

# THE B.A.S. SPEAKER

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## In This Issue

RENEWAL TIME--If you have not already renewed your membership for 1977-78, do so immediately. (There's an application at the back of this issue.) This is the last Speaker being distributed to 1976 77 members.

That said, welcome to Volume 6. You'll notice we've included a small insert--hopefully less controversial than the last. The Audio Amateur is repeating its \$1 BAS discount subscription offer. Ed Dell has advised us that TAA's regular rates will go up in November, making the rates in the prospectus something of a bargain.

Audio amateurs should enjoy this month's Speaker, which includes three construction articles. Our first feature article explains how you can modify the popular Sony TC-377 tape deck for better meter action, improved adjustment accessibility, and higher headphone output. The other is help for everyone with a dozen gizmos hitched to his tape monitor loop: a home rack-mounting system that will unsnarl the wires and put the books back on the bookshelves. Elsewhere, you'll learn how to banish acoustic feedback for \$30 and just a little work.

Also in this issue, Scott Kent begins his series of record reviews. Scott has produced a number of his own recordings and hopes to share in his technical introductions the knowledge he's gained. We expect to see some balloons punctured in coming months, so watch for the sequels.

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Membership dues are \$14 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.

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## For Sale

AR-107, excellent condition; Tandberg TR-2075, mint condition; Tandberg 9241XD, very low mileage. Best offers. Call 734-2727.

Rumble Filter: 18dB/octave Butterworth. -1dB at 31 Hz; -3dB at 24 Hz; -20dB at 12 Hz; -34dB at 8 Hz. \$35. 00 or best offer. Call Ken at (617) 272-7070 x161 days or (617) 645-3427 evenings.

Canadians, Audio Research D-76's, retubed and rebiased, \$775 each; Phase Linear 2000 with walnut case, \$275. Contact Tom Yankewicz, Winnipeg, Man., Canada, (204) 256-6329.

The Absolute Sound: Nos. 1-8

The Stereophile: Summer 1966 - Spring 1977 (23 issues)

The Audio Amateur: Vols. I - VII

Audio: Jan. 1969 - June 1977

BAS Speaker: September 1973 - September 1976

Popular Electronics: January 1972 - June 1977

Radio Electronics: August 1973 - June 1977

Contact Dana Craig, 67 Hill Street, Norwood, MA 02062

G. A. S. Son of Ampzilla, mint condition, \$350. Rappaport PRE-1a and PS-1, \$640. ERA MK 6/grace G-707, \$210. Luxman T-88V, mint condition, \$260. Robert M. Seaman, 50 Rosewood Dr., Newington, CT 06111, call 666-4543 or 667-2644.

Phase Linear 400, mint condition, \$325. Call (617) 661-1037 evenings or weekends.

- Linn Sondek LP12 turntable with KMAL damped unipivot tone arm. Both are in excellent condition. Call Pete Manchester evenings at (617) 899-9888, Waltham, MA.
- Marantz 7C Preamplifier, modified by Bill Winkler of Electronic Workshop; case, walnut cabinet, and original service manual. Everything like new. \$350 or best offer. Hector Gutierrez, (212) 856-6819, Brooklyn, NY
- DB Systems preamp, sacrifice, new, in box with warranty cards. Call (919) 449-4132 (days) or write P.O. Box 487, Gibsonville, NC 27249.
- AR Loudspeakers and Drivers: 1 1/2 inch Dome Midranges and 3/4 inch Ferro-fluid Soft Dome Tweeters (as used in AR-10pi). Two AR-10pi's; Audio General 511 Preamp. Call 687-6016.

## Wanted

- Pioneer QC-800A or other quad preamp in good condition. State of art CD-4 demodulator. Quiet low-power basic amp. Will pay cash or trade Pioneer QA-800A integrated quad amp, Leak Point One Preamp and Leak Stereo 50 amp, all in good cond. Pioneer has warranty card. George Androvette, (617) 482-2982 or (617) 267-3708.
- Futterman tube amp. Kindly write stating age, condition, and price you desire. John F. Koval, 11521 Cielo Place, Santa Ana, CA 92705, phone (714) 838-6555.
- McIntosh tube amps - MC2-75, MI-75, and (2) MC-350 (300 W, mono), plus brochures, schematics, spec sheets, etc. Ross Robinson, 1707-8888 Riverside Drive, Windsor, Ontario, N8SiHz, phone (519) 945-8486.

## Care and Feeding of the Speaker

### Ads

Ads are free to members for their personal use. They should not be verbose, and they should not include your name or address unless you want it printed. All ads run for one month. We do not accept commercial or non-hi-fi advertising. Type and double space, if possible, and send to the Editor through Box 7.

### Articles

The Speaker works only if you work. Contribute to the flow of information by writing down your thoughts and experiences and sending them to Box 7. We edit for style, grammar, and spelling, but try hard not to damage the content in the process. If we fail, let us know, and we will run a correction. Please type and double space, if you can; it helps us enormously. It also speeds things along if you mark items intended for the Speaker to the attention of the Editor.

### Address Changes

When you move, send notice immediately to Box 7, attention of the Corresponding Secretary. Returned Speakers cost the Society about 60 each and create unnecessary work for the Secretary. At this writing, 3% of the membership are lost. (No waggish comments, please.)

### Staff

We are always in need of people to be coordinating editors, meeting summary writers, Speaker stuffers, etc. Again, the Speaker works only if you work. Volunteer through Box '7.

### Errata

Recently we printed a list of recommended rock recordings without crediting the author, Brad McCoy of Ohio. Apologies to Brad; we hope this makes amends.

We also made a couple of errors in our June "In the Literature" coverage of International Audio Review. The subscription price is \$25, not \$15 as reported. And there is a brief but explicit disclaimer regarding the importance of slew rate in audio electronics.

### On Quad Broadcasting

The FCC has recently extended until December its period of inquiry into the matter of quad broadcasting, after which a decision will be made.

If you have not yet made your opinion known, now's your chance to influence the outcome of something really important.

Write your letter explaining which system you favor and send it off to: Mr. Vincent J. Mullins, Secretary, FCC Docket 21310. 1919 M Street NW, Washington, D. C. 20554.

Your Federal bureaucracy is listening.

-- Dick Lewis (Massachusetts)

## Tube Connoisseurs

I have noticed in the past how difficult it is to find a source of high-quality vacuum tubes at a reasonable price. Up here in Canada, it's closer to impossible. But whether up here or in the states, the search is over. I have dealt with a Mr. Jim Wallace of S. J. Wallace, 201 McMasters Drive, Monroeville, PA 15146, phone (412) 373-2602, and found not only excellent personal service but super prices -- \$1.95 each for Telefunken 12AX7's. He also handles Amperex, Siemens, Genelex and Mullard, all at tremendous savings.

-- Tom Yankewicz (Winnipeg)

## A New Hi-Fi Choice Edition

A new book, Hi-Fi Choice Turntables & Cartridges by Martin Colloms, is now available. Like previous editions of this series, this one begins with a primer - everything you always wanted to know about turntables (and perhaps a few things that you didn't). The technical introduction describes the testing procedures and listening review. Cartridges reviewed include:

### Recommended

ADC VLM Mk. II, XLM Mk. II  
AKG P7E, P8E, P8ES  
Audio Technica AT11EP, AT13Eap, AT20SLa  
B & O MMC 3000, MMC 4000  
Empire 2000E III, 2000Z  
Fidelity Research FR1 Mk. II  
Goldring G900SE  
Grace F9L  
Ortofon FF15E (Best Buy), VMS20E  
Pickering XSV3000, XV15 625E  
Sonus Blue, (Best Cartridge)  
Stanton 500 A  
Supex 900E Super  
Ultimo 20A (Dynavector)

Pickup Arms Reviewed:

### Recommended

Audio Technica AT1009  
Grace G707  
Haddock GH228  
Formula 4 PLS4D Mk. II  
SME 3009/2 & ND Improved

Integrated Turntables Reviewed:

ADC	Connoisseur
Akai	Dansk
AMstrad	Eagle
Ariston	Empire
Beogram	Garrard
BSR	Harman/Kardon

### Not Recommended

ADC QLM Mk. II  
Goldring G820  
JVC Z1  
Micro Acoustics QDC282E  
National Panasonic EPC 205C  
Ortofon MC 20  
Philips GP400 Mk. II, GP412 Mk. II  
Shure M75B II, M75ED II, M95ED II, V15 III  
Sonotone V100  
Sonus Silver P  
Stanton 681EEE, 680 EE  
Tenorel 2000 ED

### Not Recommended

Micro-Seiki MA505

ADC	Connoisseur	Hitachi	Micro-Seiki
Akai	Dansk	JVC	Philips
AMstrad	Eagle	Leak	Pickering
Ariston	Empire	Lenco	Prinzsound
Beogram	Garrard	Lux	Rotel
BSR	Harman/Kardon	Marantz	Sansui

Sanyo  
Sony  
Technics  
Thorens  
Toshiba  
Trio (Kenwood)  
Yamaha

"Separate Motor Units Reviewed:

Fons CQ30	Technics SP10 w/EPA100 arm
Linn Sondek LP12 (recommended)	Toshiba SR 370
Lux PD131	
Micro-Seiki DDX1000 (recommended)	

Best buys, recommendations, and conclusions follow about cartridges and turntables, and stop-press reports on Monitor Audio, Dual, and Strathearn units.

Coverage found missing from this review is capacitance of arm and lead wiring. The cover would not lie flat without breaking the binding.

You may obtain a copy through me for \$3.50 plus postage as follows:

Air mail, \$4.65 (delivery two weeks after order goes in)  
Surface Mail, \$1.50 (delivery four to six weeks after order goes in)

Send Check to: John M. Tooley  
RD2 Box 120E  
Milton, Delaware 19968

Future books planned are Hi-Fi Choice Amplifiers, Receivers, Music Centers, and Tuners. I shall inform BAS members as soon as they become available. Previous editions remain available and are listed in the May issue of the Speaker.

-- John M. Tooley (Delaware)

### **New Direct-to Disc Recording**

Organ virtuoso, Michael Murray, and an engineering team from Advent Recording Corporation produced two direct-to-disk recordings of the Great Organ in the Methuen Memorial Music Hall, Methuen, Massachusetts, during the period 20-24 July 1977. Scheduled for release this fall, under the Telarc Records label, will be an album of organ music by composers Benedetto Marcello, Charles Marie Widor, Louis Vierne, Sigfrid Karg-Elert and Marcel Dupre. A subsequent release will be of organ music by Cesar Franck.

The organ, now located in the Methuen Memorial Music Hall, was originally built for the Boston Music Hall. E. F. Walcker and Company of Ludwigsburg, Germany constructed the instrument during a six year period ending in 1863. Merged with a magnificent walnut case, of American design and replete with intricate carvings, the "Great Organ" was inaugurated on November 2, 1863. It was the first concert organ in the United States and served as the focus of musical life in Boston until the summer of 1884, when it was removed from the hall to allow more stage space for the then recently founded Boston Symphony Orchestra.

-- Edward J. Sampson (Massachusetts)

## Happy Cats Records and Melodiya-Columbia

For anyone who has been trying to order any Happy Cats records and has had letters returned, this information will be helpful. Their current address is as follows:

Happy Cats Records  
Route 2, Box  
Gerald, MO 63037

After having several letters bearing their old address returned, I made a telephone call and was given their new number. The individual with whom I spoke said that the third of their series had been sold out, but that they expect to release a fourth one in a few months. As far as I know (although I did not ask about them), the first two issues are still available.

This is a different subject, but I bought my first Columbia-Melodiya (or Melodiya-Columbia, as the case may be) record recently, the Shostakovich Symphony No. 14, Rostropovich conducting, and am absolutely delighted. It may well be the best sounding record I own. Having had some pretty bad Columbia records, I really wasn't expecting sonic quality of this sort. The record number, incidentally, is M34507. I hope this information will be helpful to those who are looking for really high quality recordings.

