THE B.A.S. SPEAKER

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In This Issue

One out of six or seven BAS members has an AR turntable. For simplicity and reliability, as well as freedom from rumble and acoustic feedback, the AR is hard to beat. Unfortunately, the arm isn't very good. Bearing friction is high and so is mass, and there is no provision for antiskating. Therefore, many BAS members will welcome this month's article by Leigh Phoenix on modifications to the AR tonearm.

It is possible to apply all or only some of the modifications Leigh applied to his arm, or to handle them differently: The important things about this note are, first, that it proves that the AR arm can be made to perform well enough to track the ADC-XLM, and second, that such modifications can be carried out by the intelligent amateur. If this article merely starts you thinking about changes you might make—even to other arms—it will have served its purpose.

Back when Arnold Schwartz, President of Micro-Acoustics, addressed the BAS, there was a lively discussion of the relative noise associated with different cartridges. Some of it may not have been terribly clear at the time, and this itself spurred further discussion. Finally, Harry Zwicker retired to his desktop minicomputer and modeled various cartridges in digital form, with the computer printing out plots of noise versus frequency for several units. Harry tells how the model was constructed and interprets the results for the Shure V-15 types II and III and the QDC-1E.

The results are interesting, but since the electrical parameters of so few cartridges were known at the time of his work, Harry was unable to generate very many noise curves. Therefore, we ask members who know the inductance, dc resistance, total cable capacitance, and load impedance of their cartridges to forward that data to Harry. We would like to know which are "the quiet cartridges."

Coming Up in the Speaker

The BAS would like a little input from its members as to topics of interest for the Speaker. Not that we are getting none at all, but we are getting very little and would appreciate more, the better to serve your interests.

That said, here are a few of the topics being bruted about in the discussions of the Publications Committee. In the area of construction articles, there are soon to appear pieces on simple-to-make, easy-to-use headphone amplifiers with extremely good performance, a description of a 110-dB-range audio voltmeter you might wish to build (from a kit which we have yet to decide about offering), more on the design of active filters, including notes on an active A-weighted filter for measurement of signal-to-noise ratio (passive filters usually have so much insertion loss that S/N measurement can be difficult).

Test reports on the Allison One loudspeaker, the Dynaco PAT-5, the Soundcraftsman preamp, and on a number of phono cartridges are under consideration if not all underway.

And there will be other, ad hoc, additions to the Speaker—more of them and more interesting if more members chose to write in.—Jim Brinton

Equipment Wanted

- Dust cover for Sony TTS-3000A turntable. Call (617) 887-5452 collect.
- dbx 117 or 119. Call Steve Reich, (617) 475-4359 collect (evenings).

Equipment for Sale

- Dayton-Wright XG-8 electrostatic speakers (Mod. One), Phase Linear 700, Sony TTS-3000A turntable, Decca 4RC cartridge (unused), Revox F36 tape recorder (four-track, 3¾ and 7½ ips, 20 hours use), Quad AM-2 tuner (5 hours use), Sony ST-5000 FM tuner. Call 945-8486, Windsor, Ontario, or write to "Canada" care of Box 7.
- Dynaco FM-5 tuner, used 15 hours for rear-channel pickup of BSO broadcasts; $175. Lew Pierce, 659-4366.
- BASF LP-35LH tape, sealed boxes, 7-inch reels (1800 feet). 10 reels for $37.50, $75.00 per case of 20. Ira Leonard, 729-5700 (days).
- AVID model 60 speakers, mint, in box. $80/pair. Ira Leonard, 729-5700 (days).
- Dynaco factory assembled PAT-4 with cabinet, $70; ST-120, $120; kit-built ST-70, $70. Dual 8-watt integrated amp, $45. Call Fred Parmenter, 739-1139.

The Audio Amateur- At a Bargain Price

With this month's Speaker, the BAS is mailing its members a copy of The Audio Amateur magazine's prospectus and subscription form. Not that we are giving a blanket endorsement of TAA (despite the Executive Committee's rabid bias in its favor, BAS bylaws prohibit such favoritism), but the editor and publisher of TAA, Edward T. Dell, has made it possible for members to receive the magazine at a discount price.

The details are spelled out fully in the prospectus, and we won't repeat them here, but if you are a serious audiophile, you should consider this offer. The Executive Committee would like to consider the $1 saving a rebate to members on their dues, and thus a bonus to BAS members.—Jim Brinton

BAS Tuner Clinics

As announced at the April meeting, the BAS will be holding tuner performance clinics at several times this summer; in fact, by the time you read this, the first one already will have been held. The purpose is to give a service to our members not elsewhere available—almost every other component can be tested against its specifications with more ease than an FM tuner; this is largely a function of the costly and complex test equipment needed to do a thorough job.

The BAS has been able to locate and borrow a high-quality Sound Technology Corp. FM generator. This unit's distortion is lower than that of many distortion analyzers and its flexibility is extreme. It is the availability of this instrument that has made it possible for us to test members' tuners.

Among the parameters measured will be frequency response, channel separation, THD at 400 Hz and at 12,000 Hz, signal-to-noise ratio, sensitivity for maximum signal-to-noise ratio, and IHF sensitivity. All appropriate tests will be done both in mono and in stereo with the exception of frequency response and separation.

What we are trying to do is, first, determine the general level of performance among members' tuners, and second, determine from this what improvements might be made either through purchase of new equipment, modification of existing gear, or at a minimum, realignment.

The stereo specs are of great interest because it is in these areas that the tuner state of the art has moved most rapidly in the last few years—especially with the introduction of the phase-locked loop demodulator, or PLL. Distortion at 400 Hz should be a little higher in stereo than in mono, but above 10,000 Hz, especially on tuners more than a few years old, distortion often rises dramatically. But not with a PLL demodulator.

Thus it may be possible for a relatively old tuner to perform with excellence in mono but to show extreme distortion above 10,000 Hz in stereo, or for it to show poor separation, etc. (Some improvement should be possible by fine-tuning the unit's alignment, and the BAS may offer alignment later this year. To see whether this is feasible, we will be viewing each tuner's IF bandpass characteristic on an oscilloscope as part of the test.) Should mono performance in signal-to-noise ratio, distortion, and sensitivity be good enough, a tuner may be a candidate for a PLL modification, which the BAS also plans to offer later this year. Thus at a tiny fraction of the cost of a new tuner, it may become possible to update your tuner's performance to something approaching the best available.

In any event, many will simply want to know how their units are performing, and whether realignment is needed or whether it would be worth the effort. These clinics will be a success if the BAS supplies only this information.

In a departure from earlier practice, the BAS is charging $5 for this service. There are reasons for this: First, at the time of the tape recorder clinic, more than forty members expressed their intention to come but only eight showed up; this time, your deposit (in advance) encourages you to appear and indemnifies us if you don't. Second, the effort involved in organizing and operating such a clinic—much less successive ones—has to be engaged in to be appreciated; the test of a single tuner can take from 30 minutes to an hour, the instrumentation has to be assembled from diverse sources, members of the test team will lose days of free time as a result. To put this charge into some perspective, electronic technicians' hourly time now costs from three to five times what the BAS clinic will cost. Further, one member was quoted a price of $60 by a local service agency when he asked to have his tuner tested.

