

# THE B.A.S. SPEAKER

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## In This Issue

This month The Speaker retreats to its usual size and appears again on a monthly schedule. The new production team is getting its act together, and we hope to continue to appear as regularly in the future as we have in the past.

There's an equipment orientation to this month's publications: Cary Lu examines the good and poor points of four quality portable tape recorders, both cassette and open reel types, ranging in price from \$370 to over \$4000. In the process, he shows why Nagra is sought after despite its high price.

Like all Dynakits, the PAT-5 is attracting the attentions of the Monday morning quarterbacks. Mike Riggs addresses the PAT-5 again this month in a recent reincarnation. With some component modifications and circuit changes, Riggs notes, there is some improvement in sound. But they are not gained without some penalty, and so Riggs has some cautions.

Within the newsletter this month is the usual variety of features including a panel review of the ESS Mk. I Heil headphones, and a meeting summary covering introduction of the Cizek speaker, which some consider an excellent performer for its medium price.

Next month, in addition to other articles already in the works, we hope to present a review by Peruvian member Hector Gallegos of the Grace damped unipivot tonearm. And as a belated Thanksgiving present, notes on some of the "turkey" raw loudspeakers presently available; words and (distorted) music by Jim Nichol.

## A Plea From a New Coordinating Editor

It would help if all articles, letters, and even short notes submitted for the Speaker were typewritten, if at all possible, double or triple spaced. It speeds production and cuts down on the chance of error in rewriting. I know I'd appreciate it, and I'm sure the other editors would, also. In the meantime, it is gratifying to see the variety of good material which is submitted for the Speaker, so keep those cards and letters coming.

-- Bob Graham

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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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## Treasurer's Report

### BAS DUES INCREASED FROM \$12 TO \$14 FOR THE YEAR OCTOBER, 1976 TO SEPTEMBER, 1977

#### I. Full-year Membership Policy

All readers of the Speaker should note the new application form at the back of this issue. On it, we try to make clear that membership in the BAS (as always) runs the full year from October to September, as outlined in the Constitution and Bylaws of the Society. Anyone applying for membership during a given year will receive monthly mailings of the Speaker for the remainder of the membership year and will also be shipped a package of back issues through the previous October. To keep press runs orderly and at lowest cost the Society offers no half-year or other partial memberships. (There has actually been very little confusion about this over the past years, but we do want to make this policy clear; this message will be repeated again later in the year.)

#### II. Why the \$2 Dues Increase?

First, we blame the U.S. government. The cost for mailing the Speaker has gone from 16¢ per issue in the beginning of the past year to 28¢ now. For 12 issues, this amounts to a \$1.44 increase. We would have to cut the size of the Speaker gruesomely to mail at the next-lower weight bracket, so we are simply stuck. Local members have in the past also picked up their issues at meetings, thus saving some mailing cost, but the tighter production schedule for next year will probably remove this savings. Ergo, \$1.44 is needed per member. Some of this increase was offset last year by reduced per-copy printing costs when the press run was upped from 600 to 1000. This saved 2¢ per issue -- not much, but it helps reduce the net increase to \$1.20 per year.

However, our Varitypist dropped her machine on the floor and replacement typists now charge about twice her rate. This increased costs by about \$50 per month, or the equivalent of 5¢ per issue and 60¢ per member's year based on 1000 members. Back up to a \$1.80 increase. We have been fortunate in the other major expenses (paper, envelopes, and mailing labels), where prices have been stable, but typing (actually typesetting) for the coming year might increase again by as much as a factor of two if we cannot find a good operator capable of putting out 60 pages of rough copy in a three day turnaround time. (You may not have noticed, but the Speaker is typed on a machine which has variable character-spacing to make reading much easier. Unfortunately, typists equipped to operate this machine are hard to find; anyone in the area willing to take this on, for about \$80-100 per month, please contact the BAS as soon as possible.)

We have also been able to print the Speaker at a local research lab for strictly the cost of labor, with no payment for overhead or depreciation of the press, but this may change in the coming year. The result could be a 50% increase in this cost. The total cost increase already on the books is thus \$1.80, with a high probability that two further large increases may be forthcoming. At the September BAS meeting this information was presented to the membership by the Treasurer, together with a recommendation for a dues increase of \$1.50, to \$13.50/year. From the floor came an amendment to raise dues to \$14.00 (and the member was not a plant!), which passed by about 4 to 1.

The executive committee and staff take this not as a vote to spend more money but as a vote to continue production of the Speaker without sacrifice in its physical quality. About two dozen local members are signed up as staff for the next year, and with some luck 1977 will be as successful as the past year. Everyone on the old membership list has received this October issue, but if you want the remainder of the year you must now turn to the back page and vote your \$14.00 in support of the Boston Audio Society.

Foreign members requiring air mail service should forward \$25.00 for 1976-77.

### Information for Those Who Have Already Sent in Dues for 1976-1977 at the Old \$12.00 Rate

If you already sent in \$12.00 you have a couple of choices. First, if you prefer not to continue your membership at the higher rate, please drop a post card to the BAS and you will quickly receive a refund check for \$12.00. We will be sorry if you choose not to continue, and apologize for your time and trouble in renewing at the old rate. Late requests for a refund (received after the November issue is mailed) will be pro-rated.