-- Edward G. Hustad (Minnesota)

## Scott Kent on Records I

From BAS members' comments both at meetings and in the Speaker, there is a gap to be filled in record reviews. It is very difficult to guess whether a record is sonically good from reviews in other publications. "A" quality sound ranges from occasionally excellent to merely average. "B" sound generally means a noisy surface or warps the reviewer's cartridge could just manage to track. "C" sound, for most BAS members, means unplayable garbage to be listened to (if even once) for musical value only.

Some audiophile publications (including the Speaker) review or otherwise comment upon the small selection of specialty records for the audio purist -- Fulton, Sheffield, Telarc etc. These records are sonically excellent and occasionally even superb, but often the musical qualities have been sacrificed, and the repertoire is seriously limited.

There are many (compared to the relatively few records specifically offered to the audio purist) sonically excellent records in the Schwann catalog and more available as imports. Even RCA has produced a few in the several thousands of different releases over the years. What I propose is to review each month five to six selected records that are sonically excellent and musically interesting. Most will be classical or jazz.

There will be a number beside each listing indicating the average lateral peak cutting level on the disc normalized to 2 kHz. If the peak level is less than 5 cm/sec., surface noise and dust can be a problem unless the pressing is exceptionally quiet and clean. Peak levels in excess of 15 cm/sec. generally indicate overcutting and gross distortion, and such a record would probably not be mentioned. However, there are exceptions, and these may be sonic spectacles and, at the least, provide a quality check for both trackability and system dynamic range. Generally, one would expect a good orchestral record to have average peak levels of at least 10 cm/sec.

Orchestral music has a dynamic range that requires this level in loud passages so that quiet passages and ambience are not lost in surface noise. On the other hand, a harpsichord recording having a small dynamic range and continuous peak information in the high frequency region might have an average peak level of 5 cm/sec. With such a level, the noise would be thoroughly hidden, but with a 10 cm/sec. cutting level, the sound could become hard, indicating not necessarily cutting distortion, but the critical velocity limit of the playback stylus. Occasionally a second, higher number will appear after the first, indicating a higher peak level that occurs in only a few places on the disc.

H AYDN: U Ritorno di Tobia (oratorio), Budapest Madrigal Chorus, Hungarian State Opera Orchestra, Ferenc Szekeres, cond. (4 records) Hungaroton LPX 11660-3 (AVPL - 12 cm/sec).

The only available recording of one of Haydn's lesser known works, this performance should please those who enjoy this form of choral music. A fine recording for spacious ambience and good dynamic range, with sufficient out-of-phase information for those having rear channel delay systems. Imaging is so accurate that I suspect the primary microphone pair were coincident figure-8's. Individual voices in the chorus are audible, rather than being blurred in a monotonal mush. Ferenc Szekeres' tempi are moderately brisk, similar to Dorati's conducting of the Haydn symphonies. This set, and most Hungaroton records, are consistently quiet; the cutting, stamper quality, and pressing are on par with DG.

The Renaissance Clavichord (collection of short works), Bernard Brauchli, Titanic TI-10 (AVPL - 12 cm/sec).

This is the most accurate clavichord recording I've heard -- very good ambience, balance, well defined sound and transients. This should be played at a low volume level for a realistic effect, but it's quite pleasant and clean when turned up to levels larger than life; many clavichord (or harpsichord) recordings aren't. This is a good tracking test, as it's cut at a fairly high level (perhaps unnecessarily) but not overcut. The performance and technique of Bernard Brauchli are superb.

SAINT-SAENS, Trio, Op. 18, and Quartet, Op. 41, piano trio and piano quartet, Groupe Instrumental de Paris. EMI/Pathe C065-12075 (AVPL - 10, 15 cm/sec).

Spectacular sound and spectacular, relaxed musicianship - not stiff or frantic as are many ensembles on domestic pressings. Strings are clear but not shrill; the European piano is crisp without being hard. Transients are impressive, and the fortissimos are really fortissimo, not strained sounding bits of music that have been electrically limited to forte. These two works are excellent music, on a par with Saint-Saens' concerto writing. One wonders why no U. S. company has recorded them. EMI/Pathe technical quality seems roughly equal to that of English EMI.

VERDI, Overtures, Berlin Philharmonic, Herbert von Karajan (2 records). DG 2707-090 (AVPL-12, 20 cm/sec).

This is a strange pair of records. Musically, for overtures, there is far too much dynamic range. Otherwise, it's a straightforward interpretation with accurate musicianship. If your listening room noise floor is 40 dB SPL, you'll have 60 dB of dynamic range if your system doesn't limit. DG generally has better than average sonic effects and cutting, and this is one of the better DG's (better than Berlioz, "Romeo et Juliette," 2707-089, by a bit). The percussion is impressive, the strings are too close and hard sounding, and the ambience sounds artificial, although not quite as fake as on many Berlin Philharmonic recordings. Overall, it's a good demo record with very quiet surfaces, low distortion, and the potential to elicit unexpected 100 dB SPL blasts from your playback system.

SCHUBERT, Sonata, Op. 162, Sonatina, Op. 137, No. 6; SMETANA, "From the Home Country", Duo for Violin and Piano, Josef Suk, Jan Panenka. Suprathon 50464 (AVPL - 6 cm/sec).

Despite the modest "6", this is an excellent record. First off, the musicianship and the music are gorgeous, partly because of the performers involved, who are seasoned masters with this material. The cutting levels are conservative and the sound is clean, in part because vertical information has been controlled with an ORTF-like microphone placement (many Suprathons appear to have been recorded with two omni's and are thus overcut in the vertical). The violin sound is particularly excellent - very defined, not distant, yet not hard or shrill. Surface noise is often a problem with Suprathon, but this record is better than most. Recorded sound, musicianship, and repertoire are strong points of Suprathon. I have yet to find a recording without a realistic image or pleasant ambience. Their problems, when they occur, appear to be related to cutting and stampers, rather than to the pressings, which are of high quality.

HAYDN, Five Divertimenti for Harpsichord and Strings, Janos Sebestyen, harpsichord, Vilmos Tatrai, Gyorgy Konrad, Ede Banda, strings. Hungaroton 11468 (AVPL - 5 cm/sec).

Clean sound, very quiet pressing, lovely ambience, and a very musical performance of these Haydn works, which have no listing in Schwann. The harpsichord is a bit thin sounding compared to a Dowd instrument, but miking is such that it's always clear. If you have only a few records of Baroque music, you should have this one as well; it's one of the best. If you have lots of Baroque, there's no way out: it's a first recording.

-- Scott Kent (Massachusetts)

### **Phono Input Test Criteria Questioned**

I was pleased and enlightened by A1 Foster and Wally Swanbon's recent article "A Comparison of Eight Low-Priced Receivers", I say this because I have some disagreements to make, and I want it to be clear that while I make them, I am generally very much in agreement with the article and recognize the difficulty of being critical of products made by friends and neighbors.

On page 2 of the article, under heading 6, Foster and Swanbon state that an "ideal preamp would have an input resistance of 47k Ohms . . . , because most cartridges are designed to operate most effectively into this load." They continue with a properly equivocal discussion of capacitance and its effects, which I will more directly address later.

My major disagreement with their comments stems from their assumption that what manufacturers cite as the nominal load (e. g. , 47k Ohms, 400 pF) is actually the correct or proper load. This assumption is directly contrary to my own experience. Let me give an example: the AKG P8E's recommended load of 47k Ohms, 470 pF. British reviewers have found something like 25k Ohms, 200 pF preferable. When I set-up my P8E, I found the optimum load to be described by two networks in parallel as follows: 27k Ohms in parallel with 200 pF, in parallel with a network of 22k Ohms, in series with 1100 pF.

The optimal network is a long way in terms of model from 47k Ohms in parallel with anything. And the AKG is by no means unique in this respect. Also, the optimal loading seems to vary from stylus assembly to stylus assembly, as one might expect, given the nature of this kind of device. I have fitted two Shure M95 cartridges that were flatter into 70k Ohms than into 47. I therefore argue that the nominal load impedance of a cartridge is just that nominal. 47k Ohms is not a bad resistance to use, and if you do, the specified capacitance is probably the best. It does not say much about what any given cartridge will sound like when used with a phono preamp that has that characteristic.



With respect to complex impedance, those preamps (both with tubes) I have found with complex input impedances exhibit an additional resistance in series with the input capacitance, e.g., 47k Ohms in parallel with 150 pF in series with 10k Ohms.

If you add the usual 150 to 200 pF cable and arm capacitance, the 10k resistor is no longer very important. I know some transistor designs exhibit nastier impedances, which include diode effects, and these may be very important. The only way to know which you have and how important it is to test for it with something more sophisticated than the simple nulling device Foster and Swanbon use.

Given all of this, it would seem that if there is a "best" input impedance, it is infinity. It is certain that under present circumstances the only way to get flat response from a cartridge-cable-preamp combination is to set it up, test it, and determine its proper loading, preferably with the insertion of a test jig and networks. I will happily offer this service to BAS members, though at a fee.

I should add that I have found that many of the differences between phono cartridges disappear once they have been properly loaded. Not all, however, and the ones that remain may be very much of interest. I use an Ortofon SL-15 and an AKG P8E. The latter is optimally loaded, while the former, because of its very low impedance (600 pF drops response 2 dB at 10 kHz), is better used with active equalization. These two are virtually identical, even though the driving principles are entirely different.

To summarize, the notion of a standard or ideal input impedance is problematical, indeed. The frequency response of any given combination can be properly ascertained only by testing, and the optimal loading, best achieved through a separate network, may differ considerably from the nominal. Finally, the idea of a phono preamp that exhibits "no phono interaction", as expressed by one local "expert" who called Shop Talk a few weeks ago, is absurd. [Depending on what's meant. It is, at least, possible to prevent a cartridge from disturbing a preamp's RIAA equalization simply by putting a flat buffer amp at the input. That, of course, is just what usually happens when a moving-coil pickup is used. -- Ed.]

I think your assumptions on this matter have led you into errors. It does not make much sense to place the Panasonic 5060 in the class of "untouchables" because its preamp does not null until you know why. As far as getting full power into LST's is concerned, it is something to note, but it is not clear what it means to the rest of us who do not have that problem. In fact, the list price makes the Panasonic look like a pretty good buy.

The downgrading of the Toshiba because of its "failure" in a "crucial design feature--phono resistance", is simply a mistake. You report its input resistance at 60k Ohms instead of 47k, which could be achieved with the addition of a resistor of around 200k. Because cartridges are inductive, this is a matter related only to high frequencies. Again, the AKG has inductance of 860 Ohms in series with 280 mH. At 1 kHz, this amounts to something under 2k Ohms, so an effective change of 200k Ohms is insignificant. At high frequencies, it might play some role by changing frequency and Q of the resonant network formed by the cartridge, leads, and preamp, the net effect of which is hard to determine, other than to say that high frequency response will be dominated by the preamp and cable capacitance. If this level of error concerns you, I suggest that you try inserting the parallel 200k Ohm resistor to hear the difference. I think you will find it subtle and basically unimportant.

I am very concerned by an asterisked footnote on page 10 relating to the rating of: "sound quality." It states: "These units were not tested subjectively because they measured poorly on one or more objective tests." What we seem to have here is the self-fulfilling prophecy, reminiscent of the early reviews of the Advent 300, which compared it with more expensive equipment and found that it did not sound that different. If they had also tested other receivers, they might have found that they, too, did not sound that different. They might even have discovered that fifteen Watts really does sound about like fifteen Watts.

The same applies here. If you do not rigorously determine what you are listening to, your results are invalid. I would suggest comparing preamps by driving them with a low impedance source, perhaps an Ortofon SL-15 with transformer, which gives close to identical frequency response in any preamp I have used it with. At least it saves the difficulty of matching each preamp and each cartridge together, and other tests, especially for nonlinear load, can give a good idea of where to look for trouble. This is not a good method, but it seems better than the one Foster and Swanbon have employed.