Because of the time needed for these tests, they are being scheduled by appointment. On receipt of your $5 deposit, your name will be listed for the earliest forthcoming clinic. Times are to be decided, but clinics will generally be held on Sunday afternoons, at least once a month, between about 1 p.m. and 6 p.m. (later in some cases).

If you are interested in this service, send your deposit to Box 7 along with your name, a telephone number or numbers where you can be reached <u>at any time</u>, and a desired appointment time (e.g., "mid-afternoon," or "after 4 p.m."). You'll be contacted by phone and a time arranged at your convenience, so far as possible.—Jim Brinton

BAS Member Equipment Survey—A First Look

The application forms received from BAS members this year provided information on each member's high-fidelity system. We thought that you might be interested in a summary of this data.

A number of general comments can be made. First, a considerable number of members have home-built, self-designed, and/or modified equipment; there definitely seems to be a tendency toward experimentation. Second, and perhaps more striking, is the variety of equipment owned — there is really more diversity than one would have imagined, even taking into consideration that members come from all over the United States, Canada, and Latin America.

Speakers. While 102 different models were listed, Only 27 of these were listed more than twice. (Of course, many members have more than one type of speaker in their systems.) Some of the more popular speakers are listed below together with the number of members that own them:

Advent, large	35	KLH-5	7
Advent, small	9	KLH-9	8
AR-3a	27	Klipschorn	6
AR-LST	4	Magneplanar	8
Bose 901	7	Ohm F	4
Dahlquist DQ-10	10	Quad ESL	7
Dyna A-25	7	Rectilinear III	8

Power Amplifiers and Integrated Amplifiers. Of the 70 different models listed, only 25 were listed more than twice. Among the most popular were the following:

AR	11	Marantz 8B	4
Crown DC-300	9	Marantz 250	6
Dyna ST-70	16	Phase Linear 400	8
Dyna ST-120	16	Phase Linear 700	12
Dyna ST-400	13	Quad 303	4
Harman Kardon Citation 12	17	SAE Mark III	4
MacIntosh 2105	4	SWTP Tiger	5

Preamplifiers. Sixteen of the 46 models listed appeared more than twice. Although the Dyna PAT-5 became generally available after most of the application forms were completed, seven members listed it—in the most recent 37 applications received, five included the PAT-5. The most popular preamps were:

Audio Research SP-3	13	MacIntosh C-28	7
Harman Kardon Citation 11	21	Marantz 3300	5
Crown IC-150	13	Marantz 7C	9
Dyna PAT-4	20	Phase Linear 4000	7
Dyna PAT-5	7	Quad 33	9
Levinson JC-2	3		

Turntables. Sixty-three models were listed and 24 of these were listed more than twice. Among the most popular were:

AR	46	Philips GA-212	13
Connoisseur BD-1	8	Rabco ST -4	4
Dual 1229	6	Sony 3000A	8
Dual 1019	8	Thorens 160	7
Linn Sondek LP12	9	Thorens 125	29
Micracord	9		

Tonearms. Only 10 models were listed and five were listed more than twice:

Decca	10	Rabco ST-8	14
KMAL	3	SME 3009	49
Ortofon	3	Vestigal	2

Cartridges. Many members listed several cartridges and probably others listed only one of several cartridges owned. Fifty different cartridges were included and 21 of these were listed more than twice:

ADC-VLM	3	Shure M91ED (and EE)	16
ADC -XLM	56	Shure V15 II (including Improved)	31
AT-11	32	Shure V15 III	46
B&O MMC-6000	3	Stanton 681EE	17
B&O SP-12	15	Supex	4
Decca V	12		
Ortofon (all models)	21		

Tuners and Receivers. Unfortunately, we did not specifically list tuners on the application form, so many did not include this information. We did get some data on receivers, since these were listed with amplifiers.

Only four of the 30 receivers listed appeared more than twice. These four were:

AR	4	Kenwood 7002	6
Heath AR-1500	3	Sansui 8D	3

Tape Decks. Eighty-five different models were listed and 20 of these appeared more than twice. The most popular were the following:

Advent 201 (and 202)	34	Sony 355	5
Ampex 1260 F44	4	Tandberg 3000X	6
KLH 40	6	Tandberg 6000X	7
KLH 41	4	Tandberg 64X	6
Nakamichi 700	4	Teac 450	6
Revox A77	36	Teac 3340S	4

—Joyce Brinton

Tonearm Damping

Erratum on Tonearm Damping

Brooklyn member Peter Nickolakakos writes that Leigh Phoenix's article on tonearm damping (Speaker, January 1975) was "well written and organized . . . and made a difficult subject easy to understand." But he also calls attention to an error. On page 3 of the article, second paragraph, next to last sentence, the statement is made that ". . . the viscoelastic ring dries out and hardens with age, thus decreasing ζ_s and increasing 1/k and consequently f_n with time." If 1/k increases, f_n must decrease, not increase. Leigh Phoenix replies that the 1/k should read just plain k.

STP Seems Safe

Several people in the BAS have tried the tonearm damping modification described in the January Speaker on their own record players, and everyone I've spoken with has been pleased with the improvement. The audible difference ranges from subtle to terrific, depending on the cartridge, arm, and record in use. In all properly adapted cases, however, it's safe to say that the bass is cleaned up and overall detail is enhanced.

The only "complaint" that has been received is about the use of STP as a damping fluid. The fears are that STP, a petroleum product, may attack the elastomer parts of the turntable, including the cartridge suspension block. One member—our president—reported having his record mat crumble in his hands when he peeled it off the turntable. This, of course, was very sobering, so I set up a test to determine the possible dangers of STP. I put about 4 or 5 cc's of STP in a small plastic box (1 by 1.5 by 2 inches), placed a piece of similar foam above the fluid, and covered the box. After a week's time had passed, I removed the foam and tried to tear it, but it seemed just as strong as an "untreated" piece of the same material.

Since my own damping system has been in use for three months, with a dust cover when not in use, and I have had no obvious trouble, I feel that STP is probably safe to use.

As with anything new, however, it's wise to be careful, so I would advise watching for ill effects no matter what damping fluid is used. (Jim Brinton's turntable mat was old; maybe it just rotted.)

I'm currently investigating the use of Dow-Corning 200 silicone fluid as a damping material. This substance is nontoxic, rubber-compatible, and is actually used in hand creams, suntan lotions, hair grooming aids, furniture polish, and in food processing applications. It is available in viscosities ranging from 0.65 centistoke (water is 1 centistoke) to 100,000 centistokes (just try and spill some). It is also temperature-stable, so damping characteristics won't change with the weather. Once a suitable viscosity is determined, the information will be published in the Speaker, and since the material generally is sold only in large quantities, perhaps a group purchase can be arranged.—Bob Graham

(Ed. Note: As you can appreciate, we are trying to get this matter straightened out. Unfortunately, as we went to press, there came word that both STP and silicone fluid can—at least sometimes, and by a poorly understood mechanism—find their way to other parts of the record-playing system. This has not proven to be a problem in all systems, nor is either STP or silicone harmful to all materials. But since the possibility exists that either may be harmful to some materials (as STP is to nonsynthetic rubber, for example), we encourage you to use the fluid you already are using until we can evaluate realistically the degree of risk—if any—involved.)