Those of you who prefer to continue in the BAS for the coming year should send in a check for the additional \$2.00; we shall be sending out reminders with the November or December issues if we have not heard from you by then.

### **For Sale**

- \*McIntosh MR65 stereo FM tuner with walnut case. \$100. W. Meyers, (617)762-0812.
- \*FREE -- Seven turkeys in tweeters' clothing. I know I'll never use the tweeters in the driver survey (next issue --Ed. ), so anyone wanting to experiment with them can have any or all. Jim Nichol, (617)668-9089 (evenings).
- \*Two pairs Magnepan MG-2, as new, singly or in pairs. Audio Research EC-3A crossover. Dyna ST-400 with fan and meters. Call (919)449-4132 weekdays. Charles Phillips, Box 487, Gibsonville, N. Carolina 27249.
- \*Quatre power amplifier with built-in fan and custom walnut case, used once, \$240. Magnepan speakers, used once, \$475. Classic Marantz 8B tube amplifier with RCA tubes, \$235. All equipment in perfect operating condition. Money back guarantee if not satisfied. Manny Polo, 340 W. 28th St., New York, N.Y. 10001.
- \*AR -LST 1 in factory boxes with transferable warranty, \$725/pair. Soundcraftsmen PE2217 preamp-equalizer, less than 6 months old, \$325. H-K Citation 12 power amp, performance certified, \$200. SME 3009/2 with low capacitance cables and 3 headshells \$100. Stanton 681 EEE less than 6 months use, \$35. ADC XLM, \$20. Shure M-64 preamp, \$20. Celestion HF2000 new, \$60/pair. Wayne Robertson, (617)648-4191.
- \*Phase Linear 700B, Pioneer TX-9100, Yamaha CR-400, Dyna A10 pair, Sony TC-153SD. Mostly in ace condition with prices negotiable. Bob Heenan, 1906 Beacon St. , Brookline, Mass. 02146. Tel. (617)731-0140 eves.
- \*KLH Model 20 compact, recently had a complete check-out at the factory, \$250. Call (617) 263-0862 evenings or weekends and ask for Victor.
- \*Decca International tone arm, \$75. I will pay shipping. Write: Gerald Johnson, 542 NW 34th St. , Oklahoma City, Oklahoma 73118 or call (405)524-7233 after 5 PM CST.
- \*Tascam series 70 4-track 1/2-inch transport with 701 electronics in excellent condition. Two years old, asking \$1500. (617)277-1573 after 5:30.

Wanted:

- \*Marantz 7C, JBL SG-520 or McIntosh C-22 preamp. Also want one Quad electrostatic and/or Bose 2201. Will pay reasonable price. Bob Heenan, 1906 Beacon St. , Brookline, Mass. 02146. Tel. (617)731-0140 evenings.

### **Sound Guard's Secret Ingredient**

Regarding my comment on Sound Guard, I find I have made a foolish error. Although Sound Guard is over 99% trichlorotrifluoroethane (Freon 113), the final (less than) 1% is what you pay for. This unknown mixture of chemicals provides Sound Guard's unique record preserving qualities, as well as the anti-static and record cleaning agents. My father, who is a chemist at Dupont, is pretty sure that the record preserving ingredient is some sort of fluorocarbon talimar. I will try to find out how much less than 1% the extra compound is, but that would still leave uncertain the amount of fluorocarbon.

My suggestion is that a B.A.S. member with access to a liquid chromatograph find out what the extra ingredients are. Or perhaps someone can locate someone who does have access to one to do it for us. I will let you know if I have any further findings.

-- David Sherwood (New Jersey)

## More on Phase/Phase/Phase Distortion

In my article on phase distortion (July issue of the Speaker) I neglected to mention an important fact: the Bose 901 loudspeaker was used with four coplanar cones facing the listener squarely, but the other five cones were covered with lead-loaded vinyl sound-absorbent sheets.

Also, Footnote 1 might be misinterpreted, the way I wrote it. I should have said: "Linear phase means that phase distortion is not necessarily zero." But one quite specific class of linear phase device can be equivalent to an "essentially zero phase distortion" device, although other classes are not. The point is that equipment manufacturers who claim "linear phase" are hoping potential buyers will assume "essentially zero phase distortion," whether it is true or not. Claims should be more clearly stated and include something about whether the particular linear phase characteristic can indeed lead to low phase distortion by suitably adjusting an arbitrary time delay (such as the time delay between the act of recording and the act of playback). Maybe "low phase distortion" would be a nice, short way to say it, wherever it truly applies. But "linear phase" alone is too nonspecific, and the reader should be aware of this.