Finally, it seems to me that the concern for this aspect of performance, though valid, focuses on a problem that is minor in the face of the kinds of compromises characteristic of recordings, what with the empirical problems of microphone frequency response, pattern, and placement, frequency response, and distortion in mixers, recorders, and everywhere else. This whole set of tests arose from a dissatisfaction with traditional methods of testing, because they did not seem (perhaps it is just that) to be relevant in that they overspecified certain areas. Is history, perhaps, repeating itself?

-- Peter K. Storkerson (Massachusetts)

Thank you for acknowledging our article. To our knowledge, it is the largest U. S. review of receivers priced below \$300.

However, I must take issue with several points you have raised. Exclusive of makers of CD-4 and moving-coil cartridges, I know of none who specify a load other than 47k Ohms. This has been the industry standard for more than twenty years. Any preamp or cartridge manufacturer failing to follow the standard should so state. Your argument that optimal cartridge loading is often not 47k Ohms does not nullify the industry standard: two wrongs do not make a right. I agree that there is nothing magic about the resistance standard, but you may be overlooking that some manufacturers may design their cartridges for non-flat playback response.

With respect to complex impedance and the ability of the bridge to be fooled, I tested your combination: 150 pF in series with 10k Ohms, all in parallel with 47k Ohms. Contrary to your assumption, the combination measures a perfect null, i.e., no interaction. (It measures 47k Ohms and 150 pF.) In fact, calculations demonstrate that the capacitor would have to be 2000 pF or the resistor 150k Ohms to obtain a resonance frequency in the audible range of approximately 8 kHz.

The latter topology would also measure a poor null with the bridge; it is also out of the bridge's range and hopefully the mind of any preamp designer. We have obtained perfect nulls with several preamps that have resistances in series with capacitors.

You object to our downgrading of the Technics because it "merely" has a poor null and can't drive the LST-2 successfully. You also feel the Toshiba belongs in the "best buy" category. The Technics 5060 was the lowest price unit tested (\$170), but unlike Consumer Reports, we do not give points for being cheap. I agree it would have been great if we had taken the time to examine

why the unit measured a poor phono input null and why it could not drive the LST-2 loudspeaker. We arbitrarily structured the test to reveal units audiophiles would be most happy with, units that represent no compromise in sound quality.

As you point out, the Toshiba SA-420 has a non-standard input resistance, but you overlook the fact that its frequency response is down 2 dB at 30 Hz, which is audible. Otherwise, it is a good receiver, but not the equal of the Harman/Kardon 330c or the Pioneer SX-550.

We suggest in the review of the Toshiba, quoting the Shure V15-III literature, that a phono input resistance of 70k Ohms may be audibly indistinguishable from the 47k Ohm standard.

To test this hypothesis, I decided to run some tests with varying input resistances.

I first plotted the frequency response of an Ortofon VMS 20E driving a non-interactive FET buffer properly terminated with 47k Ohms. (I used the CBS STR 100 test record and Decca tone arm throughout the series of tests.) I then made a second frequency response check with the buffer terminated with 62k Ohms. (I used the VMS 20E for the test because it has a high inductance of 600 mH, which renders its playback response sensitive to loading.) The capacitance between the two test situations did not vary by more than 10 pF. I repeated the tests several times. The results shown below represent the average response.

Frequency (kHz)	47k Ohm Termination, dB	62k Ohm Termination, dB
20	0	0
18	0	0
16	0	-.2
14	0	-.1
12	0	0
10	0	0
8	0	0
6	0	0
5	0	0
4	0	-.1
3	0	0
2	0	0
1.5	0	0
1	0	0

As the results indicate, there were no significant differences; the minor differences are probably measurement errors, which are impossible to eliminate completely.

The second test was to measure the response into a preamp with a reactive phono input, the Citation 17, and compare the results with those obtained using a non-interactive load, the FET buffer.

To minimize frequency response errors, the output of the buffer fed the phono input of the Citation 17. (The low Impedance output of the buffer is insensitive to the reactive input of the Citation.) The results are as follows:

Frequency (kHz)	Non-Interactive Buffer, dB	Citation 17, dB
20	0	-.3
18	0	0
16	0	+.5
14	0	+.5
12	0	+.5
10	0	+.9
8	0	+.7
6	0	+.6
5	0	+.4
4	0	+.4
3	0	0
2	0	0
1.5	0	0
1	0	0

Because the differences between the two measurements are greater than .5 dB and are consistent over a wide range the conclusion is obvious: the Citation 17, which measures a poor phono null, will significantly (audibly) deviate from flat frequency response when driven by a high-inductance cartridge, e.g., the Ortofon VMS 20E. (The Harmon/Kardon factory representative has advised me that they have eliminated the problem in Citation 17's with serial numbers higher than 250-0169.)

In summary, resistances up to at least 62k Ohms will not audibly affect the sound of a typical high-inductance magnetic cartridge such as the Shure V15-III. But preamps that measure a poor null on the Davis impedance bridge will most likely alter the playback quality of some cartridges.

You suggest that we should have auditioned all the units, regardless of whether they passed the objective tests, but in most cases, the RIAA playback response was off to such an extent that we were unable to match the units to within .3 dB.

-- Alvin Foster (Massachusetts)

### The Holman Test Clarified

A1 Foster's statement in the July issue of the Speaker that "the Holman cartridge-interaction test does not yield consistent results (I found variations of 2 dB, when the same unit was tested at two different times, were quite common)" is wrong. His statement is obviously based on a test wherein the system response of the cartridge, cable, and preamplifier is measured by means of a test record. This test, though measuring the same interaction that the Holman test does, is not the Holman test. My test, as described in the May 1976 issue of the Journal of the Audio Engineering Society, is purely electrical and is therefore not subject to the kind of variations that A1 found. The element creating the difference over time and temperature is the complex system of the groove wall and cartridge mechanical interaction. The electrical parts of the system are much more stable, which is why I opted for a purely electrical test.

With regard to the various tests one can apply to phonograph preamplifier input impedance, the Holman test is most useful in determining the direction and amount of error vs. frequency for a particular system, and the input impedance test is most useful for hanging a set of numbers on the input to characterize the input impedance quantitatively. The drawback of the Holman test is

that it does not produce a single set of numbers; the drawbacks of the input impedance measurement are that it is most useful only when a certain assumption is made (that the unit under test produces a good null) and that it doesn't produce an error curve for a specific system. Both are completely repeatable, and anyone with a well equipped audio laboratory can make the measurements. Al Foster's test with a record as a source is a spin-off that is useful in some situations, but is subject to the variability he mentions.

-- Tomlinson Holman (Massachusetts)

### Of Receivers and Tone Arms and Bookshelves

First of all, as a new member, let me say that I find the Speaker to be a rare combination of the fascinating and the useful. Being a student, and therefore poor, I was especially interested in Al Foster's and Wally Swanbon's receiver tests. There are a couple of points in that article that are not quite clear to me. First, when they were checking the subjective quality of the preamp sections, did they use the preamps to drive a separate amplifier. [Yes - Ed.] Second, as amplifiers also differ in sound quality, I was wondering if they found any significant differences, either between the various receivers, or in comparison with a "super-amp" such as Ampzilla, Dynaco 400, etc. [We compared the amplifier sections of the "best buys" with that of the Marantz 2275 and found no significant differences. - Al Foster]

Incidentally, are there any BAS members who are checking out amplifier tests the way Al Foster has been looking into preamp tests? Finally, a couple of items that might be of interest. I noticed that one of the older Speaker issues had comments about tone-arm capacitances. The Stereophile, in issues Autumn (3) 1968, Winter (4) 1968 and Spring (1) 1971 reprinted a June 1969 article from Hi-Fi Sound, which tested twelve tone arms. The results are:

Arm	Effective Mass	Capacitance
ADC 40	11 gm.	300 pF
Audio & Design (KMAL) M9BA	<10 gm.	150 pF (3' cable)
Audio Technica AT-1007	12 gm.	150 pF (4'9" cable)
Connoisseur 5AU2	12 gm.	200 pF (2'7" cable)
Decca International	18 gm.	300 pF (2'9" cable)
GH Unipoise Mk. III	14 gm.	400 pF
Goldring-Lenco L-75	23 gm.	120 pF (8" cable)
Neat G-30	17 gm.	500 pF (4'9" cable)
Ortofon RS-212	17 gm.	140 pF (4'9" cable)
SME 3009-II	10 gm.	130 pF (3'10" cable)
Sony PUA-237	28 gm.	130 pF (4'9" cable)
Thorens TP-13	12 gm.	300 pF (4' cable)

Of course, newer models of these arms may have different values.

Also, people are always talking about how heavy bookshelf speakers (AR-3, etc.) need special strong, heavy duty shelves. Well, I thought so too, but after all these years of lugging heavy textbooks around, I began to wonder. Books are pretty heavy, too. So I hauled out a cheap, inaccurate (+10%) bathroom scale. Would you believe that two-feet worth of High Fidelity and Stereo Review weigh 55 pounds? Those bookshelves are a lot sturdier than you think. I think any bookshelf large enough to hold a speaker is likely to be strong enough. If you're not sure, just stack a bunch of hi-fi magazines on it and see if anything gives.

-- James Lin (Minnesota)

## Arm Damping: More Support and a Caveat

Once again the advantages of viscous pickup-arm damping are questioned by one of our members (D. Shreve, B. A. S. Speaker, October 1976, pp. 5-7), using the same arguments and raising the same objections as did J. Rabinow (BAS Speaker, April 1976, pp. 18-19). Their objection is that, because the damping applies forces to the arm that oppose each movement the arm makes, and because these forces are transmitted via the cartridge to the stylus, they will produce stylus deflections and consequently an output signal, which is undesirable. The implication is that, in the absence of arm damping, this does not occur. This is not true, and no conclusions, can be drawn from such an oversimplified analysis as the above. As our editor notes in his comments on Shreve's letter (op. cit., p. 6), the situation must be compared, not with the (non-existent and non-achievable) "ideal" case of no arm damping and no record warps, but with the actual alternative an undamped arm tracking (?) a warped record. The incomplete reasoning of Rabinow, Shreve (and many others) leads to conclusions that can be proved incorrect. This I have attempted to show in a paper entitled "'Impulse response of the Pickup Arm-Cartridge System", which I have submitted to the Journal of the Audio Engineering Society.

The overlooked fact is that an undamped arm and a modern, high-compliance cartridge form a system whose total damping is so light that record warps can excite its natural resonance and cause considerable overshoot and ringing. The overshoot can exceed the warp in amplitude if the excitation frequency is suitable. By adding damping to the arm, this can be controlled and the performance in the audio band improved as well. A full analysis shows that the arm-cartridge system should be critically damped with at least half the damping applied to the arm and the remainder to the stylus assembly. This provides far better overall performance than that obtained by leaving the arm undamped. It might be thought that it would be equally effective to apply more damping to the stylus, but this is not so. Increasing the stylus damping can be shown to degrade the performance of the system in the audio band. Moreover, as BAS members have themselves discovered, arm damping improves image stability and integrity (assuming a proper recording, but that is another matter).

The gist of these conclusions is not new or unexpected. Amongst others, W. S. Bachman (Proc. I. R. E., 40, pp. 133-137), F. V. Hunt (J. Audio Eng. Soc., 10, 1962, pp. 274-288), B. B. Bauer (J. Audio Eng. Soc., 11, 1963, pp. 207-211), J. M. Kates (J. Audio Eng. Soc., 24, 1976, pp. 258-262), and last, but not least, our own Leigh Phoenix [B.A. S. Speaker, January 1975, pp. a1-a6) have analyzed various aspects of the problem. I believe, however, that my treatment is the first to consider the dynamic rather than the steady-state behaviour of the system.

Those of us who have experimented with arm damping can attest to the fact that correct damping can eliminate almost all visible warp-induced stylus cantilever deflections. This, of course, reduces the corresponding infrasonic output signal, stabilizes the stereo image, and provides more secure tracking because of reduced tracking force variations. The same arm-cartridge combination without additional damping can produce visible cantilever wobble as well as invisible ringing of gross proportions. I have once before referred members to the oscillograms and measurements of these phenomena made by Roderick Snell and published by Hi-Fi News and Record Review (September 1975, pp. 59-64). They indisputably confirm everything we have been saying and constitute the only such available evidence of which I am aware. Perhaps we can obtain permission to reproduce this article in The B. A. S. Speaker. More than any number of words of mine, it should settle this controversy.

