity was entirely acceptable, "as long as one doesn't try to fill Albert Hall . . ." At the power at which the IonoFane started to distort, many conventional tweeters were approaching total destruction. The IonoFane could not, of course, be destroyed by excessive audio; it would just start clipping.

The ribbon tweeters should indeed be examined, as they are potentially excellent. Regarding electrostatic high-frequency dispersion, I have yet to hear any electrostatic that does not beam noticeably at high frequencies. Some are better than others, and the Quad is certainly one of the best, but all suffer to some degree from this problem. If an electrostatic were designed to have excellent high-frequency dispersion, it would have to be very small in diameter and would therefore have limited midrange performance. Supposedly, such super-tweeters are designed into

full-range electrostatic units, but so far they still beam. Even the new Koss model I has more high-frequency directionality than I would have expected. The Janszen 130 provides a good compromise by angling the elements outwards. — R. Graham (Massachusetts)

The Rectilinear III: Three Versions of One

In response to the comments of Carlos E. Bauza (BAS Speaker, January 1976) on the Rectilinear III, I thought readers might be interested in my experiences with this speaker.

After auditioning a Rectilinear III in a showroom in 1974, I became curious about the unfamiliar sound coming from a speaker with which I am intimately familiar. I called Rectilinear. A representative stated that the midrange driver had been changed because of its low power-handling capacity (15 watts) and that the earlier midrange units were far superior. The super-amp boom in conjunction with a corresponding misuse of super amps had led to a high midrange failure rate; hence the change. It has also been suggested (by a party not connected with Rectilinear) that Philips is no longer the supplier of Rectilinear's drivers.

I am familiar with four Rectilinear III systems and have heard several of the new models (post-1973). There is no similarity between the new and the old. The latest models have a completely anomalous character that in one case sounds more like a jukebox than a Rectilinear III. I have since been told that the Rectilinear III-a has a new bass driver; perhaps this was the jukebox.

I suspect that it is these later models that have led to the verbal abuse that the Rectilinear III sometimes receives. And I suggest, if Mr. Bauza has a model manufactured between 1967 and 1971 (I don't know when the midrange was changed), that he relax and enjoy them.

The Rectilinear III does in fact have the somewhat "remote" sounding character described in High Fidelity magazine, but when properly driven with a 400-watt amplifier and fused at 1 1/2 amps (as recommended by Rectilinear), they produce unclipped peak levels of 105 to 107 dBc in my somewhat inefficient room. Not earth shattering, but loud. Some listening fatigue may set in at these levels after extensive periods, probably due to increased driver distortion.

Jon B. Elwell (Rhode Island)

$/dB and Product Pricing Formulas: Comment From a High-Line Manufacturer

The Boston Audio Society never ceases to amaze me. It is a unique entity that provides valuable information to its members.

In the December 1975 issue I read the method of computing amplifier power [sic] on the basis of dollars per watt. While I have no quarrel with your analysis, I do find that certain criteria of costs have not been evaluated. These are the quality of components and of manufacture, and the mean time between failure (MTBF).

The Barrett Group Corporation has over eight years of military experience. As a result, our disciplines are "militarized," with our equipment designed for much longer and more rigorous use than would be found in a consumer product. Certainly it costs a bit more, but such equipment is designed not to be obsoleted by next year's model and to perform predictably under adverse conditions. This brings about a new type of design philosophy when a company combines aerospace and audio technology. If all our predictions are accurate, the industry should see a pattern of similar new equipment designed for longevity of use, high reliability, non-obsolescence of design, and most of all, the value for value—a bond of mutual understanding between the customer and the manufacturer. [The cost of such qualities will lower a product's ranking on a strict "$/dB" or "$/Distortion" rating.--Ed.]

Here at Sequerra we do not intend to compete against any other component product. Each audio manufacturer, for economic reasons, provides a product to the marketplace that has the potential for the highest return on his investment. This means that the product was meant to be sold in volume at a prescribed formula that insures his ability to make money.

On page 13 of the December issue, under "The Idea File," the BAS Speaker has again brought out what I consider the most important analysis of audio industry practices: What goes into the pricing of a piece of audio gear? May I suggest that someone from your Society visit our facility and go through our costing on the Sequerra Model I? I am sure you will be surprised to see that the Sequerra Company does not follow the established practice of other manufacturers in the industry, . . . [namely] pricing the end product with a formula of five times the bill of materials cost or four times the manufacturing cost, whichever is greater. This means that in a $200 retail priced item, the actual material cost would be approximately $40 and the total manufacturing price would be $50. We at the Sequerra Company do not subscribe to that formula.

Let us therefore come up with a scale of audio consumer products value for value.

— Frederick E. Barrett

[Sequerra is now located at a new address: 143-11 Archer Ave., Jamaica, N.Y. 11435.—Ed.]

Comment: Included in the $/dB publication was, of course, the disclaimer that the "rankings" in terms of $/dB were not at all the complete basis for selection of a power amplifier. The intent of the article was to re-examine the possible insanity of super-powered amplifiers working into super-inefficient loudspeakers.

Mr. Barrett and his audio products are presently at the extreme right-wing of hi-fi, in company with perhaps Levinson, Lux, SAE, Audio Research, and commercial dbx and Burwen, and as such they merit a high price for the same initial performance specifications as the average brands. Where a product is to be in daily use, all day every day, and where a failure in a rugged remote recording location would spell catastrophe, one is forced to pay for an MTBF of several years. In the home, the audiophile must determine if the same cost is worth it. Should the audiophile's dbx 117 be as ruggedly made as its professional counterparts, or is this a waste of money better spent on sound quality somewhere else in the system? Is the subjective effect of Levinson's superb control action worth the price? These factors can never be ranked with a $/dB figure of merit.

Caution is in order, however, in judging the quality of a product strictly by the name on the label. Almost all high-line manufacturers could or do offer less meticuously made wine in the same labeled bottles. With any new such product it should be proven, not assumed, that it is a member of the "first-line" family.

— Harry Zwicker

Three Moving Coil Cartridges

Ron Dunlap of Dunlap-Clarke, Ira Leonard, and this author have briefly compared three moving-coil cartridges: the Fidelity Research 1 Mk, II, the Supex Super SD-900E, and the Denon DL103S.

Our only conclusion thus far is that except for the Denon, all exhibit a rising high-frequency response starting about 6 kHz and peaking about 20 kHz; only the Denon is reasonably flat throughout this region. All three cartridges are similar (flat) from 1,000 Hz down.

As expected, the Supex and the Fidelity Research sound brighter than the Denon; however, neither the listening session nor the testing apparatus was sufficiently extensive to provide more detailed conclusions.

Our measured frequency response correlates to some degree with the published specifications in the new edition of Sound Advice magazine. Interestingly, Sound Advice preferred in general the cartridges that exhibited, by their tests, about a +5-dB peak around 20 kHz. Equipment used for the tests included the CBS STR-100 test record, a Shure 3009/S2 tonearm, Dayton-Wright speakers, a Mark Levinson pre-preamp, and a Dunlap-Clarke amplifier.

— Alvin Foster (Massachusetts)

Onkyo 4055 Tuner

The Onkyo 4055 must be considered a top contender in the $200 tuner class. (Locally, K&L Sound, Watertown, Mass., sells it for $175.) It is extremely sensitive and very quiet, with excellent stereo separation. It seems unusually effective in suppressing the WCRB SCA "birdie."

I can receive nine listenable stations below WBUR (90.9) on the dial, plus WMEA from Portland, Maine (90.1), in stereo, if conditions are right. My location is 20 miles southwest of Boston in a good reception area, but my antenna is a 1951 TV design used without a rotor.

The Onkyo has a useful accessory on the back: in addition to scope outputs for multipath, a switch can be used to yield an audible signal for multipath detection. This has been found useful for orienting a friend's rotatable antenna, and I don't see why all manufacturers can't provide this feature. [We wonder if this output signal is also of use in fine-tuning a station? Also, see a related note in the January 1976 issue of the BAS Speaker.—Ed.]