Backcoating Versus Tape Wrap

Some surprising results were obtained when I decided to measure the frequency response of the Revox Mk III half-track recorder with some back-coated tapes. My results indicate that the so-called "posi-trak" coating, because it makes the tape thicker and/or less flexible than normal, decreases tape-head contact and reduces the quality of the head wrap. The net result is to measurably affect frequency response. For example, at 15 kHz Scotch Classic, Scotch 206, Ampex 9472-002, all of which have back coatings, were down 1 dB.

To restore the frequency response and lower the dropout rate, the large/small reel switch on the Revox had to be switched to the large-reel position regardless of the takeup reel size. As expected, there was no variation in performance when the reel-size switch position was changed with non-back-coated tapes such as Maxell UD35, BASF LP-35LH, Scotch 212, or TDK Audua.

The potential disadvantage of always using the large-reel position (which increases the takeup reel torque and thereby increases tape pressure against the heads) with coated tapes is (potentially) decreased head life. But it does reduce dropout and help achieve a more linear frequency response.

Since the head wrap of the Revox is as good or better than most tape recorders, I suspect that my results apply to other machines.—Alvin Foster

(Ed. Note: On machines without a reel-size adjustment, check for a "tape-thickness" control. Most Teac decks, for example, allow variation of tape tension for 1-mil and 1/2-mil tape. For better tape wrap, use the 1-mil setting.)

An Excellent Source for Ampex and Scotch Tape

In the last 1½ years, I have made group purchases of tape from Soundd Investment Co. (Box 338, Dunwoody, Ga. 30338) and have been quite pleased with both the price and service rendered.

Being naturally a tightwad, when I first set about ordering tape, I made inquiries to all the usual sources for price and discovered that Soundd Investment easily had the best prices for Scotch tape. This is still true 1½ years later. Scotch 177 (equivalent to Scotch 212, the replacement for 203) goes for $4.73 for 3600 feet, bulk-pack (on hubs, no flanges or box). Scotch 207 in the same configuration is $8.56. Ampex 407 is $8.21. Ampex Grandmaster (1½ mil, 2 500 feet) is $6.15 each.

SI supplies reconditioned Ampex flanges for $1.20 a pair and fasteners at 18¢ a set. His cheapest 10½-inch boxes are 60¢ each.

SI also has many other delights such as precision reels, tape on 14-inch hubs, 7-inch reels and boxes, 1/2-inch tape, and cassettes.

For very large orders SI's chief, "Spud" Wilmer, might even be talked into slight adjustments on price (e.g., for our $900 order, he paid shipping and gave us the fasteners for free).

He has been both courteous and quick in the filling of our two large orders. He even called me on the last order when there was some confusion (my fault). Over the phone, he seems to be a low-key person who is interested in giving good service and recognizes the value of repeat business. He is himself a professional recordist.

Since there still seems to be some interest in ordering more tape from him, I'm willing to organize yet another order for local members. Absolute deadline is the June meeting.—Jim Richardson

A Socket for the 814

It no longer is necessary to mess with epoxy or to endanger your 814 mike capsule by soldering to its pins. BAS member Ira Leonard has found a military-style connector that can be used to connect the 814 to accompanying electronics. So—wait for a month while the BAS orders some. We shall be buying enough to get a quantity discount and will pass this on to you.—Jim Brinton

Sequerra Replaced as Backers Take Over

(Ed. Note: Few products of the past several years have aroused the interest that the Sequerra tuner has, and when word arrived that its designer, Richard Sequerra, "had left the company," there were immediate fears that production might be stopped. Despite the fact that, at more than

$2600, the tuner was out of the reach of most audiophiles, we felt it important to investigate the matter, if only because of Sequerra's role in advancing the state of the tuner art, first with the Marantz 10B and now with the unit bearing his name.

Ira Leonard made contact with the company and filed this report—and the news is more favorable than anyone might have expected from the initial rumors.)

Not only is The Sequerra Co., Inc., not going out of business, the company is about to expand production and is planning new product introductions, according to Fred Barrett, board chairman of the parent company, Quadratech Research, and Sequerra's backer in development of the Model One Broadcast Monitor tuner.

Reached at The Sequerra Co. plant in Woodside, Queens, New York, Barrett says that rumors that Richard Sequerra and his engineering partner Sidney Smith have been forced out of the company are false. Instead, he says, both will be retained as consultants, although Barrett is taking over day-to-day management.

The Boston-educated Barrett always has been the man behind the tuner's development, and in fact seems to have conceived of the project in the first place. In the late 1960's he founded his own firm, Quadratech, and retained Sequerra as a consultant. Barrett, himself an audiophile and music lover, says that it was his desire to bring out a product that would dramatically advance the art of music listening. As a result, he capitalized Sequerra at an initial $125,000 to produce what was to become the Model One.

Quadratech had garnered a good reputation for products delivered to commercial users and to the government, and for a time Barrett had considered making the Model One a product of that firm, but one problem held him back.

Barrett is black and despite Quadratech's reputation, he questioned whether the country was ready, in his words, for a product so far beyond the state of the art that also came from a "minority firm." Thus, his organization of The Sequerra Co.

As Barrett tells it, three years and $1.2 million later, the Sequerra Co. was producing tuners at a rate of only two a week, and product uniformity was poor.

With so much of his own money invested, Barrett felt a drastic need for new management, and in February he resigned his sub-cabinet post as Executive Director of the Consumer Product Safety Commission to become board chairman of Sequerra, and de facto, its fulltime manager.

Changes have come rapidly since that time: Product output and uniformity have both been improved—as of the second week in May, 390 units had been produced; the Sequerra operation is about to move into a new 25,000-square foot facility in Jamaica, New York, and by June, Barrett expects to be producing Model Ones at a rate of 100 units a month—and with firm quality control.

Marketing plans for the tuner are being colored by its reception; the Model One has found five times the market among professional users that it has among audiophiles; in some measure this is due to the unit's RF spectral display, called by Sequerra the Panoramic Display or adaptor. According to Barrett, stations are finding the display useful not only to find out what their own signal looks like, but also to detect signals "below them" in signal strength that might be degrading their own apparent performance.

The Model One is also finding applications as a "super" SCA decoder, as a low-cost general use spectrum analyzer for FM, and as a monitor tuner in FM relay links.

Because of the growing professional acceptance of the Model One, Barrett has arranged to strike harder into this market using the assistance of Collins Radio and its sales connections in the broadcast field.

Barrett is not concerned that Richard Sequerra's departure from management will be fatal to the firm. He believes that there is plenty of engineering talent available in the audio field—enough so that he already is thinking in terms of additions to the Sequerra Co.'s product line-

Future introductions will be built along the same quasi-military lines as the Model One, and include a preamplifier with an oscillator and accessory functions to enable the user to equalize his listening room. The preamp's price should be close to that of the Model One; an announcement should be made introducing it before September, and production should begin by October or November.

A power amplifier using vertical FET's is also forthcoming, and is in pre-pilot production now. The VFET's are to be produced by an American firm—a promising sign for other audio firms and all audiophiles. The amplifier should be introduced publicly and be well into production by Christmas.