Finally, one caveat. Too much damping (especially on systems with too low a resonance frequency) can be detrimental. It is most effective if the system's fundamental resonance correctly occurs around 10 Hz and is not a palliative for massive arms used with highly compliant cartridges. Here the performance could be significantly degraded. I have not, however, seen a case of overdamping of systems whose resonance frequency is high enough. It is only in the extreme case of such overdamping of improperly matched systems that Rabinow's and Shreve's comments become relevant. Cantilever deflection is a direct measure of the effectiveness or otherwise of the damping. The less the amount of visible deflection on sharp "pinchwarps" the better.

-- S. P. Lipshitz (Ontario)

### **The Shock Platform: An Easy Solution to Acoustic Feedback**

The problem of acoustic feedback is far more generalized than most audiophiles recognize. If the system does not actually "howl" when the gain is cranked up, many are confident that all is right with the world. If only it were so. When even the subtlest amounts of acoustic feedback are eliminated, the sonic results are startling.

Solutions to this problem have ranged from sheer mass (in the form of brick platforms) to elaborate construction projects using springs or Barry mounts. Here is a project, courtesy of Mel Schilling and Craig Goff of Music and Sound of California, that is incredibly effective sonically, attractive, and easy to build.

A stonemason will provide the 16" x 20" x 3/4" slate slab required for the top. For the few additional dollars, have the edges and face honed. The results are worth it. Ours cost \$30 for the stone and polishing.

It may be difficult to resist splurging on a piece of sexy marble, but as my wife (who shopped for the parts for this project) can testify, marble resonates more than slate. In fact, it actually rings. The greater the marbling, the more the ringing. The dull thud of slate is definitely the way to go. Our piece weighed a hefty 28 pounds.

Your local sporting goods dealer will supply you with six black racquetballs. Use only the black balls, as the blue and green types are not as highly pressurized, their walls not as thick (for support). We used Seamco #558. A stop at the hardware store for six plastic caster cups, and you are done. These are the cups that fit under furniture legs to prevent carpet wear. Get the 1-3/4" size. We liked the clear plastic.

Now, with an X-acto knife, make five evenly spaced, bladewidth slashes across and at right angles to the center seam of each racquetball. Drop a vented ball into each caster cup so that the seam is parallel to the tabletop (and the slashes running perpendicular). Place the slate slab on top of your new shock absorbers. With your turntable atop the slate, adjust each racquetball/caster cup so that the weight is evenly distributed. You may find that you have to experiment a bit for very light turntables and remove a ball/caster or two, or add an additional one for very heavy tables.

What will you hear? If your system is like ours, with "no feedback problem", you should hear greater clarity throughout the entire frequency range. Triangles have a purer ring; a subtle raspiness that affected all instruments is now gone. Bass tightens up remarkably and subjectively goes deeper. Break-up that sounded like mistracking or power amp clipping has disappeared.

We must emphasize that we heard all of these effects on a system previously considered immune to feedback, or at most, subject to minimal amounts. Needless to say, we now consider the shock platform to be as necessary for the full realization of a system's capabilities as proper speaker placement or phono cartridge alignment.

-- Robert & Beverly Wolov (Pennsylvania)

### **Footnote on dbx**

In Roger Sanders' review of the dbx companders (June Speaker, pp. 6-7), he claims that the unit "effectively doubles the frequency response errors of your recorder." This is true for single test tones, but not, fortunately, for music.

Unlike Dolby, the dbx is not frequency-selective: it works over the entire audio band. If a frequency response deviation causes a decode error, this error will be expressed as a change in dynamics of the entire frequency range, not just the range in which the error occurs. Because Dolby-B affects only the high frequencies, decode errors cause level changes in this band alone, which are heard as frequency response errors. This cannot happen with the dbx unless you are recording a solo instrument with most of its energy in the region of the recorder's response deviation, which is highly unlikely.

Clearly, there is little point in using a super noise-reduction system unless your machine is in good adjustment, but you needn't have perfectly flat record-playback response to get full benefit from the dbx. Additionally, the 120-series units have a 50 Hz to 10 kHz bandpass filter in their level-sensing circuits to reduce the effect of deviations outside that band.

Mr. Sanders wonders how the dbx can work over the whole band without breathing. The 12 dB of treble boost it adds certainly helps, by reducing the noise of the tape recorder to a point where the breathing is inaudible. Tapes and heads have improved to a point where all this boost causes no problems.

I concur with Mr. Sanders' conclusions. What the dbx can do for a cassette recorder is incredible, and I would never make an open-reel recording without it.

-- William Sommerwerck (Maryland)

I passed Mr. Sommerwerck's comments to Rene Jaeger, chief engineer at dbx. He agrees with Mr. Sommerwerck except as regards the 12 dB treble boost. A preemphasis network in the level-sensing circuits makes compression and expansion a function of frequency as well as of amplitude, which compensates for the treble boost by, in effect, reducing it as the amount of high-frequency energy in the program goes up. That is, a 2 dB level increase at high frequencies increases compression (in an absolute sense) more than a 2 dB level increase at low frequencies. - MR

### **Our Man in Zurich Reports on Revox**

At the upcoming FERA show in Zurich and at the Berlin Funkawsettlung, Studer-Revox will be showing their new Revox B-series, some details of which are set forth in the cover article in this month's issue of Radio-TV-Electronic. Because this information may not have been released yet in the U.S., I'll summarize the article.



(The Revox A-series is still to be made available, and I would not be surprised if these components are somewhat reduced in price; there would seem, in my view, to be room for such a price reduction). The B-series consists of:

B790 turntable: direct-drive, quartz-referenced motor, digital rpm indicator,  $\pm 7\%$  variable speed; radial, servo-regulated tone arm with infra-red LED sensing system, which adjusts continuously for minimal errors in tangency; pushbutton controls with logic circuits to prevent record or stylus damage; effective tone-arm length 40 mm, nearly symmetrically formed.

B760 tuner: fifteen pre-select pushbuttons; 50 kHz raster for station selection, plus 25 kHz selectable offset, quartz-referenced for all 840 tunable frequencies; five-position LED numerical tuning display; center-channel and signal-strength meters (strength meter said to indicate from a few  $\mu\text{V}$  to over 100 mV); separate muting threshold controls for stereo and mono; provision for installation of Dolby circuitry; switchable 75-50-25  $\mu\text{s}$  de-emphasis, PLL; fancy front-end hardware that I can't translate.

B750 integrated amplifier: 2x75 W DIN, "2x100 W music power," separable preamp out and power amp in; inputs and outputs for two tape recorders; two phono inputs (one is switchable - 25/50/100k Ohms), separate tape copy switching; -20 dB mute switch; click-stop bass, presence, and treble controls; tone control cancel switch; all inputs with "active circuitry," e.g., tape copying takes place through a buffer stage, apparently; TIM-free power amp; relay speaker switching; output protection logic circuitry of undefined nature, but also through these relays, evidently.

B77 tape recorder: LSI logic circuitry; motion sensing; pause button that can be engaged in any mode; built-in splicing block with cutter; more room beneath the head block for marking tape during editing; Triac-controlled reel motors; infrared LED sensing of tape runout or breakage; LEDs in the VU meters for indication of +6 dB peaks; two headphone outputs; fixed-level line outputs; muting circuit for on/off switching/ sockets for remote control and variable speed.

BX 230, BX350, BX 4100 loudspeakers with phase compensation between drivers.

B730 preamp listed in an ad in the same issue but not depicted or described.

Revox is also selling a cassette machine with memory index for use with slide shows, but does not sell it as a hi-fi item.

With regard to my earlier remark, which is my own opinion only, A-77s cost about \$600 over here in Europe at retail, with the usual 15-20% discounts below list price. By comparison, a Sony EL-5 elcaset deck costs about \$750-800 here. When the new transatlantic fares go into effect, it will become worthwhile for Americans to fly to Europe to buy Revoxes (it already is with Nagra), unless Studer/Revox America lowers their markup, which they will be in a better position to do when they have both the A77 and B77 for sale, I think.

Incidentally, when I toured the Studer/Revox facility last March, they specifically denied there would be a major revision of the A700 machine, which costs around \$1200 here and about \$2000 in the U. S.

-- David Satz (Massachusetts)

## **In the Literature**

### Audio, October 1977

- \*Behind the Scenes: Bert Whyte continues his survey of some of the most interesting components heard at the June CES show (p. 30).
- \*Annual Equipment Directory: This year's collection of specifications includes over 2100 listings (p. 42).

### Audio Forum, Vol. 1, No. 1, April/May 1977

Editor J. A. Bertoglio states that there will never be a typical review of an audio component in this new bi-monthly. There seems to be a great emphasis on the technical (as well as the performance) aspect of records. Regarding classical records, the Penguin Stereo Record Guide, Gramophone, and Hi-Fi News & Record Review have been heavily used. (This is not surprising, as several of the people who submitted lists of "high quality" discs are BAS members.) Articles (most of them based on taped interviews) on arm/cartridge compatibility, tube designs for preamps and amps, the the Iverson Force-Field Speaker System. The letters-to-the-editor section will be prominent. The Audio Critic receives a generally favorable review in the first installment of "Reviewing the Reviewers."

### Audio Forum, Vol. 1, No. 2, June/July 1977

Coverage of the CES show, letters, ads, and John Puccio's "Modest Proposal."

### Audiogram, Vol. 1, No. 8

A front-page editorial singles out settling time as a possible cause of audible differences between amps. Letters follow, along with reviews of the Zeligman PAS-3x mod (better than the ARC SP-3A-1, as good as the DB), the AKG P8ES cartridge (among the best), the Audio Research Dual 100 power amp (excellent), the Ace Audio 35x2 power amp (good), the Leach LNF-1 power amp (excellent), the Spendor BC3 loudspeaker ("one of the world's best"), the Linn Sondek LP-12 (best sounding turntable), the B&W DM6 loudspeaker (excellent, with some reservations), the Naim NAP 160 power amp (flawless), the KLH 9 (a classic), and the Dayton-Wright XG8 Mk. III Series II loudspeaker ("an engineering exercise").

### Audiogram, Vol. 1, No. 9

More on new criteria for amplifier performance. Reviews of the Micro/Acoustics 2002e cartridge (excellent), the Advent 300 receiver (excellent), double LS3/5A's (excellent), the Supex SD-900 cartridge (excellent, with reservations), the Gale 401C loudspeaker (excellent), the Supex AL-2 tone arm lift (excellent), the J. H. Formula 4 tone arm (excellent), the Spendor SA-1 loudspeaker (excellent value), the Fons CQ-30 turntable (very good), and the Fidelix LN-1 pre-preamp (excellent). Also included are short features on new products, records, antiskating adjustment, and turntable mats.

### Gramophone (England), August 1977

- \*Report from America: Harry Maynard's review of innovations seen at the June CES (p. 361).
- \*Equipment Reviews: Favorable comments on the AKG P8ES and P6R pickups, Philips N2521 cassette deck, and the "Miraculous" SAE 5000 impulse noise suppressor (p. 366).

### Hi-Fi News and Record Review (England), August 1977

- \*News: Includes a report that the development of the B&W DM7 involved a computer analysis showing that a dome tweeter on a flat baffle board sets up standing wave patterns on the surface, resulting in blurred imaging because of the secondary radiation. If this is so, could it be that the absorbing foam on the fronts of the Cizek speakers contributes to their superior imaging (p. 25)?
- \*Stateside Super Sonics: Angus McKenzie reports his impressions of advanced components heard at the June CES (p. 29).