On the negative side, the muting threshold is set too high, and pops are heard when passing unwanted stations. The appearance also strikes me as kitchy, and the tuning mechanism lacks the smooth action of some competitors, for example, the Pioneers. AM reception is rudimentary.

I have previously used a Dynaco FM-3 and FM-5, and I find that the superiority of the Onkyo 4055 over the FM-5 is more significant than that of the FM-5 over the FM-3. [No Onkyo 4055 tuners were tested at the BAS tuner clinic, so comparison with, for example, the Pioneer 7500 is not immediately possible.—Ed.] At about $175, check out the 4055 before buying a more expensive tuner. — David F. Temple (Massachusetts)

Book Review: *Hi-Fi in the Home*

Hi-Fi in the Home, John Crabb, fourth edition, 1974, published by Blandford Press, London, distributed in North America by Transatlantic Arts, Inc., North Village Green, Levittown, N.Y. 11756 at $8.75.

This 330-page, hard covered introduction to high fidelity is written by the editor of HiFi News and Record Review. This is an excellent volume which should not be confused with the average book of this genre. It is not aimed at casual readers with limited endurance or intelligence, as so many such books are, but rather at individuals genuinely interested in learning something non-trivial about hi-fi and music reproduction in the home. Conversely, Crabb does not assume technical sophistication on the part of the reader, but only a willingness to follow a few logical arguments through to their conclusions. It is certainly the best introduction to the subject of which I am aware, and even advanced audiophiles will find much of interest in its ten chapters.

Beginning with a discussion of the nature of musical sounds, the author proceeds to deduce and define those technical specifications that are relevant to music reproduction equipment. This leads to a detailed discussion of the items that make up a hi-fi system. Following this are chapters on selecting equipment, apportioning costs among items, and installing them in the home. A short list of recommended (British) recordings is included, with selection based on outstandingly natural sound and/or superb performances. The book concludes with thoughts on future directions for sound reproduction, an extensive glossary of technical terms, and a useful bibliography of further readings on the subject.

For someone just starting in high fidelity, or for anyone whose motivation is simply to improve his understanding of sound reproduction in the home, this book is highly recommended. And when a beginner friend buys this book, borrow it from him for yourself; it provides interesting and even stimulating reading. — Stanley P. Lipshitz (Ontario)

Modern Recording Techniques at Discount

BAS member Robert Runstein's Modern Recording Techniques is widely held to be the best book on its topic. Indeed, it may be the only thorough treatment of the subject for those more interested in musical recording than in sound reinforcement, radio, TV, or film sound techniques.

Now Runstein is offering the book to BAS members at a modest discount from its $9.95 list price. Runstein will mail copies to members postpaid in exchange for a $9.25 check. Make out checks to Robert Runstein and mail to 44 Dunsmore Avenue, No. 610, Framingham, Mass. 01701.

If this seems too modest a discount, consider that most authors profit little from their books and that by purchasing through Runstein, we may keep him eating long enough to write further on the subject.

The BAS plans to write further on Runstein's book—a review should appear within the next two months.

In the Literature

[Major contributions this month come from Dan Shanefield and Dana Craig.]

Audio, March 1976

- Behind the Scenes: In one of the bravest and most damning editorials in memory, Bert Whyte attacks the acoustics of the well-regarded Minnesota Orchestra Hall. Response in later issues should show the other side of this issue, if any. (p. 14)
- Short articles include one man's view that enjoyable rock-level music may not be damaging to one's hearing after all (p. 32); a new stylus-suspension mechanism in the offing from AKG (p. 24); Heyser tells about loudspeaker IM distortion tests (p. 38); and reviews of the $1100 Tandberg receiver, a precision cassette gauge for checking mechanical tape path alignment, plus a slightly ambiguous review of the EV Interface A loudspeaker system.

Audio Amateur, 3/75

- Highlight of this issue is a visit to Audio Research, and a discussion with William Z. Johnson, president. (p. 5)
- A Bilateral Clipping Indicator: A very simple amplifier clipping indicator, with LED's to indicate positive or negative music peaks; can be built by anyone. It will soon be available as an Old Colony "kit." (p. 3)
- What is PCM? Discusses this still futuristic signal-processing system which has application to very expensive but "noiseless" tape machines. [Odyssey Y33200 is a PCM recording; listen to its unusual but quite audible background noise before you hope for too much from this technique.]
- In Defense of the Ear: Defends the proposition that we should, if trained as audiophiles, be able to spot good and bad sound strictly by ear—with minimal recourse to test instruments or auditing hours of test tones.

Audio Engineering Society, Journal of the, Nov. 1975

- A Wide-Dynamic-Range Program Equalizer: Richard Burwen describes his new equalizer, which has four shelf response controls, two peaking controls, and 120 dB dynamic range using discrete and IC op amps (Harris HA 2-911). Circuit diagram is included. (p. 722)

Audio Engineering Society, Journal of the, Dec. 1975

- Horn Employing a Piezoelectric Driver: Describes new family of Motorola devices. (p. 796)
- AM Stereophonic Broadcasting—An Historical Perspective: AM is currently looking toward stereo "and the possibility of an expanded AM quadraphonic broadcast service is suggested." SQ is favored—no surprise since the author is at CBS Technology Center. (p. 802)

Consumer Reports, Feb. 1976

- Review of "under $100" loudspeakers. Although some of CU's conclusions seem to agree with local opinion, at least as many appear incredible, specifically the published curve for the Large Advent system. If your listening experience agrees or disagrees with CU's, please let them and (with a carbon copy) the BAS know.

dB, Jan. 1976

- From Disc Master to Pressing Plant: Editor Larry Zide's tour of Capitol's disc manufacturing facilities, includes 13 photos of the various processes in making mothers, masters, etc. But one wonders if all that care goes into the manufacturing, how come they sound so bad? (p. 26)
- PLL Modulators for CD-4 Cutting: John Eargle describes the latest advances in CD-4 technology. (p. 32)

dB, Feb. 1976

- The Whites of Their Eyes: Good article on the new multi-media Bunker Hill Pavilion in Charlestown. (p. 20)

EDN, Feb. 5, 1976

- Banishing Crossover Distortion in Class A-B Amplifiers: "With proper biasing, it is possible to operate with near class B efficiency, yet achieve fidelity approaching that of class A." "In precision audio applications where neither crossover distortion nor excessive heating are tolerable, an obvious need exists for a solution that avoids both." Result is a complementary output amplifier using "automatic biasing" via current source, integrator, and differential amplifier. Schematic included. (p. 92)

Electronics, Feb. 5, 1976

- Britons Mull "Magazine" Via TV: Experimental system using $260 detector lets TV viewer select pages of 800-page "electronic magazine" to be displayed on his TV. (p. 68)
- Digital Techniques Promise to Clarify the Television Picture: Writtten by another engineer at CBS Technology Center.

Electronics, Feb. 19, 1976

- New product announcement by Signetics of their NE570/571 compressor/expander IC. The device has a claimed operating range of dc to 20 kHz with gain stability of ±0.2 dB and an 80 to 110 dB dynamic range. Distortion is 1 to 2%, and the price for the NE571 version is $5.88 (in quantities of 100 to 999).

Electronotes, Jan. 1976

- Two New Analog Delay Line Circuits: Two circuits contributed by readers, one using ITT type TCA350 185-stage delay line, the other using Panasonic MN3001 dual 512-stage delay. (p. 20)
- Back to Basics—Resistor Tolerances: (p. 20)
  [Electronotes address is 203 Snyder Hill Rd., Ithaca, N.Y. 14850.]

FM Guide, Jan. 1976

- Review of the Stax DA300 power amplifier (and radiant heater); this $3600 unit, operating fully class A, totally eliminates crossover distortion. The penalty for such operation is, however, significant ac power consumption all the time. Idle power with no signal input is 560 watts, versus much less than 100 watts for most solid-state amplifiers regardless of power output rating. Feldman's comments do not give much hint as to whether the double penalty of high purchase cost and really high operating cost is worth it, although he does state, 'You may find that the so-called `tube sound' which has eluded you in most other transistorized equipment is

really not a product of tube-designed amplifiers and that Class A amplification really does make a difference. . . " Note that most tube-sounding amplifiers are class AB push-pull, in which the crossover distortion is anything but absent unless the notch distortion is carefully designed out, i.e., tube sound is not the result of class A operation.