Finally, a four-channel vector oscilloscope also is planned for the near future.—Ira Leonard

The BAS has asked Fred Barrett to address a meeting of the Society this summer and he has graciously agreed. If we can succeed in scheduling it, the meeting would mark the first public appearance of The Sequerra Co.'s new management and would give members a chance to hear the behind-the-scenes development story in person. Also, there are anticipated technical discussions and demonstrations of the Model One and the company's forthcoming products. We are attempting to schedule this meeting as quickly as possible and will keep the membership informed.—Jim Brinton

Your Radio Shack SPL Meter—Better Than You Think

At the last meeting, and privately, BAS member Ira Leonard checked the calibration of fourteen Radio Shack SPL meters and the results have been surprisingly good for such an inexpensive device.

Using a Simpson model 889 calibrator, which emits a controlled 114-dB-SPL tone at 1 kHz, Ira found only three meters that were exactly correct, but even the worst unit tested—and that with a weak battery—was only -3.5 dB out of calibration at 114 dB. There seemed to be little if any difference between the performance of units with black meter panels as opposed to the earlier series of white-faced units. With a fresh battery, the average unit was down 0.8 dB (the range was from +1 dB to -2 dB) at the 114-dB calibration level. The calibration showed up two characteristics of the meter which had not been suspected. One is its greater than expected sensitivity to battery voltage; for example, the same meter measured -1.5 dB with a weak battery (which measured "good" on the unit's battery indicator) but dead flat with a fresh battery. Moral: Use the Radio Shack battery card frequently, and always use a fresh battery before a critical measurement.

The second point arose over a disagreement between two calibration standards, one itself calibrated against a piston-phone, and the other in agreement with two H. H. Scott/Eastern Air Devices units. Four units were tested both with the Simpson 889 and with a B&K 4230, the latter using a 94-dB reference tone at 1 kHz. In each case, the tested meter was found to read 3 dB higher at 94 dB than at 114 dB.

It now is understood that the reason for this is two-sided. First, the 90-dB scale is more apt to be used in checking live music than the 110-dB range; second, for that reason, and because of the meter's (slow) ballistics, its designers appear to have added a little boost to response in this range to more accurately reflect peak information.

All in all, though, the Radio Shack meter has proven to be an excellent instrument at a very advantageous price. If you plan to purchase one, try to do so while the units still are on sale for $39.95—and keep a fresh battery handy.—Jim Brinton

In the Literature

Audio, June 1975

- Audio has not been reviewed in this column because we assume everyone already subscribes to the "big three" glossies. But if this is not the case, you are missing out this month mainly on a how-to-do-it Burwen-type dynamic hiss filter. (Let us know if you want Audio taking up space in this column.)

Audio Amateur, 4/74 (April 1975)

- Low Level Phono or Tape Preamplifier: Not only a construction project, but also a step-by-step design philosophy discussion, good even for the non-experimenter.
- SME Shell Surgery: Lowering the mass of the detachable shell.
- Kit Report: Southwest Technical's Headphone Amp: Unenthusiastic review of the two-watt (that's a lot into a headphone) class A amp.

Popular Electronics, May 1975

- Stereo Scene: Good Stereo: Amplitude, phase, and time differences as they affect sound localization. (p. 15)
- Matching Tape Decks to Magnetic Tape: Useful, but oversimplified. (p. 34)

Popular Electronics, June 1975

- Non-technical Demonstration Records: Reviews of several music-realism demonstration records. (p. 16)
- The Titan Modular Stereo Power Amplifier: Review of the Integral Systems "power operational amplifier" modules, which have the virtue of simplicity but rather poor distortion specs. (p. 27)
- Grounding: Brief, but may help in conquering hum problems. (p. 67)

Radio Electronics, May 1975

- Inside Op Amps: The beginning of a rather detailed series, looks worth reading. (p. 51)
- Tape Bias: Nearly useless (p. 70)

Radio Electronics, June 1975

- Radio Electronics Tests HiFi Gear: The beginning of a HiFi equipment technical measurements column, which will concentrate on detailed measured data on electronics.
- All About CD-4 Cartridges: Quite detailed description of the inner mechanisms of CD-4 cartridges, including the QDC-1, the Panasonic strain gauge, and a comparison chart. (p. 46)

Wireless World, Jan. 1975

- Silent Switch for Stereo-Pair Comparisons: An FET-controlled electronic switch of unbelievable complexity and quite good specs. (p. 31)

Wireless World, March 1975

- 75 Years of Magnetic Recording, Part One: For the historian. (p. 102).
- Noise—Confusion in More Ways Than One: First part in a tutorial about noise sources an amplitudes. (p. 107)
- High Quality FM Tuner: Uses 565 and 1310 IC with varactor module front end. (p. 111)

Wireless World, April 1975

- 75 Years of Magnetic Recording, Part Two: (p. 161)
- Noise—Confusion in More Ways Than One, Part 2: (p. 169)
- Announcement that a Dolby construction project will follow shortly. (p. 173)

April BAS Meeting

Business and Open Discussion

More than 160 gathered at GTE Labs, Waltham, for the April meeting. Jim Brinton opened by announcing organization of a tuner clinic to measure tuner performance parameters, some rarely seen in test reports. These will include mono and stereo signal-to-noise ratio, IHF sensitivity, total harmonic distortion at various frequencies, and frequency response from 20 to 15,000 Hz.

Before the meeting began, and during break, BAS member Ira Leonard calibrated SPL meters for members. He also sold BASF LP-35LH tape available for $15 per 4 reels or $75 per case of 20. The Scotch 177 tape ordered last month was delivered by Jim Richardson, who also called attention to ads in Audio and db offering factory reconditioned Revox A77's for $650.

Adding some additional comments to his note in the April Speaker, Joel Cohen said that the (old Cartrivision) video tape recorder being offered for $150 by Knickerbocker Enterprises uses 1/2-inch tape running at 4.3 ips and is able to record the full 4-MHz color bandwidth by skipping fields. Cassettes are available for 1/2 hour to 2 hours of continuous recording, the 1/2-hour units going for $6. Some interface electronics will be necessary to record from, and play back through your TV set, since the recorder has no tuner or RF output. A small users group of about 12 persons has been formed in the Boston area to aid those wishing to set up and maintain their recorders. Contact Joel Cohen for more information.

Peter Mitchell gave a demonstration of the Thermo Electron 814 microphone's "improved" midrange when incorporating the equalizer described in last month's Speaker. Using a Dynaco Stereo 400 amp and four pairs of Dynaco A-35 speakers set up for the meeting feature, he played cassette recordings he had made without the equalizer. By switching the equalizer in and out of the playback signal, it was possible to A-B the equalized and unequalized program. The broad 3 dB of equalizer boost centered at 3500 Hz was barely noticeable as a slightly emphasized presence on vocals and modified string character. Appreciation of the equalizer was made somewhat difficult by the very prominent bass spectrum of the four pairs of A-35's, which tended to mask the subtle effect of the midrange equalization.

Meeting Feature: Dynaco

Dynaco, known in the past for its conservative approach to equipment design, features, visual aesthetics, and industry leadership, has in recent years, begun to lean slightly to the left. That is, if some of the most recent products and pronouncements are indicative. Bob Tucker, Dynaco's Director of Public Relations, reviewed the development philosophy of the PAT-5 preamp, Stereo 150, and Stereo 400 amps, the A-25XL speaker, and revealed some behind the scenes vignettes in the continuing saga of the FTC versus power amp manufacturers.