- \*Letters: A missive from Mike Riggs about The B. A. S. Speaker and a report on the subjective improvements made by lining a turntable with resonance-absorbing plasticine and using TV coax in place of audio cables (p. 31).
- \*FM Radio: McKenzie contrasts the dismal quality of much American FM with the fine work done at WFMT in Chicago (p. 33).
- \*Can We Hear Connecting Wires?: Jean Hiraga's earlier discussions of "musicality" were illogical and implausible. This one is incredible -- but fascinating, if there is anything to it. The idea is that the inductance and capacitance of ordinary speaker wires, which have measurable effects in the megahertz range, make an audible difference, and that special multi-strand cables are better (p. 35).
- \*Interface: Turntables/Arms/Cartridges: An efficient survey of the various resonance, feedback, and compatibility problems that deserve attention in disc-playing gear (p. 47).
- \*Blumlein: On the original work of the man who developed stereo forty years ago (p. 57).
- \*Film Music on Disc: Movie music (p. 64).
- \*Test Reports: Reviews of the Hitachi 920, Yamaha 610, and ARD 4000 FM tuners (each good, but none state of the art), SAE 5000 impulse noise suppressor (quality-control poor, performance okay, but side effects noticeable), and AKG transversal-suspension cartridges (pretty good) (p. 107).
- \*Positive Feedback: McKenzie suggests that incompatibility of equalization among cassette decks may be traceable in part to the test tapes; BASF playback test tapes are 1 to 3 dB hot at 10 kHz (p. 119).

### High Fidelity, October 1977

- \*Why Records Should Never Be Flat: A pointed essay by John Culshaw on the dismally flat acoustical perspective commonly produced by multi-miking. "There is all the difference in the world between a soft sound recorded close and a loud sound recorded from a distance" (p. 19).
- \*Test Reports: Technics 6000A linear-phase speaker, KLH 355 Baron, Visonik D-50 "David," EPI 200, and ESS/Heil Tempest LS-5, each judged pretty good except for the mediocre ESS (p. 49). Note the reappearance of curves, with a cautionary note about the interpretation of low-frequency data, evidently a result of last year's published report on the Allison One.
- \*Pathfinders: Biographical sketch of Frank McIntosh (p. 64).
- \*Loudspeaker Testing: A summary of the test methods presently used by CBS Labs for High Fidelity, with notes on interpretation (p. 69).
- \*Computer Technology Transforms Speaker Design: A brief sketch of the digital signal processing used by KEF, B&W, AR, and others in speaker development (p. 74).
- \*Time Dispersion in Loudspeakers: Peter Mitchell's exploration of the audible significance (or lack thereof) of linear-phase speaker design (p. 76).
- \*Art Weds Technology: After looking at direct-disc records in July, Hal Rodgers compares some super-records made from tapes: Denon PCM records from digital masters, Gale's demo discs, and Sumiko's Reference Recordings (p. 112).

### Marshall Leach Low-TIM Amplifier Newsletter

Damon Hill is back with another of his helpful-hints-on-how-to-build newsletters. The price is 504 per issue, and Damon will not accept payment for more than two future issues. Write: 3261 Circle Oak Drive NW, Atlanta, GA 30339.

### Popular Electronics, October 1977

- \*Stereo Scene: Ralph Hodges surveys the new product crop at the June CES show (p. 22).
- \*Test Reports: Sony EL-5 Elcaset deck and Scott R376 receiver, both judged good (p. 34). The Shure 516 EQ microphone was also tested, but obviously would be of no interest for musical recording.
- \*Wireless Stereo: On the workings of the infrared transmitter-receiver systems used for wireless headphones (p. 70).
- \*IC Voltage Regulators: A nice introduction, but figures 2 and 3 are swapped (p. 88).

### Radio-Electronics, October 1977

- \*Realign Your FM Receiver: This article is essentially a combined sales pitch and instruction

booklet for the Philips 6456 signal generator (p. 50).

\*Class H: On the power amplifier circuit being introduced by Soundcraftsmen; like Quad's current-dumping and Hitachi's Class G, Class H is a sensible approach to raising the transient output capability of an amplifier (p. 53).

\*Reviews: Dyna SCA-50 amplifier (good), Heath AR-15 receiver (very good).

### Stereo Review, October 1977

\*Getting the Room Right: Straight talk and common sense on room acoustics (p. 32).

\*Technical Talk: Julian Hirsch tells why he doesn't include RFI-susceptibility testing in his reviews. Unfortunately, his answer sounds like a cop-out and is based on a logical fallacy. In essence, he says he doesn't test for the primary form of RFI (CB) because a rigorously complete test for all possible forms and frequencies of RFI would be too expensive and difficult. Huh? (p. 34).

\*Test Reports: For people who complain that Hirsch only does favorable reviews, this issue is instructive: the reviews of the Nakamichi 630 tuner/preamp, Hitachi 8300 power amp, and JVC KD-75 cassette deck are enthusiastic raves, while the reviews of the AMC 14 speaker and B&O 4400 receiver are only moderately favorable (p. 36).

\*Noise Reducers: BAS member Dan Shanefield surveys the available garbage suppressors and identifies the pros and cons (p. 7U).

\*Direct-to-Disc: David Hall finds that some 1950's mono and early-stereo records have more natural, honest bass than the costly, multi-mike Direct From Cleveland production (p. 144).

### Studio Sound (England), August 1977

\*The Noise Jungle: A clear and thorough discussion of the various types of hiss (white, pink, Johnson noise, etc.), measurements, weighting curves, reference levels, etc. (p. 26).

\*Magnetic Tapes Reviewed: A new round of measurements of studio recording tapes, similar to the measurements printed in the Speaker several years ago. Nothing particularly startling is found in the new report; on balance, the best 1-mil tapes seem to be Ampex 407, Maxell UD35, and TDK Audua (in alphabetical order). Curiously, all of the dozen tested tape types were found to have essentially the same useful dynamic range. For instance, Ampex 407 was 2 dB noisier than Maxell but also had 2 dB more headroom. The first tested samples of back-coated Audua had poor oxide coatings, replacement samples were superb, and non-back-coated Audua was okay to begin with. The table has at least one obvious misprint: a distortion figure for Audua is given as 2.9% instead of the clearly intended 0.9%. Two new tapes which were not available in time to be included in the testing were Maxell UDXL and Memorex Quantum (p. 64).

-- Peter Mitchell, Richard Ranheim, Michael Riggs

## **September BAS Meeting**

### Business Meeting

The meeting, held in the auditorium of the Boston University Student Union, was opened by Jim Brinton with a call for votes on the BAS slate of officers for the coming year. Before voting began, Peter Mitchell withdrew his name from consideration for the only contested office, that of treasurer. A motion was made and seconded to elect the slate by acclamation. The vote was carried, electing officers as follows:

President - James Brinton  
Recording Secretary - Alvin Foster  
Corresponding Secretary - Frank Farlow  
Treasurer - Henry Belot

Jim announced that no discount will be available to BAS members for quantity orders of the Sabtronics Multi-meter. They will, however, pay shipping charges on orders of ten or more. A back-order delay of at least two months can be expected. Thus, the BAS is not taking orders.

Peter Mitchell, through the courtesy of Dick Glidewell, has been able to test the EC-3 cardioid

version of the Superscope EC-1 omnidirectional microphone reported on in the June issue of the Speaker. The cardioid is slightly more expensive than the omni (\$18 vs. \$12) and similar in overall quality. Its on-axis sensitivity is about 2 dB higher than that of the omni and back rejection is 15-18 dB at mid frequencies, dropping to 10 dB at 100 Hz. This unit exhibits the low-frequency proximity characteristics typical of cardioids; the bass response drops rapidly below about 80 Hz in the far field of the sound source, but as the mike moves into the near field, the bass comes up rather rapidly. Close miking, as in PA applications, then, gives rather boomy response. Use at a distance for recording purposes will be fine except for a deep bass loss below 80 Hz. Bass sound of the cardioid would be described as tight and well defined while the omni version, which is flat to 30 Hz, would be called fuller, higher and less well defined. It is a bit larger than the omni, with a larger wind screen, which knocks the high end down by 2 dB (1 dB for the omni wind screen). Quite decent recordings can be obtained from both mikes.

Commenting on the high quality of service rendered by Harry Zwicker as BAS treasurer for three years, Peter Mitchell made a motion nominating Harry for honorary life membership in the BAS. The motion was seconded and passed with no opposition.

Frank Farlow pointed out that we currently have five life members, six editors of large high fidelity publications, and six past meeting speakers who receive the Speaker and do not pay a membership fee. This total of seventeen amounts to a \$240 subsidy by the BAS. Because it is likely that other BAS officers will be nominated for honorary life membership in the future, this could develop into a substantial drain on the budget. Frank moved that eligibility for future honorary life membership be restricted to officers elected prior to September 1976. In the ensuing discussion, it was indicated that this would not necessarily restrict the options of future meetings, in that such a motion, if passed, could also be rescinded. An argument was advanced for retaining the present system because it offers the flexibility to regularly place free copies of the Speaker in the hands of those whom we may wish to influence and from whom we can obtain free advertising, such as editors of mass market hi-fi publications. Overall, it consumes less than 2% of the BAS budget. In a vote, the motion was overwhelmingly rejected.

The Direct from Cleveland disc was again offered for sale at the meeting, but Jim Brinton said this would probably be the last time. This, the second shipment, is of more consistent quality than the first, some of which had a noisy surface on the second side.

Outgoing treasurer Harry Zwicker gave a summary of the treasurer's report for 1976-77. A \$1300 surplus, or \$1.30/member, will be transferred into next year's budget. This came substantially from the postage savings incurred in bulk-mailing back issues to new members and to those who purchased back volumes. A result of society growth, this surplus cannot be counted upon to be repeated in future years. A complete listing of 1976-77 financial transactions was exhibited in the form of a half-inch pile of computer printout.

Harry Zwicker presented a motion for forming an RFI Panel in the BAS. This was stimulated by the present Federal legislative activity concerning new RFI suppression regulations for manufacturers, such as the Goldwater bill. The motion, presented in written form and read by Harry, is as follows:

#### RFI Panel Motion

The following motion is in seven parts:

1. I move that the Boston Audio Society form a panel on Radio Frequency Interference (RFI), to be termed the "RFI Panel. "
2. I move that this panel be allotted a sum from the BAS treasury not to exceed \$200. These funds shall be held by the treasurer, who shall maintain the fiscal records of the RFI Panel. The funds shall be used as the panel sees fit within the scope of this motion.
- I 3. move that this panel be required to file with the Congress of the United States a position letter giving the consensus of the BAS with respect to any pending legislation which would regulate RFI suppression techniques in consumer electronic equipment, including high fidelity components and systems.

4. I move that this panel be chosen from the membership of the BAS, with the addition of any advisors the panel may appoint, and that the panel shall consist of individuals with backgrounds broad enough to maintain objectivity and credibility with the panel's findings yet including individuals most technically qualified to study techniques of RFI suppression. Should the members of the panel include individuals with a commercial interest in the findings of the panel, these shall be balanced by hobbyists without financial interests in hi-fi equipment or suppression regulations.

5. I move that this panel be encouraged, but not required, to: (1) compile a bibliography of published information on RFI suppression techniques for hi-fi systems; (2) request disclosure of the policy of the primary hi-fi equipment manufacturers in responding to complaints of interference; (3) compile a listing of RFI suppression devices and available test reports; (4) include those appropriate references currently compiled by the American Radio Relay League's RFI Task Group; (5) create, if needed, an independent document describing RFI suppression techniques, to include a summary of existing references plus techniques not currently well described in the existing body of articles; and (6) undertake any similar actions, including a testing program, which would either assist audiophiles to reduce their RFI problems or which would help members to evaluate the current RFI suppression techniques and any remaining problems which exist today, prior to national regulatory legislation.

6. I move that this panel be required to poll the opinion of the BAS membership in a manner which will elicit thoughtful, unemotional response to possible options for RFI legislation. It is suggested that this poll of members be conducted by mail, with all expenses paid for from the BAS treasury, and that this polling be included with an issue of The B. A. S. Speaker which contains a summary of majority and minority opinions of the members of the RFI Panel.

7. I move that this panel be empowered to determine for itself its structure, time of existence, meeting schedule, schedule for submission of the letter to Congress, method of polling the membership, and selection of material to be submitted for publication in The Speaker.