High Fidelity, March 1976

- The Many Paths to Noise Reduction: Opinionated but not definitive; noise reduction tradeoffs must be a matter of personal taste. No unit can be absolutely inaudible in operation; some music must be lost along with the noise. (p. 48)
- Rx for RF Interference: Timely, but if you have a problem don't look here for a quick-fix. (p. 56)
- Rossini's Barber: The TV version from PBS in January receives a rather unfavorable review in the Musical America section. (PMA-22, in many libraries)

New York Times Magazine, Feb. 22, 1976

- A well written "human interest" article about master flutist Jean-Pierre Rampal (the author is a flutist himself), and Monsieur Rampal is a sufficiently interesting character to make for good reading.

Popular Electronics, March 1976

- An LED-Readout Audio Power Meter: A build-it article for a two-in/one-out LED voltmeter which, if one assumes constant impedance (as do almost all VU meters on power amplifiers), gives "power output" readings. Until current-times-voltage multiplying units become available on the market (soon), this approximate approach will have to do. Although this unit can indicate rapidly changing peaks, there is no "hold" feature, so your eye will have to be quick to use this box. It is attractive, however, because of its simple (if brute force) approach and low cost: $38 in kit form, without box. A MITS product. (p. 35)
- The Care & Feeding of NiCd Batteries: Of general interest. (p. 39)

Radio Electronics, March 1976

[This issue is worth a visit to the library.]

- Tests of the Heath Modulus System plus matching power amplifier. Although receivers are anything but the vogue within the BAS, this Heath tuner/preamplifier is worth knowing about. As usual, little can really be learned about its sound from RE's review. As for the power amplifier, it is inexpensive and low power, and with -60 dB distortion products, would not seem state of the art. (p. 33)
- Review of Sound Guard, the new record lubricating system from Ball Brother's Research Co. of Colorado. Impressively done review, complete with data on record wear, noise, harmonic distortion (with spectrum analyzer), and CD-4 carrier loss versus number of record plays, for lubricated versus non-lubricated discs. Read the advertisements for this system before reading the article. An expensive product, but perhaps discs could come direct from the factory pretreated to save trouble and cost—if the system really is as useful as this article would have us believe. (p. 41)
- Understanding Tape Specs and Turntables for Today's HiFi Systems—basics. (p. 48 and p. 38)

Stereo Review, March 1976

- For those of you who read between the lines to find unfavorable reviews, read (after the review of the other-league Lux L-100 integrated amplifier) the Miracord 825 review: ". . . rumble was about -33 dB. With ARLL weighting it improved to -50 dB," followed by the Frazier Concerto review: "slightly constricted" with a "lack of openness," and finally in the Realistic STA-90 review, the statement that it is good for urban areas "but perhaps not nearly so ideal for fringe areas or for rural listeners." If not downright unfavorable, these are at least none-too-subtly unfavorable comments.

- Chromium Dioxide Pro and Con: Debate between Andy Petite (pro) of Advent and Tor Sivertsen (con) of Tandberg. (p. 65)
- Optimizing Cassette Performance—The Problem of Azimuth: An interesting article that helps explain some of the vagaries of cassettes. Must reading for anyone who wants to test cassettes. (p. 68)

Wireless World, Dec. 1975

- Current Dumping Audio Amplifier: The new Quad 405, made in England, uses feed-forward rather than feedback to correct for non-linearities in the transistors. Both of these distortion-reduction methods were invented by Harold Black of Bell Labs, but the former has previously been used mainly in automation systems. It is claimed that biasing and other adjustments are less critical here than in feedback-type circuits, and that the resulting class A amplifier has practically zero crossover distortion and improved reproducibility (i.e., all units live up to specs, not just those that have been carefully tweaked). However, two caveats as culled from the manufacturer's literature: the raw specs are not outstanding. Power is 100 watts/channel at less than 0.01% THD, but the use of limiting is suggested with Quad's own electrostatic loudspeakers, which reduces output to one-half power. Also, less than 20 watts are delivered to the loudspeaker if its impedance drops to 2 ohms, as can happen with the AR LST (among others). [More on the Quad in a month or two.—Ed.]

February BAS Meeting

Business Meeting

Well over 100 members attended the February meeting, held at the now standard location (GTE Laboratories in Waltham). Ira Leonard had copies of the latest Sheffield disc and "Fidelity First — An Unrehearsed Experiment" from Insight Records for sale, and Scott Kent was selling copies of the record "Angle on Harpsichord" at $5 each. The latter is technically an excellent demonstration-quality disc made on a highly modified Revox with absolutely no noise-reduction equipment.

Bob Borden expressed his satisfaction with a PLL modification that Scott Kent performed on his Kenwood KT 7000 tuner.

Jim Brinton announced that the Mark Davis phono preamp has undergone some design changes that have even further reduced the noise and distortion. A final specification sheet is not yet available, but the price will be "in the $150 ballpark."

Al Southwick read a scathing attack on RCA disc quality from the March 1976 issue of Consumer Reports; perhaps this was in atonement for last month's speaker ratings.

Dr. Brian Leeming announced that more orders are needed to keep the BAS overseas record buying service active; he had received only four orders. Records ordered through Dr. Leeming will cost between $4 and $6, depending on the list price of the record. Members who wish to order may do so at the next meeting. Or, if you have a Gramophone catalog, send your request for any listed items (specifying label, serial number, and price) to P.O. Box Seven. In addition to his usual recommendations from the Gramophone catalog, Dr. Leeming offered to make available to BAS members a list of 100 or so records (not all recent) that were rated highest in the Penguin Stereo Record Buying Guide. This Guide, published in England, is a compilation by three reviewers.

The question of changes to the BAS bylaws on quorum requirements was raised. It was moved and voted that the bylaws remain unchanged until the next business meeting in September.

The Audio Pulse Model One digital time delay system, manufactured by Hybrid Systems in Bedford, Mass., was on demonstration. Dubbed "The Acoustic Space Expander," the Model One compares with the Sound Concepts SD-50 analog delay lire (see last month's meeting summary). Although intended to achieve basically the same end, the two units differ radically in their technology. In contrast to the analog SD-50, the Audio Pulse unit uses entirely digital processing. Quoting from Audio Pulse sales literature: "Using various components (such as shift registers) developed for highly complex information storage and processing, it takes conventional stereo signals, delays them by various controlled time intervals, then mixes and electronically `reflects' the delayed signals back and forth during the period of each musical note. Among other things, it employs an advanced encoding process called `Delta Modulation with Memory,' which is an extremely accurate but economical way of converting wide range audio wave forms into digital pulses."

Subjective reactions to the demonstration were favorable, but many members were unable to decide (on the basis of two brief demonstrations a month apart) between the Audio Pulse and the Sound Concepts units. The competition will be keen and the decision. difficult until comparative test reports and home demonstration units become available. BAS members have been involved in the development of both devices. As mentioned last month, Joel Cohen is the man behind Sound Concepts, and Peter Mitchell has worked closely with Hybrid Systems on the design of the Audio Pulse unit.

Meeting Feature: Panel Discussion. on Hi-Fi Servicing

Three long-established and respected members of the hi-fi servicing community were assembled to discuss servicing and to answer members' questions.

The members of the panel were:

• Henry Niklas (HN)—Henry came to this country about 10 years ago and joined the servicing department of Audio Lab. Later he set up and manned Tech Hi-Fi's service shop in Cambridge. After a relatively short stay, he set up his own independent operation, Stereo Lab, at the old Audio Lab location at 16 Eliot St. in Harvard Square.

• Clint Van Arsdale (CVA)—Van Arsdale, who runs Gyro Gearloose at 1302 Commonwealth Avenue, Brighton, began his business by fixing rock-band equipment in his apartment. As the business grew, he moved to commercial quarters and added servicing of hi-fi equipment. Hi-fi repairs now account for about 50% of his business.