In addition to equipment demonstrations, there was a mini-clinic on amplifier distortion presided over by Ed Laurent, Chief Engineer at Dynaco. An HP audio spectrum analyzer was used to graphically display the frequency spectrum of harmonic distortion in a number of popular power amplifiers, including, of course, Dyna's.

When the PAT-5 preamp was introduced, according to Tucker, questions were raised in some circles about the need for a new preamp. He explained that Dynaco felt definite improvements could be made in the phono input to minimize interaction between the cartridge and phono-input circuit. In addition, Dyna wanted to provide more useful tone controls and added appeal to the more sophisticated audiophile market.

Dynaco engineers were pleasantly surprised by the great sonic improvement of the PAT-5 over the PAT-4, although Tucker did not discuss the significance of any new components or circuit designs incorporated in the PAT-5 that might account for this. He went on to describe the various features and controls, most of which are covered in Dynaco literature and ads. In a sidelight, he mentioned the seeming inconsistency of having a 3-wire plug on the Stereo 400 amp while the PAT-5, with a line switch capable of handling the 400, has only 2-wire receptacles. It seems that Underwriters Laboratories would not approve a product with a mixture of 2- and 3-wire receptacles, and the decision was made to use all 2-wire receptacles. An adapter is needed 10 mate the 400 to the PAT-5.

On the market now for 18 months, the Stereo 400 power amplifier is the most complex amplifier kit yet produced by Dynaco (taking an estimated 18 hours to assemble against 6 hours for the Stereo 120). This is due partly to the extra circuitry required for the 400's speaker protection system, but is primarily the result of Dynaco's decision that it is no longer economically feasible to spend time trying to simplify and distill a design to reduce parts while maintaining performance. Dyna feels they have achieved such an improvement with the Stereo 400 and PAT-5 that they are, for the first time with any piece of equipment, touting them as sounding better than their established line of components. Both the Stereo 400 and 150 (which is similar in design to the 400) have significantly less distortion than Dyna's first transistor amp, the Stereo 120—according to Tucker, still the largest selling transistor power amp in the world. Even the Mark III tube amp still sells well, although the majority of sales are overseas, particularly in Japan, where the amp recently received a favorable review. Tube amplifiers, though, are likely to become scarce in a few years, Tucker predicted, as specialized parts, such as filter capacitors in the right values, disappear from the market.

In Dynaco's line of speakers, the A-10, -25, -35, and -50, employ the same drivers in different size cabinets, with the exception of the A-10's smaller woofer. The new A-25XL has been designed to sound similar to the A-25 but is 3 dB more efficient, with wider dispersion and better top end. This was achieved with a different woofer and reduction of tweeter diameter from 1.5 to 1 inch. Tucker commented that the A-35 was the smoothest sounding speaker in the group and the one preferred by most of the Dynaco staff.

In reviewing the history of the FTC ruling on power amp specifications, and Dynaco's appeal, Tucker mentioned that one of the first Stereo 400 amps produced was sent to Audio for review. Dynaco was surprised to find that this unit had no trouble achieving a 200-watt-per-channel rating in the preconditioning test, while some similar units at the factory, in the same preconditioning test, could be rated at only 60 watts per channel. This variability was soon traced to a few degrees tolerance in the 400's thermal cutout sensor, the 200-watt rating being met by allowing a slightly higher temperature in the output devices. Eventually the mounting of this sensor was modified by using a better insulating material between the heat sensor and the output transistors such that all 400's can be FTC rated at 200 watts per channel into 8 ohms.

The FTC is reluctant to consider appeals on its amplifier test specifications because this would mean, according to Tucker, reopening hearings, with the whole process consuming up to two years and additional funds. They are, instead, looking for ways of interpreting the 1/3 power preconditioning test, within the spirit of the rule, to yield more realistic performance ratings of high power amps. The proposal, introduced by Larry Klein in Stereo Review, for driving the amplifier with a signal that would cause full power output 1/3 of the time and no output 2/3 of the

time (giving an average power out of 1/3 full power) did not meet with approval. It was felt that the 2/3 off left too much time for the amplifier to cool. The latest proposal calls for running the amplifier at a continuous 1-watt output level with periodic full power peak signals to give an average power out of 1/3 full power. This more closely approximates a typical use situation, and Tucker reports it is being favorably considered by the FTC.

For many members the most interesting portion of the meeting came when Ed Laurent began testing various power amplifiers for harmonic distortion content. He used a Sound Technology ST1700A distortion measuring system to feed a 1-kHz sine wave into the amplifier driving an 8-ohm resistive load. The amp output was sampled by an HP 3580A spectrum analyzer showing a CRT display of the amplitude of the signal harmonics versus frequency. This is a fascinating presentation of amplifier distortion. Since the entire harmonic content of the signal is spread out before you, the relative amplitudes of low-order and high-order harmonics (to which the ear is more sensitive) are immediately apparent. This emphasized the limited usefulness of the traditional total harmonic distortion (THD) figure usually quoted.

The amplifiers were driven to 1 watt at 1 kHz unless otherwise noted. Harmonics greater than 90 dB down were not resolved on the analyzer.

Amplifier	Harmonic Content
BGW 500	2nd, 75 dB
Acoustic Research	2nd, 3rd, -78 dB
Phase Linear 700 (cold)	2nd, -70 dB; 3rd through 14th, -75 dB
(after warm-up)	2nd, 3rd, 4th, -78 dB
Dyna Stereo 150	2nd, -85 dB
Dyna Stereo 400	None detected!
(at 180 watts out)	2nd, -86 dB

The Phase Linear 700 showed poor performance when cold due to the thermal lag of its improperly mounted temperature sensor which biases the drive transistors for minimum cross-over distortion at their operating temperature. Too much credence should not be placed on the above figures (except for the Dynaco equipment as representative of these particular units, since much can be done to minimize harmonic distortion by critically optimizing the bias on the driver and output stages. It is likely that these amps could be tweaked to give better performance Whether they can reach the perfection of the Stereo 400 is material for another report.—John Schlafer

A Publication of the BAS

Improving the Performance of the AR Tonearm

S. L- Phoenix*

In a recent article on tonearm damping (Speaker, January 1975), I mentioned that I had modified my AR arm and turntable and was now operating it very successfully with an ADC-XLM cartridge, a cartridge noted for tempermental behavior and incompatibility with most arms. The modification project was a valuable learning experience and led me to conclude that there exists a good deal of nonsense and folklore regarding desirable tonearm properties and behavior. Rather than embark on a crusade in this article, I will describe briefly the modifications that I made, and how they appeared to affect actual performance. The second part of the article will be devoted to some of the methods used in the final set up of the arm, the necessity of which cannot be overemphasized.

MODIFICATIONS

The AR turntable is a good candidate for modification because it is very simple, rugged, and inexpensive. The turntable section has long been heralded for its speed, accuracy, and low rumble, but the arm has invited improvement for some time. For one thing, there is no anti-skating device, though the arm's relatively long length has somewhat reduced the necessity for antiskating. It is obvious that there has been no design effort expended in reducing arm *mass* and here is where improvements can be made easily. Vertical and lateral pivot friction and lead drag frequently are high. The modifications described here deal effectively with these problems.