Comments: Personal opinion, not part of the formal motion:

1. I feel that we should admit that some legislation regarding RFI suppression will be enacted within the next two years. We should therefore not attempt to entirely block all legislation, but rather we should work to make it useful and workable and as non-destructive to audiophile qualities as possible. We should admit that the fault behind RFI is not always with the source, but that in many cases defects in the hi-fi product design (such as poor shielding, RF rejection, or input overload) are at fault and cause a properly operating RF source to cause interference.

2. This is possibly the only opportunity for the voice of the audiophile community to be heard in congress. It may also be the only opportunity for the consumer as a body, including the consumer of non-audiophile quality equipment, to have input to the legislation. Other inputs will definitely come from CB groups, radio amateurs, and the electronics industry, but no other audio-consumer organization appears to have been formed.

3. This action can propel the BAS, as an organization of serious, thoughtful individuals, into national prominence, should this be desired.

4. The BAS is unique; no one else, including the publishers of the audiophile quarterlies or monthlies, can do this job.

5. The panel need not be limited to local members; indeed, Alvin Foster suggests that a member in the Washington, D. C. area who is willing to testify can personally carry the voice of the BAS to the proper committees.

6. If the BAS has any function as a consumer action group, now is the time to show it.  
-- Harry R. Zwicker (Maryland)

In the discussion of the motion, it was determined that about 40% of the membership present had had RFI problems in the past, some of which remain unsolved. Six people expressed an interest in serving on such a panel. The motion was passed unamended, and Frank Farlow was appointed to act as a clearing agent for the organization of the panel.

## Meeting Feature: Irving M. Fried

Deeply involved in the high fidelity field for over three decades, Irving M. Fried has, over the years, been associated with the development or marketing of a number of well known products. These have included the Williamson Ultralinear amplifiers (1950), the AR-1 with Edgar Villchur (1955), the Janszen four-element electrostatic tweeter (1955), the Lowther TP-1 Horn Loudspeaker, the Dynakit Mark II with David Hafler (1955), the Quad Full-Range Electrostatic (1958), the SME arm, the IMF line of loudspeakers, and the Decca and the Goldring cartridges. Most recently, Mr. Fried has severed his relationship with the British IMF firm and has formed his own company in the U.S., which markets a line of speakers under the Fried name. Distinguishing features of these speakers are the use of plastic driver cones for more consistent and controlled characteristics and transmission-line loading of bass drivers, a technique for obtaining smoother, extended bass response.

Over the past sixteen years, I. M. Fried has, aperiodically, published a newsletter, the thirteen issues of which are available through Fried dealers. The newsletter follows, in a chatty style and lay language, Mr. Fried's peregrinations through the advances in the state of the art of audio reproduction. The material presented in the lecture dealt with his conception of the important parameters which must be controlled in loudspeaker design and design methodology for suppressing the remaining mechanisms that color loudspeaker reproduction. Much of this information is covered, in similar detail, in his newsletters and product brochures.

With the exception of the new Model H, the guiding philosophy in the design of the Fried line of speakers has been that of the Monitor reproducer, i.e., a speaker that provides, as nearly as possible, an acoustic wave at the ear identical to the electrical waveform fed into it. A corollary to this is that the speaker should interact as little as possible with the listening room to minimize the effects of room response on speaker accuracy. This has led to the rejection of design concepts employing omnidirectional or dipolar radiators as creating "multipath distortion," smearing of transients, and the addition of ambience not in the original recording. Broad dispersion in the forward direction is necessary, however, for good spatial imaging.

According to Fried, one of the rationales for exact waveform reproduction is that, for maximum impact and increased sense of dynamic range, it is necessary to preserve transient waveforms to hit the ear with peak acoustic transient energies resembling the electrical input. It is the smearing of these transients by the driver and crossover (at the leading edge) or by delayed resonances of driver and cabinet (at the trailing edge) that is the most important remaining source of speaker coloration.

Another facet of the design philosophy is that of the expanding sound source: each radiation element (including cabinet) should appear as a point source within its frequency range. This is implemented through a reduction in cabinet size for increasing frequencies. To reproduce acoustically the electrical input, it is sufficient (if perhaps not necessary -- see Peter Mitchell's comments in the August Speaker) to have speakers with good impulse performance. Impulse testing, or examining the response of a speaker to a very short pulse of electrical energy, has been the prime tool used in the optimization of the latest speakers in the Fried line. In fact, in the Model H final adjustments were made favoring impulse performance, even where it might be at the expense of frequency balance and smoothness. Using impulse performance as a quality criterion places more stringent demands on the individual performance of each component of the speaker system, as well as their integrated response, than is typical of non-time-coherent designs. For instance, Mr. Fried pointed out that all of the drivers must be of the minimum-phase type, i.e., their phase response, and therefore their impulse response, must be uniquely determined by the frequency response. Also their response should be smooth for two octaves above and below the crossover points to allow phase matching 6 dB/octave crossovers to be used. The use of plastic cone elements aids in the suppression of cone breakup and spurious resonances that can contribute excess phase shift.

Cabinets that accept the rear radiation of the drivers must be properly designed to absorb this energy and minimize reflection back through the drivers. This must be done without unduly restricting the flow of air, and without introducing cabinet resonances. All this is accomplished in the Fried design through a special arrangement of edge-on slabs of acoustic foam. Lossy transmission line loading of the drivers offers a well behaved way to smoothly extend bass response

while maintaining low phase distortion and coloration.

The Model H is, thus far, Fried's most successful integration of the above design approach, as measured by the impulse performance. It consists of three pieces: two small satellite enclosures containing midrange and high frequency drivers, which cover the 100 Hz to 20 kHz band, and a dual transmission line woofer housed in a 3 1/2-foot prone enclosure, which handles the 20 Hz to 100 Hz band. The satellite enclosure frontal dimensions are small (11" x 8") in keeping with the desirability for point source radiators and to minimize visual impact. These enclosures are still larger than a wavelength above about 1.6 kHz, and it is in this frequency region and above that sound begins diffracting from the enclosure edges. This causes more energy to be directed toward the area in front of the enclosure, yielding a slight step in the frequency response. Fried employs compensation techniques to mitigate this effect. In a departure from the monitor philosophy, room interaction has been taken into account in tailoring the bass response,

In a comparison demonstration, the Model H was matched against the Model R, a small Fried speaker of earlier design having similar midrange and high frequency transducers and a "resistive line tunnel" loaded bass driver. On organ and drum recordings, the bass superiority of the Model H was obvious. A mistracking cartridge marred the midrange comparison of vocal material, which might have indicated differences due to cabinet size and improved crossover design in the Model H. The performance of the Model H is presently limited by the quality of the available drivers, according to Mr. Fried. He is evaluating new driver designs and indicated that some promising units are now becoming available to him. It is likely, however, that they will be considerably more expensive than those now in use.

One feature which has differentiated Fried speakers from nearly all others is their policy of updating older designs through dealer modification kits, when state of the art advances are made. Presumably any new drivers for the Model H will also be available to current owners. Factory assembled for \$1,900, the Model H is also available in kit version for \$750, including drivers, crossovers, acoustic foam, and plans for the wood cabinetry. -- John Schlafer



Rack Mounting for Audiophiles

Dave Reiter

One of my closest friends has a delightful array of well respected audio components, interconnected by ten-foot cables with plastic connectors and perched on bookshelves meant to hold paperback novels. I lived with a similar (though less impressive) arrangement for some ten years, always searching for a better coffee table to hold my tuner, turntable and preamp. The tape deck I wanted was two inches too wide to fit between a tuner/preamp sandwich and the turntable, and our guests frequently kicked the amplifier under our couch.

Just about the time our server top buckled under the combined weight of the system, I began looking for a flexible and sensible way to house my equipment. My requirements were that it be attractive and presentable in our living room and that it have the capacity for all the new equipment I thought I'd have by now. The nineteen-inch rack-mount system, used by virtually all industrial and professional electronics manufacturers, is the answer.

The construction of a flexible and precise mounting system has brought about dramatic improvements in both the appearance and sound of my components. It has solved a great many problems related to both spatial arrangement and interconnection of equipment. A single locus for the system is more readily defensible against children, pets and the generally curious. A permanent home for the system permits fabrication of cables of optimum length and the proper routing of signal and power lines. A switched, fused outlet box centralizes line current sources. A rack cabinet is convenient and attractive, and you don't have to find a larger coffee table when there's a sale on noise-reduction units.

The mounting principle employed is front-panel fixation to side rails nineteen inches apart, though many kinds of brackets are available or designable to distribute the weight between panel, chassis and auxiliary supports. Panel height is standardized in multiples of 1 3/4 inches. Almost all commercial electronic equipment is made in conformity with these standards. Because of consumer appeal, many manufacturers of mundane equipment are beginning to offer "professional, rack-mount styling" in their quest for the "state-of-the-mouth" market. There are also some manufacturers of high-quality consumer-oriented equipment who recognize the need for rack adapters and offer them either as add-on brackets or, in some cases, as replacement front panels.

However, most of the equipment that has found favor with the knowledgeable audiophile market will require the fabrication of rack-mounting adapters. This is very easy to do, and consistent results are readily obtainable with the use of standard rack-mounting panels available from most electronics jobbers. The cut-out pattern I use most is a sideways "H." Lay out the front-panel dimensions of the piece to be mounted on the panel of your choice. Cut along the top and bottom lines, and interconnect these two with a vertical line at the center, making the configuration shown in figure 1. Using a vise to support the panel firmly, you can bend the peninsular tabs, as in figure 2, leaving a panel cut-out of the proper size with supporting side rails for chassis fixation. This relieves the equipment panel of the burden of total support, for which most consumer equipment is not strong enough. Other panel variations are shown in figures 3 and 4.

Panel choice is an individual matter. Several finishes are available, but I prefer the Crown blank panels, which are of consistently high-quality brushed metal. Crown mounting hardware is also beautiful, though any oval-head 10-32 machine screws can be used, with cup washers behind them. The chromed Crown screws and black plastic cup washers are far and away the best looking, but their prices are so high that I've been looking for other sources of hardware. Flat-head screws are a mistake, but round-head screws with flat washers will do in a pinch. Panels are

available in several materials and finishes, but the 1/16-inch aluminum with gray finish are the least expensive ones that give high-quality results (I spray mine flat black after all the cutting and drilling). Again, the Crown panels look fantastic if you're willing to pay twice the price of painted aluminum.

Cabinets are available from several sources, but all the commercial ones I've seen are metal and ugly. You can build or have built a simple flakeboard cabinet and finish it in any of a variety of materials, including formica, wood veneer or (as one enterprising but offbeat enthusiast did) leather. Just make the inside panel height (not the overall height) a multiple of 1 3/4 inches, and allow 19 1/8 inches between inner surfaces of the sides. Pre-drilled side rails are available if you look hard, but I spent a delightful afternoon drilling over two hundred holes and an even more pleasant evening tapping them all. Don't be tempted to use one-inch angle bracket. It is stronger than the 3/4-inch stuff, but you don't need the strength, and the seventeen inches left between rails will not clear some equipment (e.g., Crown tape decks, some Lux items and many receivers).

Spacing of the holes in the rails is also standardized, with the uppermost holes 1/4 inch below the top of the rail and each lower hole alternately 1/2 inch and 1 1/4 inches down. If you've measured it properly, the bottom hole on each rail will be 1/4 inch up from the bottom of the rail. The centerline for the column of holes is between 5/16 and 3/8 inch in from the panel edge (there must be a standard, but I don't know what it is). They are tapped for a 10-32 thread.

The specific arrangement of components in the cabinet should be dictated by convenience factors (don't put a controlless basic amplifier at eye level and leave your tuner at the bottom), cooling needs (hot air rises) and logical signal routing. Arrange things to permit short and direct cable runs, and avoid redundant wiring. Heavy equipment belongs at the bottom, which usually means that the calories are created below the cooler equipment. Allow adequate room for air circulation, and provide access for cooling air to any internal equipment fans, heat sinks, etc. If you want or must have a high equipment density in your cabinet, a cooling system is a good idea. A "Whisperfan" or similar device is good, with a foam air filter over it and a ducting system if required (I've used ducts of anaesthesia tubing, similar to vacuum-cleaner hose, with good results).