• Gene Leger (GL)—Leger owns and operates Leger Laboratories, which calibrates and services electronic test equipment for industry in addition to servicing hi-fi and consumer electronic products. His Electronics Service Center in Pepperell, Mass. (near Nashua, N.H.) is a factory authorized warranty service center for at least 60 manufacturers and importers.

The following summary of the discussion should in no way be construed as a "transcript." Often a speaker's comments have been modified to convey the intent rather than the exact quotation. Occasionally, portions of the discussion have been transposed to fit better with other sections of the panel's comments.

Each member of the panel made an opening statement describing his history in the business and his servicing philosophy:

HN: At Stereo Lab, about 200 to 300 repairs are performed per month. "If service is independent and is done in an honest way, you cannot make much money on it." Each serviceman is an individual specialist on turntables, tape decks, amplifiers, etc. His labor charge is about $20 per hour, or lower for additional hours.

GL: Leger stated simply that servicing must be "defined." He returned to this at the conclusion of the discussion. His labor charge is $22.50 per hour.

CVA: Van Arsdale is a trade school graduate with a master's servicing ticket. He grosses about $80K per year. He is not in business to get rich, and illustrated his point by stating that he drives a 1937 Ford. He does almost no warranty work.

Peter Mitchell (PM), assuming his familiar role as moderator, began the anticipated fray with a reference to a BAS questionnaire which indicated that members were most generally satisfied with factory repair work, less so with repairs at the place of purchase, and quite dissatisfied with the work of the independent service operations. The major complaints were high cost and the high rate of immediate breakdown. Peter asked why this should be so. To the question of high prices, the panel members responded:

HN: High rent in the Harvard Square area and capital outlay for test equipment that must be amortized result in the "high" costs. The technician's wages are not as much a factor as might be thought, and good technicians do much better in industry. The average repair cost is about $25 per unit, which is actually quite low. Warranty repair is much lower, at say $4 for a turn-table. Also, some customers do not pick up their units immediately, which adds to cash-flow cost.

CVA: In addition to the items listed by HN, insurance in Brighton is high—including fire and theft on the test gear. Advertising is an added expense now that Gearloose has grown. Hourly rates have grown from $3, $5, $7.50, $10, $12, $15, and $18—not to make more money but just to keep in business. To put repair cost in perspective, Van Arsdale noted that he offers an overhaul service for each type of unit, normally a flat $30 to $40 rate.

GL: Referencing his labor change, Leger noted that a rule of thumb calls for a customer charge of four times the rate paid to technicians. Some of his men make $7 per hour, yet he charges only $22.50. A unique service offered by Leger is washing of the entire unit—any unit, of any type—in warm water, with a 24- to 48-hour bake at 150°F to dry. All controls are cleaned and lubricated after the washing. This does not add to the bill to the customer, but is included in the effective labor charge.

PM: What about parts cost? Is it much of the total bill?

All: Except for the most expensive items such as tape heads or output transistors, parts are only a small portion of the total.

Audience (AUD): What about the immediate call-back (re-repair) complaints?

CVA: Customers are given the choice of an hourly rate, where the three-month guarantee is on only the part that is fixed, or the overhaul rate, where the guarantee applies to the total unit. Return rate is 10%, caused particularly by intermittents or customer screw-ups; these are apportioned 60%/40% of the 10%, for a 0% rate of return from overlooked problems. These returns do cost Gearloose a lot of money.

HN: Stereo Lab also offers a 90-day guarantee on the portion repaired; when something else is really overlooked, there is no charge. If the problem is with another portion of the unit, he gives a break on the second charge. He feels that he has few really dissatisfied customers, and that many of their problems are due to customer misuse or ignorance.

GL: Agreed with the problem of customer errors. Rate of returns is only 1%, but he demands that all customers agree to the full overhaul policy. He will not fix only the obvious fault. The guarantee is 90 days on the entire unit, with exception of the main power transformer. Typical costs are $35 for an amplifier, with no cost for call-back repairs within the warranty period. One reason for the "total unit" policy is that so many manufacturers ship out very poorly set up equipment. He named Scott for nearly zero tuner separation out of the box (just before their recent reorganization). This complaint was seldom noticed by the customers.

AUD: What are the hardest to fix lines of equipment?

GL: Marantz is poorly designed, and requires complete chassis removal just to change a pilot lamp.

CVA: You get what you pay for. The cheaper the unit, the harder it is to service, the higher the labor charge, and the higher the parts cost. Higher priced equipment is less expensive on all three counts, and the documentation is far superior, again lowering the bill and improving the final results.

GL: Often the Japanese do a much better job with their repair manuals than the domestic manufacturers. Sony, Marantz, Sherwood, and Pioneer put out beautiful documentation.

AUD: What companies are seen most often in the shop?

GL: This can be misleading because of the large number of units actually in the field from Sherwood, Kenwood, Marantz, etc. Often it simply depends on what is on sale locally. Named for infrequent servicing were Phase Linear and SAE, while a genuinely poor line is the Sansui 5000/2000/3000 receiver line. These had to be modified by replacing the driver boards.

HN: Dyna 120. He does not accept these because his fire insurance is insufficient. If you want to have an intermittent, buy a Pioneer, especially the 828 and the 747, where the $40 (cost price) tone control board must be replaced. The 424 had some problems in the beginning. Yamaha had some problems initially because of faulty transistors. SAE sometimes requires a new bank of transistors for $12 to $20. Nothing is really that good.

CVA: You get what you pay for. Sees many KLH and Kenwood because they are pushed locally, but Kenwood is easy to fix. Sees very few Sherwoods (nods of agreement from the others on the panel). Likes Pioneer, in difference with HN; they are hot in the front end with fine sensitivity. Dynaco 120, 80, and SCA35 are nightmares. AR receivers and amplifiers provide lots of headaches.

AUD: What are the reasons for not doing warranty work? Is it true that you don't make money on this work? (Comment from Ron Dunlap: If a company does set up a good service policy with decent repair rebates, this adds to the cost of the unit to the customer. Shouldn't those shops that refuse warranty work urge the customers to write to those manufacturers with flimsy warranty policies?)

CVA: They might pay me $6 per unit; I don't do warranty work.

GL: Differs. They give me free advertising and 28 filing cabinets full of documentation. Some (Panasonic TV) do pay well, but most do not. But even with the low rates, the high volume is useful for follow-on repair work after the warranty expires. Lots of customers know about him through warranty contracts. I do make money, but someone without the high volume would not.

CVA: It isn't fair for me to make up for the low warranty rates by charging extra for out-of-warranty work. I try to charge the lowest rates I possibly can. I do warranty work for four companies—three rock amplifier companies and Akai. Akai refuses to sell me parts or service information unless I enter into a warranty agreement (a "gotcha" business).

AUD: Why is QC so poor on audio products and apparently not so with, say, color TV's?

GL: This is a problem with all portions of American and Japanese industry—TV, cars, and audio. RCA had admitted that 20 to 25% of their equipment is not quite right out of the box, but the assumption is that the customer will not know the difference. With TV, Leger stops by each new customer's home to check out the new unit. Inspection is an overhead burden to industry and is shortchanged by management.

AUD (Ron Dunlap): The same applies to the use of cheap parts even in good designs. The formula list price equals five times the parts cost forces the use of the least expensive parts that can be found. Perhaps consumers concerned about the "cheapness" of products in general should push manufacturers for better quality.

AUD (with expression that the consumer really has no argument with the service shops, but rather with the manufacturers): Which manufacturers give you the most hassle in paying warranty bills or in supplying parts?

CVA: Those who do, we put on a list; those products I refuse to service. German and European and (pointing to HN) Tandberg are slow.

GL: Leger praised many of the companies that have Watts lines for orders, but parts delays are getting worse, probably because of sheer volume. One to three weeks delay is not uncommon. Japanese are among the fastest. The U.S. Postal Service is a constant source of delay, which is why the toll-free lines are of such assistance. Tandberg is no worse than most.

CVA: We have stopped sending parts orders through the mail; we use the phone.

AUD: What is the markup on parts?