The headshell is far bigger and heavier than it ought to be. Without the cartridge it weighs about 7 or 8 grams. By using a machine shop grinder, it was easy to grind away the skirts and other plastic material not structurally necessary. My headshell has a "dogbone" shape as viewed from above, and even the cueing handle has been trimmed down in size. The brass pins connecting the headshell to the arm were drilled out of both the headshell and the arm to further reduce mass. (The rewiring of the arm is discussed later.) After these modifications were made, the headshell weighed about 3 grams, well below half its original weight. To compensate for the reduced headshell weight, it was necessary to reduce the weight of the brass counterweight by about 40% (for the ADC-XLM). This was done in a lathe by removing about 20% of the brass from each end of the counterweight. This completed the mass-lowering modifications of the arm.

The only modification made to the vertical bearing system was to disconnect the "butter-fingers" damping device. This was done by grinding off the brass pin on the drum inside the vertical pivot assembly. It was then possible to tighten the vertical shaft into the pivot assembly without generating any hindrance to vertical arm motion. The vertical bearings were then lubricated with STP and set about 1/4 turn back from their "tight" position.

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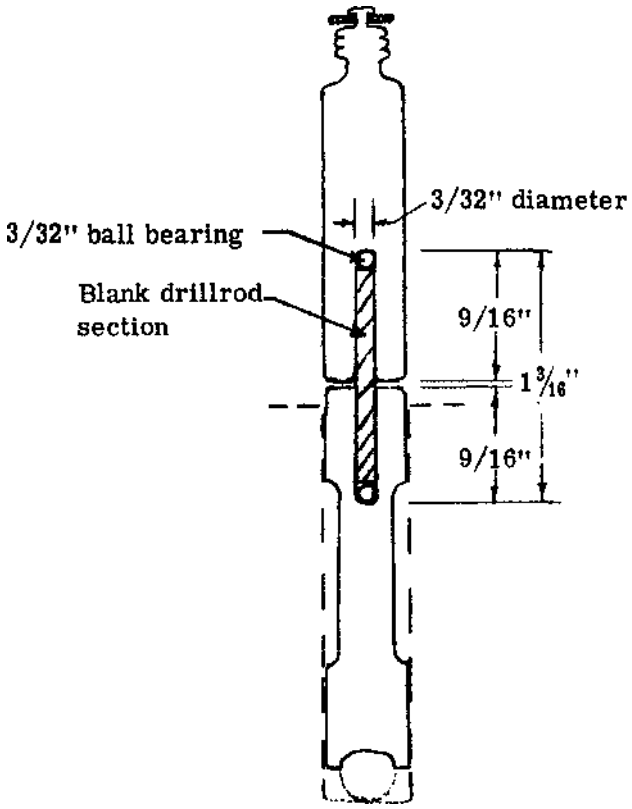

Fig. 1. Horizontal bearing modifications

The horizontal bearing was modified as shown in Fig. 1. The vertical supporting shaft was cut in half, then each half was drilled out in a lathe with a 3/32-inch drill to a depth of 9/16 inch. The holes were just large enough for a 3/32-inch blank drillrod section to turn freely. One 3/32-inch-diameter ball bearing was placed in each hole. A 1-inch section of blank drillrod was flattened carefully at each end, and placed in the holes, bringing together each half of the shaft. STP was used as a lubricant. One end of the shaft assembly was put back into the lathe and the assembly was "run in" to reduce friction by holding the free half while spinning the lathe.

Rewiring the arm was not particularly easy but was an absolute necessity because the bending stiffness of the leads running from the AR arm to the underside of the base was far too high. (In fact, the bending stiffness of a wire grows approximately as the fourth power of the wire diameter.) After a substantial search I came across what is known *as* Litz wire made by Belden and sold by Gerber Electronics in the Boston area. The wire is nylon wrapped, 5x no. 44 stranded, and is very flexible. Four leads were cut and marked to run from the cartridge, through the arm, to the terminals on the underside of the turntable base. A fifth lead was wrapped around the other four to hold them together at the rear of the arm and to act as a ground wire leading from the arm to the ground terminal underneath the turntable base. The colored leads that had been connected to the cartridge were saved and soldered to the new Litz leads. The length of the leads running from the arm to the hole through the base was set at about 5 inches and looped so that the final bending resistance was miniscule and certainly an order of magnitude below what it was originally. Unfortunately the flexibility of an easily removable headshell was given up, but then I have need only for the XLM at present. (The rewiring job requires extreme patience and you may "blow it" once or twice before you finally succeed.)

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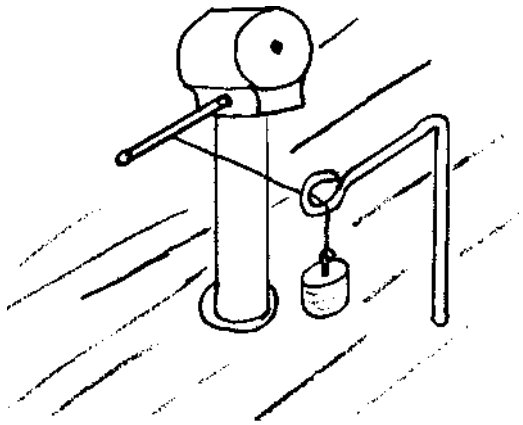

Fig. 2. Antiskating device

A simple hanging-weight antiskating device was built for the arm. First a 1/16-inch-diameter horizontal hole was drilled at the spot shown in Fig. 2 and a 1-inch piece of 1/16-inch-diameter welding rod was mounted and glued into place. Off to the side another hole was drilled through the base, and a structure was made from the aluminum rod over which the weight could dangle as shown in Fig. 2. A tiny weight was connected to a fine piece of nylon fiber (monofilament fishing line) and then tied around the horizontal rod, which had several notches filed into it before mounting. By sliding the weight along the shaft, the antiskating force can be adjusted.

The suspension of the turntable was modified slightly because a rocking motion of the arm/platter assembly was noticed which seemed to be induced by a slight imbalance of the platter. This resulted in lateral arm oscillation. To solve this, three block-shaped foam rubber spacers were placed between the undercarriage of the platter and the base and the suspension springs were tightened slightly. This alleviated the difficulty without introducing noticeable side effects.

The final modification was to add onto the arm a Graham Mk II damping device, about 2 inches in front of the pivot. This seemed to help a little bit on badly warped records, though the arm was working extremely well already after the other modifications had been completed. (Ed. Note: The STP in the vertical bearings was probably supplying some damping already.)