Make your cables after you have determined the equipment layout. Use high-quality cable with braided shield, and don't scrimp on the plugs and jacks. Route signal cables away from line cords (I keep the signal harnesses at the center of the cabinet and run line cords along the inner walls with cable clamps securing them). Use cable ties, and identify each cable in each harness with some sort of coding as to channel, source and destination. Avoid banana plugs and jacks like the plague: they are readily separable and have no place in our systems except, possibly, for test equipment interfacing (and, even there, I prefer BNC connectors).

Route line power to the rack with heavy wire. I prefer to use an outlet strip with an integral switch, pilot and circuit breaker. There are several designs of rack-mount terminal boxes available, and this is the safest and best way to distribute the juice. Use more than one, if necessary. I like the 15 Amp rated series. Avoid at all costs an octopus arrangement of line cords. You're building this to improve your system, and piggy-backed line cords are fire hazards, as well as a step backwards in cleanliness and order. Pyramiding line cords off a standard extension also decreases the voltage available to your circuitry.

Rack mounting can eliminate both ground-loop problems and RFI. Use a terminal box with a three-prong plug and solid ground wire, making sure that your outlet is truly grounded (remember that not all modern plumbing is conductive and that the builder of your home or apartment building may not have properly grounded your house wiring). Do not interconnect grounds on any two components in your system, and do not use any three-conductor line cords between any pieces. I also do not like to use the convenience accessory outlets on any components, unless the switching function is mandatory. You will, however, probably have to ground your tone arm to the system. RFI can be reduced by use of short, direct cables with proper shielding (I use RCA plugs designed for RF shielding and am going to BNC connections on all home-made equipment).

An additional benefit of rack mounting is the ready inclusion of test equipment in your system. Hewlett-Packard and Tektronics make many of their oscilloscopes in rack-mount form. Leader has a few scopes available with rack adapters; I use a Leader LB0310A three-inch scope mounted in an 8 3/4-inch panel, which looks great.

Some specific manufacturer-related information may help you. In addition to making the most beautiful panels and hardware, Crown makes all its equipment for racking. SAE makes several pieces of gear in the rack formula, but be wary of using their rack adapters on the earlier pre-amps, amps and equalizers. Some of their first products, such as the Model XVII equalizer, are not made in conformity with the usual industry practice. The equalizer, for example, is 5 3/4 inches high, and the holes in the adaptor are a non-standard distance apart. Measure carefully several times. Tandberg offers rack adapters for most of their tape recorders, but I gave up after a four-month wait and cannot tell you how attractive or sturdy they are. Revox makes a comprehensive line of rack-mounting equipment, as well as adapters for originally cabinet-bound units. They are readily available, according to my dealer. Southwest Technical Products has several amplifiers in "1/4 rack width," and dbx makes rack-adaptor end plates for certain units. The new McIntosh amplifiers (2120 and 2200) have rack adapters, and the 2300 is in rack format (it also makes a great anchor at the bottom, as a five-foot high cabinet is no match for gravity if all the weight is at the top). Sequerra has a rack face available (for something like \$175), and Dyna makes rack end pieces for their 400 series. Occasionally there are ads in the Audio classifieds for assorted Dyna rack panels from private entrepreneurs. The Advent 100A Dolby unit lends itself well to racking (it looks gorgeous in a Crown 5 1/4-inch panel). Marantz made a rack-mounting faceplate for the 7, which I'd like to get if anyone can help and there are several rack adapters in the Sony and Marantz catalogs. The Shure 60 and 600 series of mixers have rack plates readily available, and many reinforcement and recording mixers (such as Tapco) are made in rack format.

Making your own projects in rackable form is a real kick. They seem to work better when they look better (the Reiter Audio OC149 1/2 output control center, with Toyo peak-reading meters, is a real delight). The time and effort required to make a functional and cosmetically acceptable rack-mounting system is more than worth it. I can say that even after drilling and tapping over 200 holes. My wife's happy, my bookshelves don't warp, and my Pioneer tuner is having the time of its life playing Sequerra among the flat black panels.

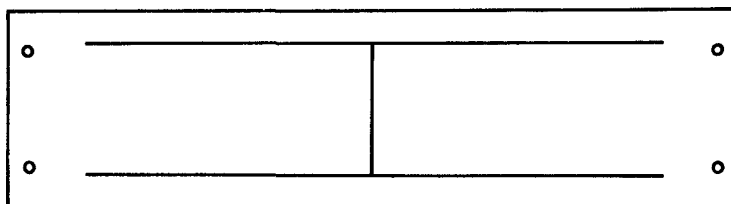


Figure 1

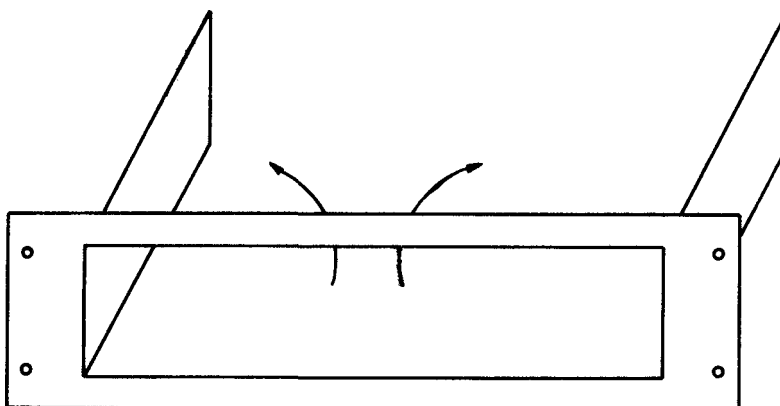


Figure 2

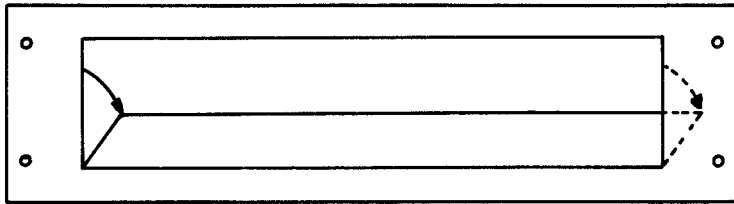


Figure 3

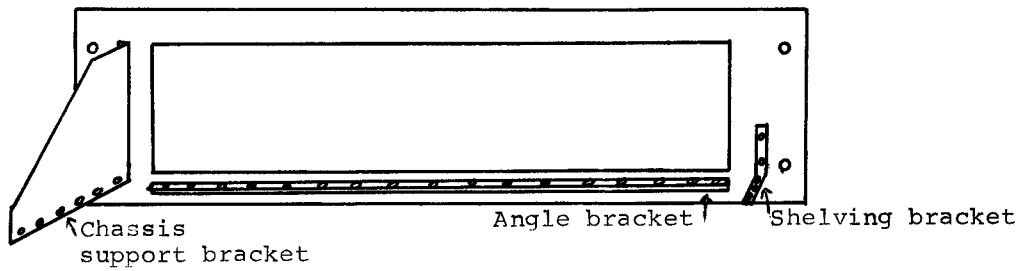


Figure 4 Support alternatives: back view

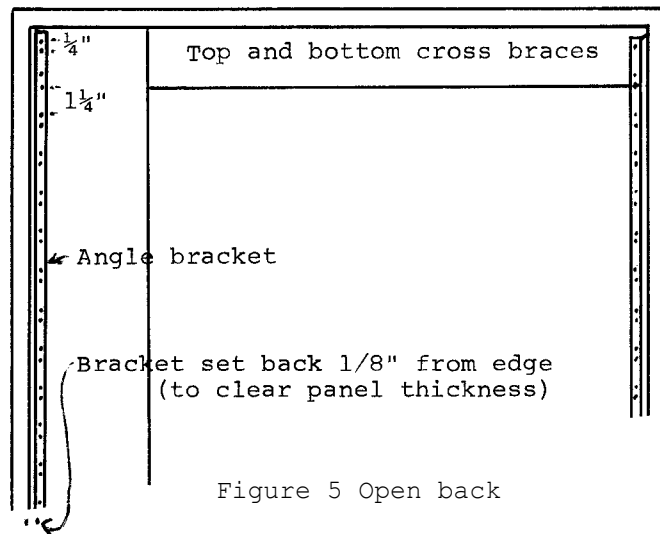


Figure 5 Open back

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A Publication of the BAS

### Embellishing the Sony TC-377

Randy Westfall

With the recent favorable publicity on "Shop Talk" for the Sony TC-377 tape deck, I thought it might be helpful to share some of my ideas for improvements to the deck: there may soon be a few more 377 owners who might want to make use of them. By the way, I certainly agree with those who have recommended the 377. Even without modification, it is a real bargain. Performance is excellent at 3 3/4 ips, which seems to be rare even in more expensive machines. Only the slightly higher noise tells you you're not running at 7 1/2 ips. It's very nice to be able to cut tape costs in half. The deck is also very easy to use, so that I miss solenoid operation only a little. Finally, construction is of unusually high quality for moderately priced consumer equipment. I've had my deck for three-and-a-half years, and despite neglecting lubrication, which is supposed to be done every six months, I've had no problems at all with the fairly complex transport. I think I'll remain satisfied with my 377 for quite a while, or at least until I get a chance to look at the Sony Betamax PCM system?

Before I describe any alterations, I should warn 377 owners about the heads. After about two years of use, I began to notice a slight high-end rolloff at 3 3/4 ips. After trying the obvious (adjusting bias and equalization and touching up head alignment), I concluded that my ears were improving. As the problem got worse, I stubbornly refused to suspect the heads. After all, the owner's manual says that their "ferrite-and-ferrite" head shows "1/200 the wear of a conventional head," which implies that the heads should easily have outlived me. No such luck. Ferrite may be 200 times as hard as permalloy, but that doesn't mean ferrite heads will last 200 times as long as permalloy ones. What it does mean, apparently, is that ferrite heads wear differently. Looking at my heads under a microscope, I saw many tiny chips in the ferrite right along the head gap, instead of the smooth erosion seen with permalloy. It seems that ferrite wears because of brittleness, rather than softness. To the unaided eye the deterioration is barely noticeable, but to the ear it's all too obvious. Anyway, I now have a new pair of heads on order (they aren't cheap, by the way).

Now for the modifications. First, though, I would like to thank Sony for printing a schematic in the owner's manual; it certainly has been helpful. I also appreciate the large open spaces on the chassis, which facilitate the mounting of the extra circuitry needed for some of the modifications. I attached a four-inch square perfboard on the rear of the chassis, above the existing PC boards. There are even several unused, tapped holes in the chassis which will accept #4 machine screws. It seems almost as though Sony has tried to make it easy for owners to modify the 377. The upshot is that one shouldn't be afraid to try the modifications because of inexperience with such projects.

#### Remount Bias Trimmers

This is probably the easiest modification. The screw on the bias-adjust trimmers is somewhat fragile. The slot tends to become eroded after a reasonable amount of use, and eventually it becomes impossible to turn the screw (which is difficult to start with). The cure is to remove the trimmer, bend the terminals around, and solder it back in upside down. Getting the trimmer out is a little tricky, but you can do it without removing any other components or wires. (I defin-

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itely recommend using a solder sucker, as this makes the job much easier. ) The reason for reversing the trimmer is that the screw has a much larger- head on the other side. This greatly simplifies bias adjustment, and if you drill a couple of well placed holes in the bottom of the wooden cabinet, you can set bias from the outside, which makes it easy to readjust for different brands of tape or for different batches of the same brand. While you're at it, drill holes for access to the playback equalization trimmers as well.