CVA: Tubes, a 60% markup. Everything under $5, I usually double. From $5 to $10, I add 50%; from $10 to $20, I use a 1/3 markup.

GL: We usually get a 40% discount on parts from the published list price; we then charge the customer the list price.

CVA: As for why we mark up at all, I have a $25K inventory of parts.

GL: We have a $75K investment in parts. I must pay to maintain this inventory. The customer benefits from this large inventory because he saves a two-week delay in obtaining the part. I often replace an original part with a part of better quality (response to Dunlap question).

PM: In addition to the possible two weeks parts delay, what are the other causes of the frequent delays in obtaining service?

GL: First, there is no such thing as a quick fix. I must burn-in all repaired units, especially those with vacuum tubes. Also, keeping the shop busy, plus the extensive testing that must be performed to ensure that nothing else in the unit is defective (high and low voltage tests plus aligning the complete system and not simply the repaired section) requires time on the bench.

HN: Our normal waiting period is two weeks. In an emergency, I repair in 48 hours at an extra charge. Again, to keep everyone busy all of the time, I cannot hire technicians just to provide fast turnaround in the peak repair periods (the winter).

CVA: One week. Usually the repair is completed in less time than this. Rock amplifiers or emergencies, one day or less if there is a real need.

AUD: Which tape decks are the most reliable? Are Teac motors or Sony decks frequent offenders?

CVA: I love Sony and Teac. I find no particular problems with motors in the Teac 2300/4300.

GL: No particular problem with Teac motors; usually just alignment. I have never found major failures with Teac decks.

[Joining the panel at this point is Scott Kent (SK), local service representative for Revox.]

AUD: Which units are furthest from their published specs as they come from the box?

SK: Tuners. But measuring sensitivity is difficult without an RFI-screened room, which few of us have (H. H. Scott Co. and Leger do). Tape recorders very rarely meet spec, mainly because they are set up with a particular type of tape and, for playback EQ, with a test tape that has been used so many times that it is no longer reliable. At 15 kHz, oxide loss can reduce output by 6 to 10 dB at 7½ ips for 1/4 track. Buy your tape in bulk and have the machine set up for it if possible. Deviation can be ±2 dB within a single batch, even in studio tape.

AUD: Can units be brought up to spec? Or are the published specs simply wrong?

CVA: In general, only a touch up will bring them into spec. It is only the QC that is poor, not the design. [Or hyped specifications in the sales literature.—Ed.]

PM: Do any tape machines meet spec out of the box?

SK: Revox.

HN: Not Tandberg, until it is adjusted.

AUD: How are AR products?

SK: Tuners were not good.

PM: Differs. All tuners tested in the BAS clinic were fine, while none of the Pioneer tuners met their sensitivity spec. Separation of the AR wasn't too good.

SK: But we only see equipment that is defective.

AUD: Is it true that some equipment manufacturers use two different sets of specs, one for sales literature and one for the service shop?

GL: We repair to better specs than published.

PM: But there are cases where the service manual, for example, for a Sony tape machine, lists twice as poor a frequency accuracy without Dolby as the sales literature states for Dolby on!

AUD: And Teac has cases where the S/N ratio listed in the service manual is 10 dB poorer than that in the specifications.

AUD: How should we go about selecting a good service shop?

GL: You can try to look at the test equipment, but check also to see if it is actually in daily use. You will have a hard time knowing if the equipment is good, much less if it is in calibration. The Sony/Superscope (especially Superscope) in Woburn is terrible; they had a wow-and-flutter meter that couldn't possibly be used with a good deck. Even Sony test tapes are terrible. Check for shops with an IM (not THD) distortion meter. [After a lengthy discussion, and in spite of the previous comments that much equipment out of the box is not up to spec, it was not recommended that new equipment be returned immediately for checkout, except for tape devices. Usually the out of spec items will not be that far off unless a problem is audible.]

SK: The surge of discounters has added to the out-of-spec problem. In the past, the dealer checked out and repaired all of the units that were sold, plus offering service for a year.

PM: To what extent are manufacturers trying to make the servicing job easier?

GL: They are trying more and more to improve serviceability—with manuals, seminars, schools, and logical troubleshooting aids.

CVA: The more you pay for a product, the easier it is to service.

AUD: Can you recommend some good test tapes?

GL: Magnetic Reference Laboratory, advertised in the professional magazines.

SK: I disagree. Studio Sound published a review of test tapes: the only good ones they found were AGFA and BASF, available only in Germany. All others (Ampex, MRL, etc.) were found to be anomalous, especially MRL for phase alignment. The only good domestic ones I know of are 15-year-old Ampex tapes with McKnight's voice on them. I make my own on a Revox that can outperform any test tape in phase alignment. But it takes two days to make each one.

PM: Don't trust any Dolby level calibration tape; their levels are ±2 dB off, even those straight from Dolby Labs.

GL: Yes, Advent has had a very rough time obtaining test tapes.

SK: Ampex's "187-nanoweber/meter 0 VU" tapes are good. Probably the same is true of those from Standard Tape Labs. Phase accuracy may be poor, but this is not critical for most decks because tape skew is worse than misalignment unless a good transport with a back-coated tape is used.

AUD: Is there any relation between the good technicans and those who are also avid audiophiles?

All: No. Anyone technically skilled can do a good job at the test bench.

AUD: Do you handle used equipment sales (customer items left in the store)?

All: No.

PM: Who are the best technicians? Trained engineers?

HN: Anyone with ten years of experience is better than, say, a fresh engineer.

CVA: My two best technicians were trained in the service and had a lot of experience. Trade schools and manufacturers provide the best training.

GL: Engineers are the last people I would hire. And the problem of finding good help is really serious. It adds to the delay in obtaining service. Lack of logical troubleshooting instincts is the single biggest problem.

AUD: Don't women make the best technicians?

CVA: I have had two. One was the best and one was the worst I've had.

SK: I have no employees in my shop, but I've seen many women in industry who would have been good.

GL: We would hire them, but they don't apply.

AUD: How about amateur radio operators? Aren't they good servicemen?

GL: This used to be true.

CVA: They are usually heavy on tube-type stuff, but not quite so good with solid-state.

AUD: Is the "low status" of the repair technician part of the problem?

GL: The attitude is the the real problem. People simply do not understand servicing. Not just fixing, but double-checking all possible sources of problems. Returning a really working unit to the customer.

PM: What proportions of service problems are due to 1) wear and tear, 2) parts failure, or 3) incorrect use by the owner?

GL: 98 are parts failures.

CVA: In receivers and amplifiers, I usually find blown channels. I insist the customer bring in all their cables and speakers. Often these are the cause of the problem (i.e., incorrect use by the owner).

HN: I find 30% from misuse and 50% from parts failure for power amplifiers. On preamplifiers, mostly component failures.

SK: About 1/3 each, but much of what I service is professional equipment, subjected to hard use. Much trouble is simply old age in tube equipment.

PM: Is a maintenance program useful?

SK: For tape recorders, definitely. Keep the heads aligned, or wear is accelerated. Tapes won't play well after an after-the-fact realignment. And buy a service manual.

HN: Read the instruction books.

GL: Keep vacuum-tube equipment clean.

CVA: Not much maintenance can be done for the electronics.

SK: Service the mechanical parts according to instructions.

GL: Keep your equipment clean; use a vacuum cleaner. And don't use alcohol unless it is pure alcohol on any of the belts or pinch rollers. Use printer's cleaning fluid, or buy lacquer thinner (Sterling).

SK: If possible, go to New Hampshire or western Massachusetts for medical alcohol. Use Xylene, but very carefully, on extremely dirty tape heads; Xylene is very flammable.

AUD: What easily obtained alcohols should be used to clean rubber items on tape decks?

SK: It differs; the best can take even wood alcohol. For the more fragile ones (Tandberg) I use drinking (ethyl) alcohol. Do not use rubbing alcohol; it contains lanolin and water.

AUD: Which units do you recommend for the finest specs?

HN: Today, Yamaha; Tandberg, when it is adjusted. Mac in the past.

AUD: Can we consider washing our components in the home a la the Leger method?