ARM SETUP AND ADJUSTMENTS

I discovered that the tracking error of the arm was high when set up according to the manufacturer's procedure and that the cartridge did not ride parallel to the plane of the record surface. The problem was always there apparently but I had not noticed it before. Using a nail file I was able to file a little here and there on the headshell screwhole shoulders to achieve a satisfactory rake angle for the stylus. I removed plastic material with a razor blade and nail file to generate rotational "slop" at the headshell-arm interconnection. By taking out the stylus and lowering the arm and cartridge (without stylus assembly) onto an old flat record, it was easy to set the headshell and then tighten the lock ring so that the cartridge was perfectly parallel to the record surface, side-to-side. To adjust tracking error, I butted a flat piece of plastic (my Dustbug to be exact) up against the front of the cartridge with the stylus assembly removed. By toeing the cartridge in toward the center of the platter a small amount I was able to adjust the cartridge so that tracking error was zero with the stylus about 3 inches from the spindle and varied in the usual way for other distances from the spindle. These adjustments reduced inner groove distortion a stunning amount. (I would advise every audiophile to carefully check these aspects on his or her tonearm.)

Antiskating was set using the "blank" band on an old Shure test record; skating would occur on this blank surface with a tracking force of 0.25 gram. From the geometry of the arm and using a value of 0.3 for the coefficient of friction of the stylus on the record surface, I concluded that the effective bearing friction was below 20 milligrams. Now because the groove surfaces are approximately 45 degrees to the horizontal, the drag force on the stylus is approximately $(1/\sin 45°) \approx 1.4$ times the flat surface drag force. The oscillations of the grooves increase the drag force even further, perhaps as much as an additional 30 to 40%. So my procedure was to decide on the tracking force of 0.8 gram for the XLM and then to add on another 60%, bringing this value to about 1.3 grams. Using the 1.3-gram tracking force with the Shure disc's flat surface, I then set the antiskating device so that no skating occurred in either direction. I then set the tracking force back to 0.8 gram, ready for operation.

Finally, I added ST P to the damping device container and found that a tiny tracking force adjustment was necessary. I am very happy with the final result and certainly will not be in the market for a new arm or turntable until a new radical device is invented and proven to be superior- I would encourage anyone with an AR turntable to make the modifications. Be patient and take your time; the results will be worthwhile. You'll learn a great deal in the process, and when you evaluate the final performance, the proof will be in the lack of audible pudding.

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A Publication of the BAS

Feedback on Phono Noise—Micro-Acoustics Versus Shure

Harry Zwicker

In the February Speaker, Peter Mitchell discussed the difference in noise generated by a typical magnetic phono cartridge compared with the Micro-Acoustics QDC-1. He correctly indicated that the inductance of the magnetic type acted to increase noise at higher frequencies, while the essentially resistive QDC-1 had a rather constant noise output regardless of frequency—a "white" noise spectrum.

At 10 kHz, it was concluded that a Shure V-15 would be about 10 dB noisier than a QDC-1- But the note implied that it was the noise of the magnetic cartridge itself that increased at higher frequencies. Micro-Acoustics' advertising literature is a bit more correct in implying instead that the impedance of the cartridge acts to shunt the noise generated in the 4?-kohm phono preamp resistor, which is the actual noise source. Since the reactance of the magnetic cartridge is higher at high frequencies, this shunting is diminished and the high-frequency noise increases; with the QDC-1, the shunting and noise are constant with frequency.

Complicating the noise question is the effect of the high extra capacitance used with the Shures but not with the QDC-1; this tends to shunt some of the high frequency noise in the region where it is no longer shunted by the cartridge. Some who have listened to the QDC-1 feel it is actually hummy and perhaps noisier than, say, an XLM.

To help resolve the noise comparison, I constructed a computer model of a phono cartridge and preamp, including RIAA equalization, and with an HP 9830 plotting calculator computed noise voltage versus frequency (from 20 Hz to 20 kHz) and integrated it to arrive at a total RIAA equalized phono-stage noise output voltage.

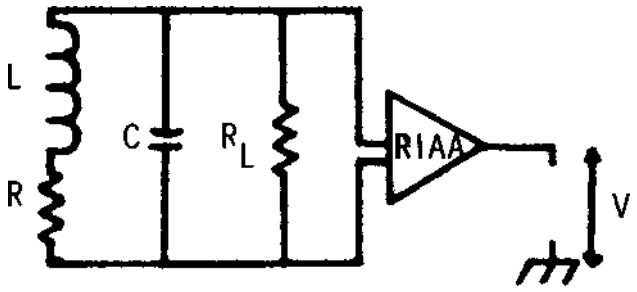

Fig. 1. Computer model

The model is shown in Fig. 1 and the results of this first computation are shown in Fig. 2. The integrated noise voltages were 0.763 µV for the QDC-1, 0.691 µV for the V-15 II, and 0.693 µV for the V-15 III. (Open circuit noise is 2.76 MV.) Thus, although the total integrated noise of the QDC-1 is actually greater than that of either Shure, the difference is very small. There is an important difference in the frequency distribution, however; for the QDC-1 most of the noise lies at low frequencies, while noise from the Shures lies at higher frequencies, near 3 kHz, at the peak of hearing response. The Micro-Acoustics would have a rather "rumbly" noise characteristic, while the Shures would have a more familiar "hiss."

The shape of the curves in Fig. 2 is easily explained qualitatively. For the QDC-1, the plot is very nearly a replica of the RIAA equalization curve, with some slight deviation at the highest frequencies owing to the shunting cable capacitance. For the Shures, the aforementioned inductance causes a comparative noise increase at high frequencies until the shunting effect of the larger capacitance rolls it off above resonances at 9 to 10 kHz; the competing increase and decrease cause the noise peak of about 10 dB, just as computed by Peter Mitchell. The differences in noise at low frequencies result from the higher dc resistance of the QDC-1 when compared with the Type HI, and from its higher resistance compared with the Type II (see the cartridge resistance values below).

Although the noise plotted in Fig. 2 is the noise your amplifier "sees," it isn't what you hear because of the ear's frequency-weighted sensitivity. Therefore, in Fig. 3, we present the same data after applying A-weighting (as well as RIAA equalization) to the same cartridges. (The integrated "voltages" now are 0.41 µV, 0.51 µV, and 0.45 µV for the QDC-1, Type II, and Type respectively.) Now the relative differences aren't very large, and probably the audible effect of noise from these cartridges will depend largely on the frequency balance of one's system. In a bass-heavy system, the QDC-1's low-frequency output might be a limitation, while in a very bright sounding system, the Shure's high-frequency noise distribution might be a drawback. Which brings it down to a matter of taste.

Noise curves can easily be run for members' cartridges and compared with a selected standard. Please send me (at P.O. Box 7) the cartridge data (resistance, inductance, total cable capacitance, and preamp input resistance) and a self-addressed stamped envelope.

For the engineers, the values used in the above calculations are as follows (R_L = 47 kohms in all cases):

For the QDC-1: R = 3900 ohms, L = 0 henry, and C = 150 picofarads.
For the Type III: R = 1350 ohms, L = 0.5 henry, and C = 450 picofarads.
For the Type II: R = 630 ohms, L = 0.72 henry, and C = 450 picofarads.

The RIAA function was assumed "perfect," with time constants of 3180, 318, and 75 microseconds. The amplifier was assumed noiseless with constant input resistance. The A-weighting curve used time constants of 4700, 594 (twice), and 22 microseconds. Noise voltage was computed from $V^2 = 4\,kTZ_{real}(f)$. Bandwidth. The integrated noise voltage is the square root of the sum of the values of V^2 computed at 100 discrete frequencies. No attempt was made at analytical integration.