### Convert to Peak-Reading Meters

If you don't think this modification is needed, just watch an averaging and a peak-reading meter monitoring the same signal. While the averaging meter wiggles around at about -10 VU, the peak-reading meter will be up around 0 VU (assuming they are calibrated for equal response for steady-state input), even for moderately compressed signals. Fortunately, it's not hard to add peak-reading capability. Figure 1 shows a circuit for this purpose, to be run from the power supply shown in Figure 2. This supply uses the 377's power transformer, which should have no trouble supplying a few extra milliamps (mine doesn't even get lukewarm). Referring to Figure 1, note that it's possible to vary the meter decay rate by changing  $R_1$  and  $C_1$ . The values shown give decay rates with time constants of .056 second (switch closed) and 1.5 seconds (switch open). The short time constant results in ballistics that look like average-reading, in that they "follow the music," but that respond to all but the shortest peaks. The longer time constant allows measurement of any peak that would be audible. Actually, the circuit is capable of much longer time constants. For instance, with a  $C_1$  of 100  $\mu$ F and no  $R_1$  at all, the reading will decay 1 dB in about half an hour. This makes it possible to monitor a whole piece of music before recording just by looking at the meter when the piece is over to find out the level of the highest peak. Of course, on a record the peak probably would be a noise pop, but it's an interesting idea. In any case, you can mount the switch on either side panel just by drilling a hole in the plastic plate. If you are a little more ambitious, you may want to put the switch on the front panel below the monitor switches. You may also want to add a switch returning the meters to their original ballistics just to see what you had been missing.

The network in Figure 1, just before the meter, may need some explanation. The meters' scales are inaccurate when supplied with a linear signal (i.e., one directly proportional to input level). Apparently, Sony relies on the voltage dropped across the diode driving the meter for compensation. After a little experimentation, I came up with the driving network shown, which has improved the accuracy of my meters considerably. They're now within .2 dB from -3 dB to +3 dB, off .4 dB at -6 dB, and close enough below that to make estimating the error difficult (the scale is too cramped). To calibrate the network, set the trimmer for a reading of 0 VU with a DC output of 1 Volt from the second op amp. Then you can calibrate the meter with the trimmer on the original PC board. Note that you must change the connections to the latter trimmer (see Figure 1).

You may also want to add the capability to monitor after record equalization. I have tried this, but it seems to make little difference, as record equalization is fairly moderate, except perhaps at 1 7/8 ips, which I wouldn't use for critical recording anyway. I don't think it's worth the effort of adding another switch.

### A New Headphone Amp

This is essential if you do any live recording. The original headphone amp supplies a fixed output, which is usually too low to overcome external noise, even when using high-isolation headphones. The circuit in Figure 3 permits volume adjustment with the existing output level control. You may want to change the value of the feedback resistor to suit the sensitivity of your headphones (the values given provide levels more than adequate for my Koss PRO-600AAs). You probably will want to bypass R329 and R429, as shown, to allow complete attenuation. And disconnecting the primary of the now unused headphone output transformer eliminates a hump in meter frequency response at around 25 to 50 Hz. The power supply for the peak-detecting circuit will also feed the headphone amp.

### Test Oscillator

I haven't incorporated this addition yet, but I will get around to it one of these days. I plan

to add a simple Wienbridge oscillator, which will put out, at a fixed level, either a 400 Hz or a 10 kHz signal, to be fed into the line input. The low-frequency signal could be used for setting bias, the high for aligning the record head. I plan to save mounting another switch by using the microphone attenuator switch for frequency selection. The switch has a set of unused DPDT contacts, and there is no reason to care whether microphone pad is in or out while using the test oscillator.

### Eliminating "Flywheel Ringing"

I don't know whether other people have had the same problem I had, but my deck's flywheel used to make an annoying ringing noise. I found out why when I tapped the flywheel lightly with a screwdriver. It must have been made by a bell maker. The cure is to apply some silicone sealant to the inside surface of the rim of the flywheel. This damps the ringing very well and results in a very quiet transport. I had fears of destroying the delicate balance of the flywheel, but by applying the sealant evenly I at least avoided any audible increase in wow. Nevertheless, don't do this unless you do have a ringing problem. If you do, don't be overly afraid of removing the flywheel. It may at first look as though you'll never get the transport back together, but it's really not difficult at all. Besides, you'll come away with a lot of respect for the mechanical engineer who designed the transport, and you'll have an opportunity to clean and lubricate the mechanism.

After you've made these changes, you won't have to concede that Tandberg's peak-reading meters give their decks an advantage over your own. You will have a useable headphone amp. Bias and equalization adjustments will be easy to make without removing the cabinet. Finally, you will have the pleasure of knowing you have increased the value of what was already an excellent piece of equipment.

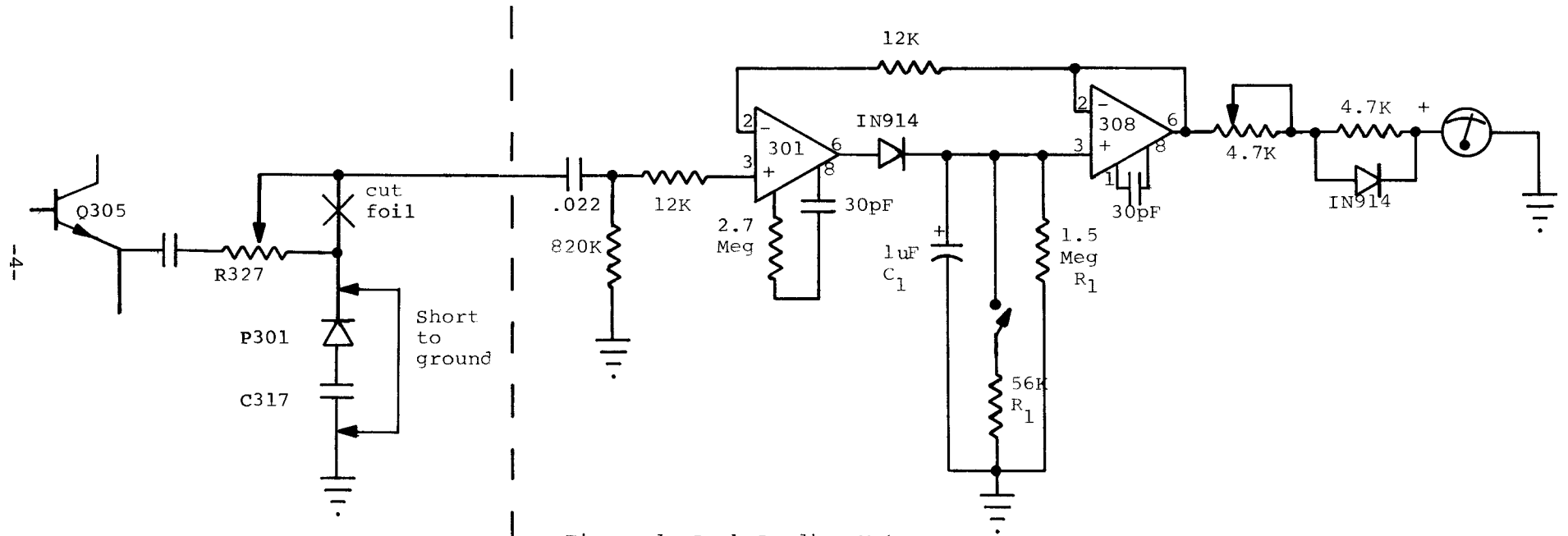


Figure 1 Peak Reading Meter



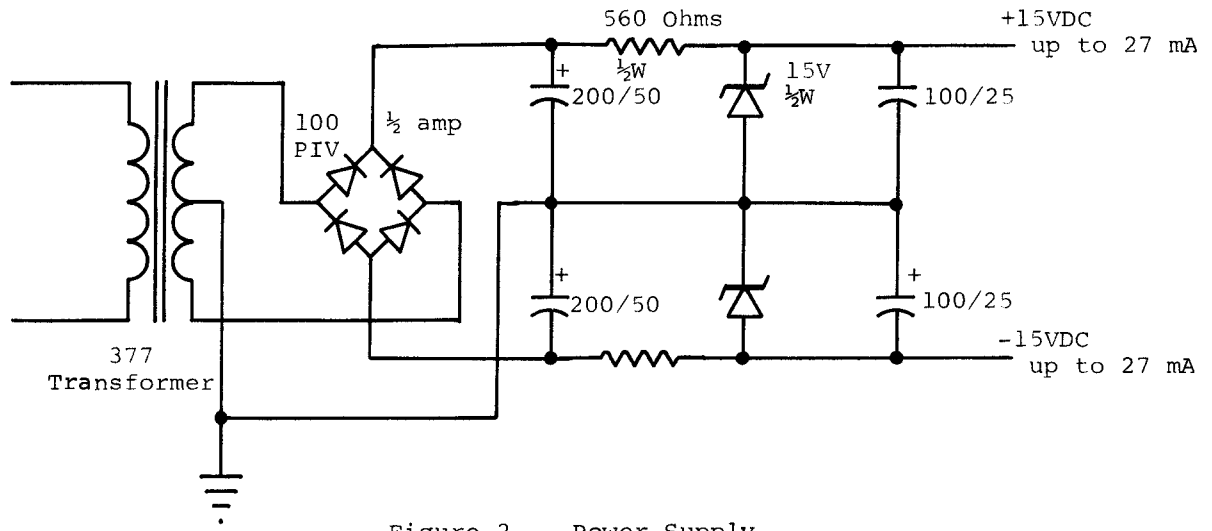


Figure 2. Power Supply

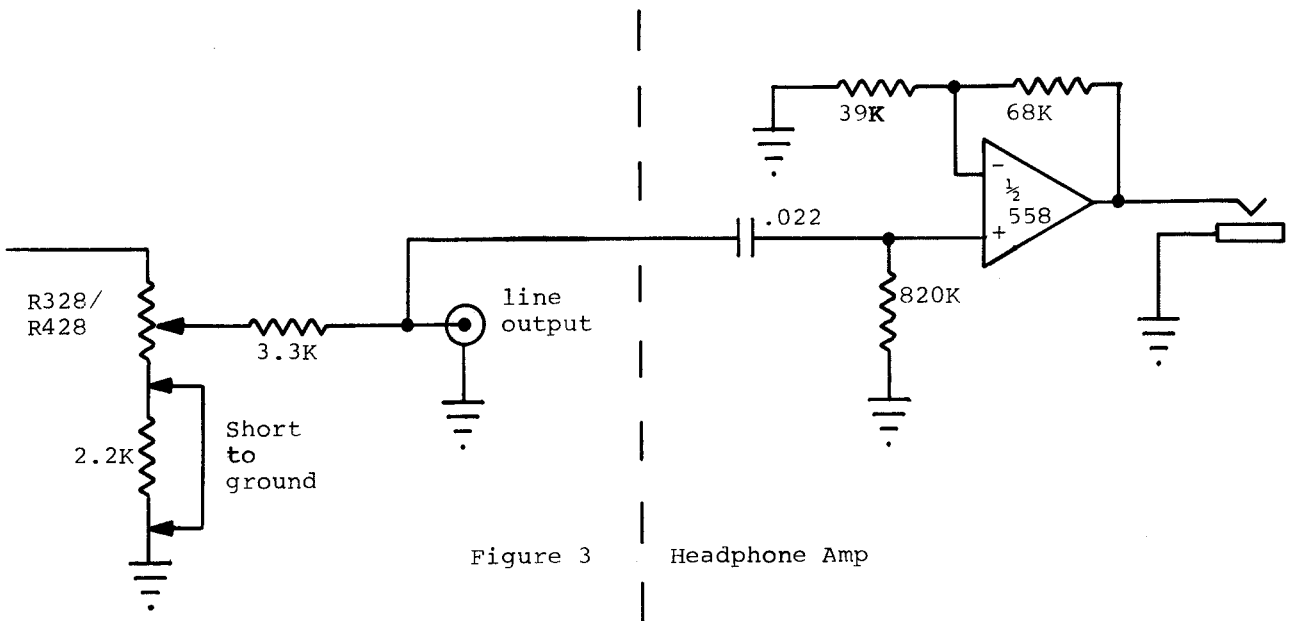


Figure 3 Headphone Amp