GL: Yes, but watch the temperatures. Keep the bake below 150T, and examine closed-shell parts such as transformers to be sure they are dry. Use a biodegradable detergent like NL concentrate. Do not immerse the unit; use a spray gun and a gentle spray. Then rinse, dry, and relubricate.

— Ken Deen and Harry Zwicker

Dollars and dB Revisited

Dana Craig

I read with interest Tom Mashey's article on amplifier pricing (BAS Speaker, Dec. 1975), since I had gone through the same procedure last summer when I was thinking of buying or building a super-power amplifier. In doing so, I ran into a problem Mashey apparently overlooked. He says in the first paragraph on page 2 that the rankings by dB in the table do not depend on the reference power level. This is emphatically not so. Let's see why.

What Mashey has done is to invent a figure of merit for amplifiers. Other things being equal, the best amplifier will have a low cost and lots of power. If we define a quality in dollars per watt by

$$Q_1(x) = \frac{C(x)}{P(x)},$$

where C(x) is the cost and P(x) is the power, we get a quality number $Q_1(x)$, in which a smaller number indicates better value. But, since we hear logarithmically (in dB) as Mashey noted, let's change the formula to

$$Q_2(x) = \frac{C(x)}{10 \log \frac{P(x)}{P}}$$

$$= \frac{C(x)}{10} \cdot \frac{1}{\log P(x) - \log P}$$

$$= \frac{C(x)}{10 \log P(x)}$$

$$\text{if } P = 1,$$

where P is the chosen reference power (Mashey chose 1 watt). Note that P is arbitrary, and it does affect the rankings. It may not be obvious, but a small value of P favors lower-power amplifiers. Put another way, decreasing P will tend to push small amplifiers to the top of the list.

I calculated Q_2 using a P of 10 watts and 100 milliwatts. (Note that if the amplifier power equals the reference power, we get a figure of merit of infinity.) The headroom in dB can be figured by subtracting 10 dB and adding 10 dB, respectively, to Mashey's figures. The super amplifiers look better at 10 watts; there is not much difference at 100 milliwatts. One could, I suppose, argue that 1 watt is a good reference level for actual listening, but this is an arbitrary choice, not an empirical one. The results are tabulated in Tables 1 and 2.

Table 1 - Amplifier Ranking by $/dB Referenced to 10 Watts
(Largest changes in rank noted by ^ and v)

Rank	Amplifier	$/dB	Rank	Amplifier	$/dB
1	Quatre	30.00	21	Bose 1801	70.71^
2	SAE 31B	35.71	22	Mac 2505	71.43v
3-4	Citation 12	38.46	23	Sansui BA3000	73.17
3-4	Phase Linear 400	38.46^	24	BGW 750A	75.38
5	Dynaco ST150	40.91	25-26	SAE 3CM	76.92
6	Futterman H-3A	44.87	25-26	Technics SE9600	76.92
7	Dynaco ST410	46.15^	27	SAE 25/2500	84.46
8	Futterman H-4	50.00	28-29	Dunlap-Clarke 1000	85.71
9	Phase Linear 700B	51.95^	28-29	Paoli 60M	85.71v
10	BGW 250B	52.63	30-31	Mac 2300	87.84
11	Crown D150A	53.33	30-31	Sansui BA5000	87.84
12	Dynaco ST400	55.77	32	Quintessence I	96.59
13-14	Crown D60	60.00v	33	BGW 1000	100.00
13-14	SAE 4DM	60.00	34	Quintessence II	101.69
15	Ampzilla	61.54	35	Infinity 500DSP	132.59
16	Accuphase	63.56	36	Yamaha B-1	135.59
17	Mac 2105	63.73	37	ARC Dual 76A	136.36
18	BGW 500D	64.62	38	ARC Dual 150	169.49
19	Crown DC300A	67.23	39	Stax DA300	305.08
20	Dunlap-Clarke 500	67.80			

Table 2 - Amplifier Ranking by $/dB Referenced to 100 Milliwatts
(Largest changes in rank noted by ^ and v)

Rank	Amplifier	$/dB	Rank	Amplifier	$/dB
1	SAE 31B	9.26	21	Dunlap-Clarke 500	25.15
2	Quatre	10.65	22	BGW 500D	25.45
3	Citation 12	10.79	23	Technics SE9600	26.32
4	Crown D60	11.02	24	Sansui BA3000	27.86
5	Dynaco ST150	12.50	25	Bose 1801	29.12
6	Futterman H-3A	12.59	26	Quintessence I	^29.51
7	Phase Linear 400	15.15	27	BGW 750A	29.70
8	Crown D150A	16.55	28	SAE 3CM	30.30
9	Futterman H-4	16.67	29	Dunlap-Clarke 1000	35.29
10	BGW 250B	16.95	30	SAE 25/2500	35.92
11	Dynaco ST410	18.18	31-32	Mac 2300	37.36
12	Mac 2505	18.52	31-32	Sansui BA5000	37.36
13	SAE 4DM	20.00	33	Quintessence II	37.74
14	Mac 2105	21.52 ^	34	BGW 1000	41.18
15	Dynaco ST400	21.97	35	ARC Dual 76A	41.67
16	Paoli 60M	22.22 ^	36	Yamaha B-1	50.31
17	Phase Linear 700B	22.60v	37	Infinity 500DSP	54.41
18	Accuphase P300	23.58	38	ARC Dual 150	62.89
19	Ampzilla	24.24	39	Stax DA300	113.21
20	Crown DC300A	25.08			

To get a more graphical idea of what is going on, I added a few other interesting amplifiers and some kits to Mashey's original list and computed the corresponding data. Many high-power amplifiers are available in metered and unmetered versions, e.g., SAE Mark IIIc/Mark III CM, Marantz 250/240, etc. Rather than rank them all, I graphed them on semi-log paper. (The reference data are given in Table 3.) In this graph (Fig. 1), the vertical distance between amplifiers is the dB difference between them, not the power (watts) difference. Clearly the "best" amplifiers in terms of our revised figure of merit are those at the upper left corner, and the "worst" are at the lower right.

The problem (and I leave it to you to solve) is to compare amplifiers lying on the diagonal from the lower left to upper right—more power but also more money.

How might we use all this data when considering a purchase? Suppose you own a Dyna Stereo 120 that is worth $200 as a trade-in or if sold to a friend. You want to buy a Phase Linear 400 at $500 list. So it will cost you $300 net for an additional 5.23 dB, or $57.36/dB. Assuming the sound quality is otherwise the same (it probably isn't), this may seem like a lot, but it may be what you need.

So much for power. I myself find dynamic range to be the most important specification of a hi-fi system. Residual noise is more distracting to me than frequency response aberrations or moderate distortions, but others may feel differently. Conceivably we could invent more elaborate figures of merit, such as

$$Q = \frac{\text{Cost} \times \text{Distortion}}{\text{Power} \times \text{Dynamic range} \times \text{Bandwidth} \times \text{Slew rate}}$$

where, as before, the smaller the number, the better. However, I don't think it is worth the effort.

By the way, what amplifier did I finally buy? I didn't. I decided that a multiway system with several smaller amplifiers and active crossovers was a better approach than an inefficient speaker system and a monster amplifier. This, of course, leaves me pretty much on my own. So I am taking some courses in circuit design, and maybe Professor Bose's course in acoustics at MIT.