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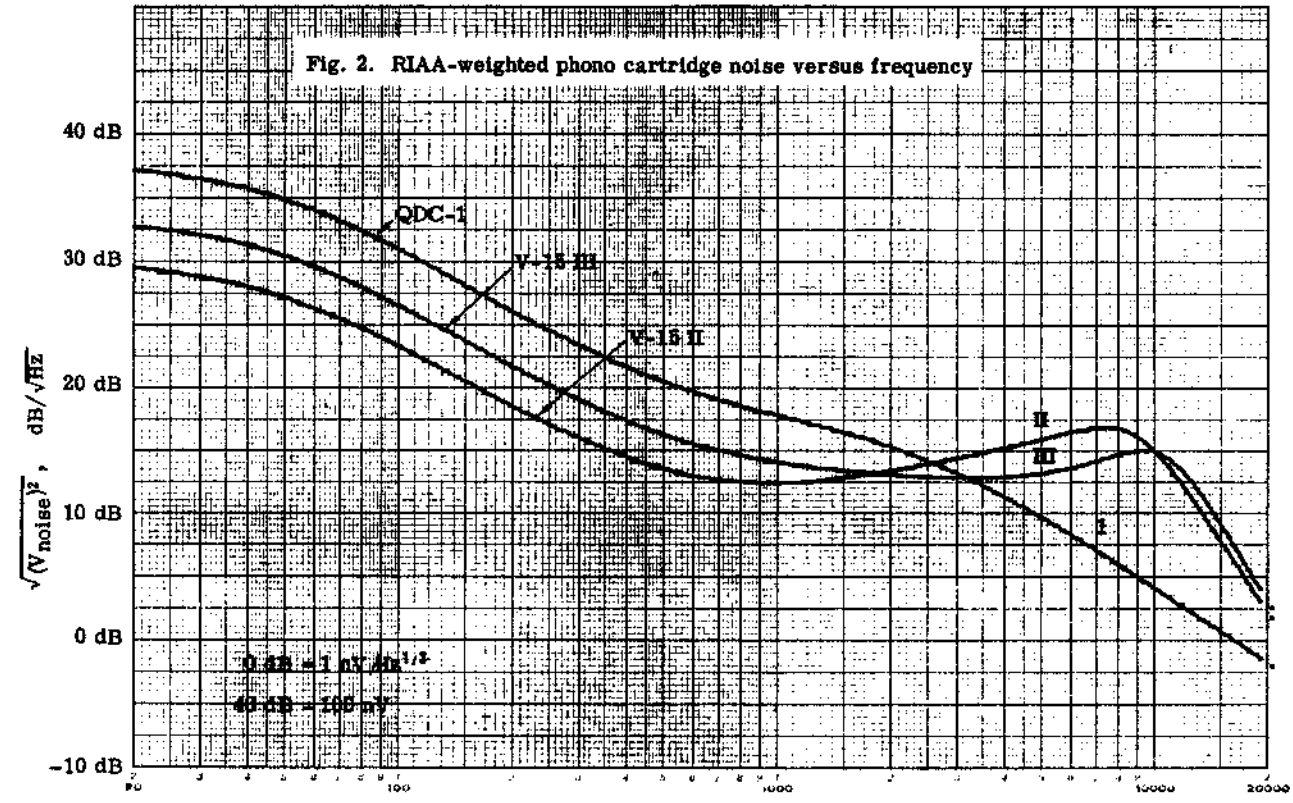

Fig. 2. RIAA-weighted phono cartridge noise versus frequency

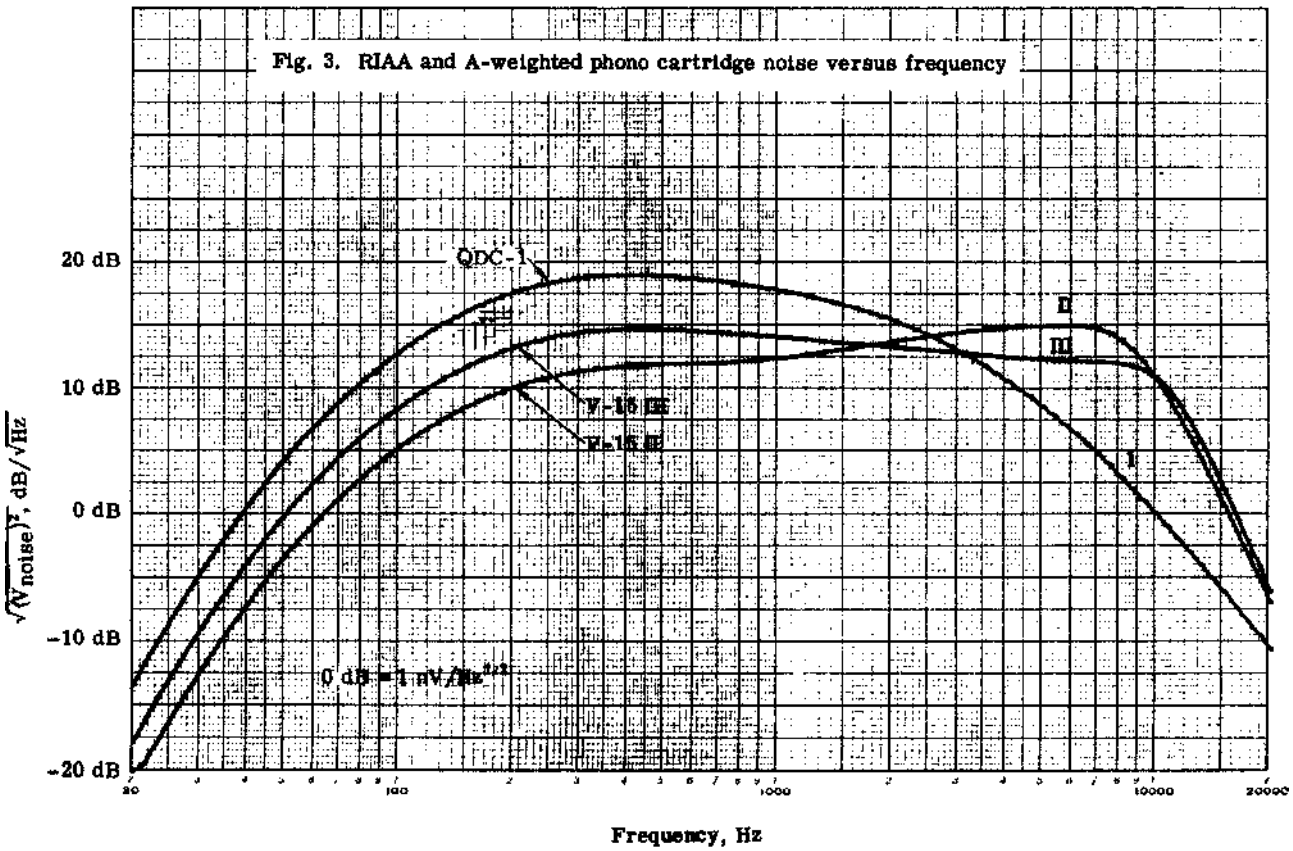

Fig. 3. RIAA and A-weighted phono cartridge noise versus frequency

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