Table 3 - Reference Data for Fig. 1
(K = kit, M = meters)

Manufacturer	Model	Watts/ Channel (81)	List Price	dB Ref. 1 Watt	$/Watt	$/dB
Audio Research	Dual 52	50	$ 595	17.0	$11.90	$35.00
Bozak	929	150	849	21.8	5.66	38.94
	929PV (no meters)	150	749	21.8	4.99	34.36
C/M Labs	CM912	150	900	21.8	6.00	41.28
Dynaco	ST 120	60	269	17.8	4.48	15.11
	ST120 (K)	60	189	17.8	3.15	10.62
	ST150	75	369	18.8	4.92	19.63
	ST150 (K)	75	249	18.8	3.32	13.24
	ST150 (M, K)	75	334	18.8	4.45	17.77
	ST400 (K)	200	499	23.0	2.50	21.70
	ST400 (M, K)	200	584	23.0	2.92	25.39
	ST410 (K)	200	399	23.0	2.00	17.35
EPI	1	125	649	21.0	5.19	30.90
Harmon/Kardon	Citation 16	150	795	21.8	5.30	36.47
Heath	AA-1640 (M, K)	200	490	23.0	2.45	21.30
	AA-1640 (K)	200	440	23.0	2.20	19.13
	AA-1505 (K)	35	160	15.4	4.57	10.39
	AA-1506 (K)	60	180	17.8	3.00	10.11
Integral Systems	200	100	350	20.0	3.50	17.50
Kenwood	700M	170	750	22.3	4.41	33.63
Luxman	M6000	300	2995	24.8	9.98	120.77
	M4000	180	1495	22.6	8.31	66.15
	M2000	110	995	20.4	9.05	48.77
	M1500	75	695	18.8	9.27	36.97
McIntosh	MC2100	105	600	20.2	5.71	29.70
	MC250	50	430	17.0	8.60	25.29
Marantz	510M	256	1000	24.1	3.91	41.49
	510	256	900	24.1	3.52	37.34
	250	126	600	21.0	4.76	28.57
	240	126	350	21.0	2.78	16.67
Pioneer	Spec 2	250	900	24.0	3.60	37.50
Quad	303	45	275	16.5	6.11	16.67
SAE	Mark XXXI B	50	300	17.0	6.00	17.65
	Mark IV D	100	500	20.0	5.00	25.00
	Mark III C	200	900	23.0	4.50	39.13
Sony	TA3200F	100	400	20.0	4.00	20.00
	TAN8250	150	1300	21.8	8.67	59.63
	TAN8550	100	1000	20.0	10.00	50.00
SWTPC*	Tigersaurus 250 (K)	200	309	23.0	1.55	13.43
	Tiger .01 (K)	60	155	17.8	2.58	8.71
	Universal Tiger "B" (K)	70	125	18.5	1.79	6.76
	215 (K)	25	139	14.0	5.56	9.93

* Kits are mono; price shown is for two.

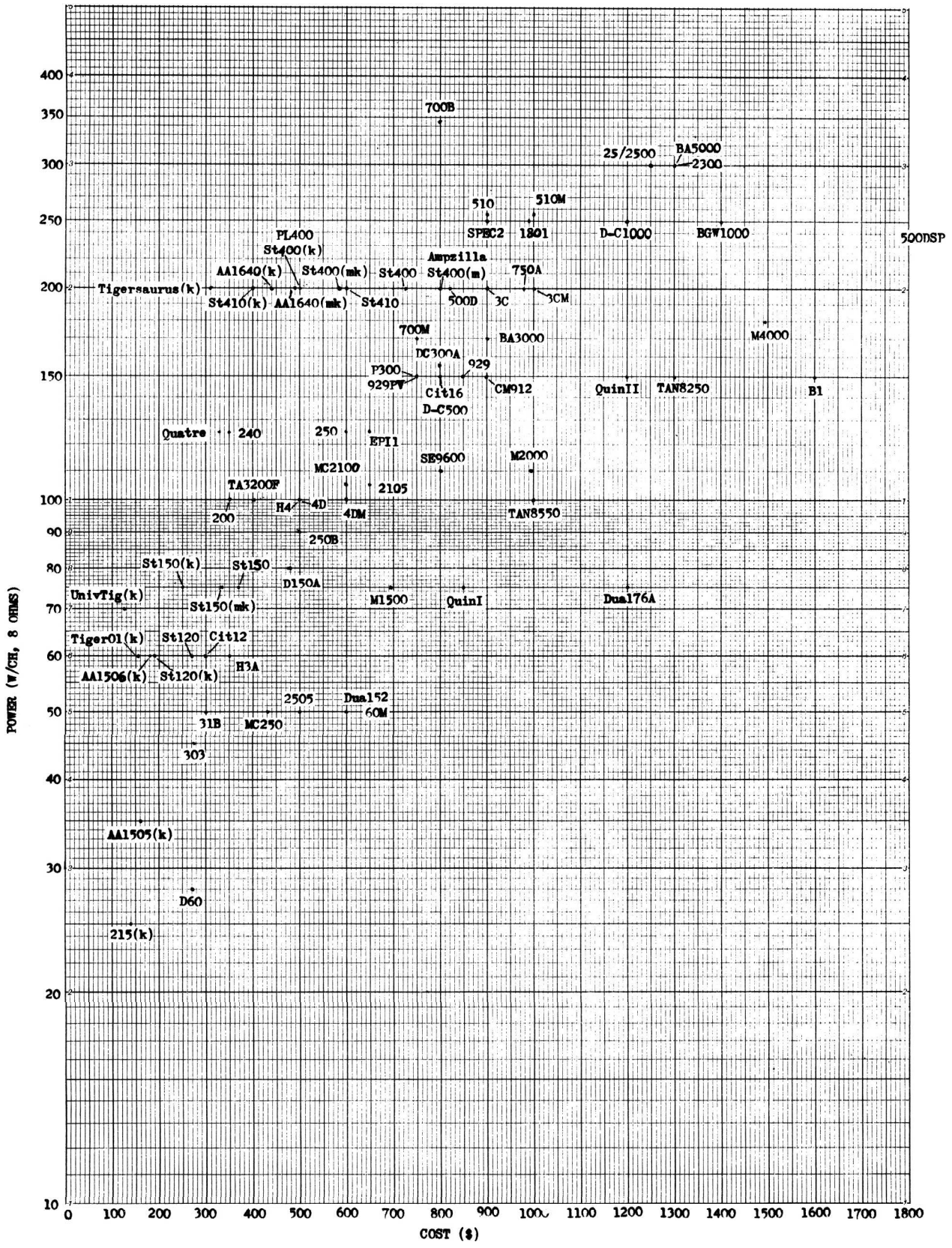

Fig. 1. Amplifier rankings: cost versus power

A Publication of the BAS

A Filing System for Audio Articles

John E. Gombos

"I just bought new speakers. Now, how should I position them in my room?"

"Which amplifier should I buy?"

When friends asked me questions like these, I was often tantalized with a vague memory of having seen a magazine article on just such a subject, but I could not remember where. I decided I had to find some way of locating these lost articles quickly. I did so eleven years ago, and now I can find any particular article in less than a minute.

At that time, I began an index card file system for all my audio magazines. This system consists of a 3- x 5-inch card for each magazine article. The cards are filed by subject. When I want to find a particular article, I look up the subject in the file, and a card tells me where to find the article. Let me show you how simple this is.

Here is how each card is completed. I skim through a magazine with blank cards and a pen in hand. When I find an article to be filed, I write on the card: title of the article (or subject if the title is misleading), magazine title, date of issue, and page number. I allow two lines for this and the rest of the card is used for comments.

Occasionally, I have to use more than one card for an article, as when two or more subjects are covered together. An example might be: "Which are better—tapes or records?" Here I would complete two cards and file one under tapes and one under records.

This is my sorting system. I use two levels of classification (i.e., division and subdivision). The divisions are: Amplifiers, Antennas, Cassettes, Cassette Players, Eight-Track Players, Graphic Equalizers, Headphones, High-Fidelity—General, Loudspeakers, Magnetic Tape, Microphones, Mixers, Musical Instruments, Noise Reduction, Preamplifiers, Phono Cartridges, Quad Decoders, Quad Software, Records, Room Acoustics, Tape Cartridges, Tape Recorders, Television, Tonearms, Tuners, Turntables, and Video Recording. The subdivisions are: Accessories, Commercial, Construction, Design, Installation, Maintenance, Operation, Repair, Specifications, and Testing.

The divisions are self-explanatory; however, the subdivisions require explanations. Each subdivision is defined this way:

- Accessories—Minor devices and software used with each major category.
- Commercial—All product reviews and how-to-buy articles.
- Construction—How-to-build articles.
- Design—Articles on theory and design.
- Installation—How to set up equipment and connect it to the rest of the system.
- Maintenance—How to keep equipment working in optimum condition.
- Operation—How to use equipment to its full capabilities.
- Repair—How to fix malfunctioning equipment.
- Specifications—Articles defining equipment specifications.
- Testing—How to test the equipment.

These same subdivisions are used with each division to provide two advantages. (Obviously some do not apply to all divisions.) First, this degree of classification suffices to define specific articles. Thus it solves my original problem. Second, it lets me look across divisions at one subdivision. For example, examining all repair articles lets me put together general rules for repairing any component in my system.

Two minor problems developed with the solution of my original problem. One was how to handle magazine corrections appearing in later issues. I solved this by adding a third line of data to the index card. I listed the date and page number of the correction below the date and page number of the original article.

This solution has proved to be an advantage in two ways. First, it alerts me to errors in the original article, and second, I use the same technique to list continued articles so I can read the whole article as one.

The second minor problem that developed was how to deal with the isolated audio article in ,non-audio magazines. I wanted to save the article, but not the magazine. The obvious solution was to remove the article and discard the magazine; however, I feared I would lose the loose pages. I decided to store these loose pages in folders. One folder was used for each file division (e.g., "Amp Folder" is used for amplifier articles). On the index card I list the folder in place of the magazine title. This allows me to locate these loose articles as quickly as the other articles.

Now to make the whole system clearer, let's look at my original two questions. The first asked about speaker placement. To answer this question, I look in my files under Loudspeakers—Installation. In this category, there are fifteen articles on positioning speakers in rooms. By reading these, I get the expert's advice on how to position my own speakers.

My second question concerned selecting an amplifier. For an answer, I look under Amplifiers—Commercial. Here are two types of articles. The first discusses amplifiers in general: what types are available and how to buy one to fill your needs. I found twenty of these. The second type is product reviews of specific amplifiers. I found 150 of these. I usually read the first type to get some idea of what to look for; then I read the second type to limit my choice to models that meet my needs.

To further clarify what I have said, let me illustrate the information I found for one particular amplifier, the Dynaco Stereo 400. (Note: this list is not necessarily complete.)

The Absolute Sound	1-4	p. 216
	2 -5	p. 33
Audio	5/75	p. 46
The B.A.S. Speaker	11/74	p. 3
	5/75	p. 11
	12/75	p. 4
High Fidelity	4/75	p. 37
	8/75	p. 27
Modern Hi-Fi & Stereo Guide	8/74	p. 34
Stereo	Spring 74	p. 53
Stereo Review	7/74	p. 32
The Stereophile	Win 74	p. 11
	Sum 75	p. 16

This example indicates one further advantage of the system. Reading reviews from different authors gives me different points of view. Thus I can eliminate an author's personal prejudices. But the biggest advantage follows.

In the eleven years I have used this filing system, I have not wasted hundreds of hours trying to track down vague memories. Instead, I have gone directly to the articles I needed. The time I saved has been used to do things—to position speakers or to audition amplifiers.

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A B.A.S. User's Report

The KMAL M9BA Mk. III Tonearm

Michael Riggs

Otherwise known as the Keith Monks mercury contact arm, the M9BA—an improved version of the old A&D arm—is a low-mass, viscous-damped unipivot design that sells for about $150. The Mk. U differs from the Mk. III only in that it does not have the sliding base, which Monks, for obscure reasons, chooses to make available as an option. (One can't adjust stylus overhang without the base.) Another peculiarity is that one can buy the arm with either of two elastically decoupled counterweights, the standard version for cartridges weighing 4 to 6 grams, the alternative for those of 6 to 9 grams. The arm comes with 3-foot, color-coded leads of 100-pF capacity, arm wiring included. Its effective mass is approximately 10 grams, which is about 3 ½ grams more than that of the standard version of the improved SME, about equal to or perhaps a little less than that of the detachable headshell version and less than that of any other arm I know of, save the Vestigal or, perhaps, the Formula 4. Bias compensation is achieved by means of a clever, frictionless, magnetic arrangement, which, annoyingly, is not adjustable. Consequently, use with cartridges that require over 1½ grams tracking force is not recommended.

The arm performs quite well, even with the original, super-compliant version of the ADC-XLM. There are, however, a number of practical difficulties one should consider before rushing out to buy one. I've already mentioned the antiskating, which, on an arm of this one's price and quality, should be adjustable. However, the deficiency seems not to be serious if one is using the low tracking forces required by most modern cartridges; at least, I've had no difficulties flowing from this source. Hi-Fi News reports that the arm is underbiased when tracking at one gram or over with elliptical styli and that the bias decreases toward the record center instead of increasing as some (not all) claim it should. But they too found no problems in actual use.

Most of my problems have had to do with the lifting device. The dealer (Suffolk Audio) advised me that Monks' lift is a sad affair and kicked in with a free Decca Microlift. Anyone who's owned one of these miserable items knows what that says about the Monks. The Microlift is an undamped, mechanical affair that seems unwilling to move other than in short jerks. Occasionally the support rod on mine would loosen and slip down the shaft, leaving the stylus resting securely on the record, lift actuating lever in the full-up position. Finally, unwilling to tolerate any longer the abuse being meted out to my stylus, I laid down $20 for a Supex AL-2 Autolift, also from Suffolk Audio. At last, a cueing mechanism I can recommend. This is a damped device with a very smooth, gentle action. The mounting screw is a bit short, so it is perhaps best to secure the lift base to the mounting board with an adhesive, and the actuating lever is so long that I had to cut off the tip of the plastic handle on mine to keep it from bumping against the inside of my dust cover. After all that, it works quite nicely.

And there's the matter of the "detachable headshell," which is either nonexistent or the world's largest, depending on one's point of view. The entire top of the arm, from cartridge to counterweight, bearing housing included, lifts off the supporting pedestal, which contains four plastic basins, each with a metal contact at its bottom. These wells are filled with mercury so as to conduct the signal currents from the four metal pins that protrude from the underside of the pivot hub; there are no lead-out wires. In the midst of these pools is another of silicone damping fluid with a spike poking up from its center. The spike fits into a small ball bearing race in the top's pivot hub. A metal collar extends down from the bearing housing over the spike and into the silicone. The result is a properly damped arm with absolutely minimal friction.

One can order extra tops, just as one might order extra headshells for another arm, though the cost is higher. (Counterweights are also available separately.) This feature permits cartridges to be changed with somewhat less fuss than with other systems, as each top can be preadjusted for the cartridge installed init. Unfortunately, removing a top from the pedestal almost always disturbs the balance settings slightly, unipivots (which must be balanced laterally as well as vertically) being somewhat finicky in this regard. This tends to make stylus replacement a bit more tedious than it is with more conventional arms. Setting up is also a little trickier, and a good stylus force gauge (e.g., the Shure SFG-2) is a necessity.

The headhsell twists slightly on the shaft of the arm to permit adjustment of the vertical stylus alignment. This requires an alien screw loosened and, for a while, the hand of Kong applied. Occasionally one or the other channel may begin cutting out—a sign that the contact pins need wiping. This problem should be less common than it once was now that the importer is packing triple-distilled mercury with the arms.

An alignment protractor comes with the arm, as does a reasonably thorough manual, which contains the remarkable understatement: "not for portable use." It fails, however, to mention the two allen screws on the counterweight. The one on the top can be adjusted so as to disengage the adjustment thumbscrew at the rear of the counterweight, thus locking the weight into position. The lower one adjusts the snugness of the weight's fit to the arm shaft and decoupling pad.

As I said at the beginning, the KMAL is a very fine arm—one with which I've been quite satisfied. And if you don't mind the extra effort it sometimes requires, it may be the arm for you. There are, however, several interesting competitors on the horizon. When I bought mine, the only other commercially available viscous damped tonearm was the now discontinued Decca International. Now the Grace 940 and the Formula 4 are here, and I understand more are on the way. (The Formula 4 looks especially interesting. Has anyone out there had any experience with it?) Those who want more information should write Audiophile Systems, 851 W. 44th, Indianapolis, Indiana 46208. Gary Warzin, the proprietor, will send a descriptive leaflet and, if asked, reprints of some characteristically informative and well written reviews from the British magazines.

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