-- Dan Shanefield (New Jersey)

## Construction Hints From Someone Living Outside North Carolina

For those who might conceivably like to work in speaker system construction, here are some of my experiences so far:

1. Many speaker manufacturers publish construction projects, namely JBL, Electro-Voice, Phillips-Norelco, KEF, etc. (They all sell separate drivers. --Ed.)
2. You can work well with simple tools: electric drill, hand circular saw, screwdriver and hammer.
3. Wood finishing need not be difficult if you cut the wood carefully, or easier still, if you laminate the cabinet with Formica or similar products.
4. It is really rewarding, and there is a great sense of achievement.

Now, there is one slight peeve. In the June issue of the Speaker my name appears twice, and twice I am identified as being from North Carolina! Really, now! I am from Puerto Rico.

-- Carlos E. Bauza (Puerto Rico)

## BASF Leaves Recorded Music

I read in the International Herald-Tribune that BASF will be withdrawing from the recording business. That is a particular shame because their catalog includes many really outstanding performance. The records have been hard to find recently in Boston, but I was told that they would be available again by now, and I recommend the following:

BACH: Cantata 106

BEETHOVEN: 4th Piano Concerto, performed on original instruments

SCHUBERT: "Trout" Quintet, played on a fish of the period (actually an excellent performance in my opinion)

-- David Satz (Massachusetts)

## On the AR Tonearm

[The following letter was in answer to BAS member Carlos Bauza's inquiry regarding an improved tonearm or a modification for the AR-XA turntable. --Ed.]

Discussing the design and interaction between a tonearm and a cartridge-stylus combination is not easy, particularly in a letter. Optimally, the best combination will result in a resonance frequency of approximately 15 Hz. One of the primary considerations is to make certain that under no circumstances will the resonance of the tonearm be closer than an octave to the resonance of the suspension. Obviously, the resonance of the suspension should be approximately one octave below the resonance of the arm-cartridge combination.

If one examines these considerations and then investigates the differences in stylus compliance of the most popular cartridges today, one can begin to understand how difficult it is for anyone to design a tonearm that will accommodate the great majority of the cartridges available today, and operate in the "optimum" region. Indeed, it is best to design a cartridge-tonearm combination that is meant to be totally complementary and, therefore, "best performing". However, any such combinations made in the past have proven very unsuccessful commercially. The reasons for their being commercially unsuccessful are myriad and, like everything else, a cartridge-tonearm combination is a series of compromises and there will always be those people that do not believe the "right" design compromises were made. This is so even though the compromises made in separate cartridge -tonearm combinations are much greater than would be the case with a combo unit.

The ADC-XLM is a very fine cartridge which, unfortunately, requires a tonearm designed specifically for it to operate optimally and to permit its performance superiorities to emerge. One can take an existing tonearm and make attempts to modify it but, unfortunately, the result will be a severe compromise at best. Such things as bearing friction, moment of inertia and many other factors have to be made optimum; and the simplest way to do that is to design and machine a tonearm for the cartridge. It is strange that when ADC made available the Pritchard arm for a short period of time, the acceptance of this arm was so small that eventually it was discontinued.

To recap then, we must make a tonearm that will accommodate the majority of cartridges available. You would be surprised at some of the mounting requirements of some cartridges, and the results of providing mounting capability for these. Having done a research project recently, I found it was very difficult to substantially reduce the mass of the tonearm shell and still provide mounting capability for cartridges such as the Microacoustics, Denon, et cetera. At the same time, a tonearm has to have the facility to permit replacement of the shell in case that the cartridge mounting threads are stripped, et cetera. We do not offer a modified low mass arm since it would be difficult, if not impossible, for someone to mount this arm and adjust the bearings properly in the field.

-- C. Victor Campos, Director of Technical Services for Marketing, Acoustic Research

## Damping, and the Shreve/Rabco Tonearm

For some time I have read the B.A.S. Speaker's articles on pickup arm damping with interest and occasionally more than a little amusement. The interview in the April issue with Mr. Rabinow has moved me to offer my own comments on damping. Mr. Rabinow has given you a good clue with his statement that damping forces act at all times. Damping forces applied at the pivots act against the arm and cartridge, and thus push on some of the generating elements in the cartridge. This has to have some effect on the electrical output of the cartridge! This acts on each pulse in the musical waveform, and music is made up of pulses rather than continuous sinewaves. In addition, F. V. Hunt has pointed out (Benjamin B. Bauer, "F. V. Hunt and the disc recording arts", J. Acoust. Soc. Am., Vol. 57, No. 6. Part 1, June 1975, pp. 1327-1331) that viscous damping at the pivots may cause mistracking at low tracking forces. I fear that damping forces will have some effect even at higher tracking forces. Also,

some types of damping enhance low-frequency response, a result which cannot be considered faithful to the original performance.

[It may be that some damping force is present at all times, as Mr. Shreve suggests. If the damping is optimally applied, however, it will not degrade the normal performance of a good cartridge. When the purists suggest that damping is harmful, etc., they seem to forget the fact that in the real world of tone arms with mass, there are certain physical laws that cannot be ignored. Let's look at the automobile again: it would be fair to say that the shock absorbers have an effect on the car at all times. Properly adjusted, they provide a smooth, relatively comfortable ride. If, however, one were to remove the shocks altogether to eliminate any damping effects on the car, the ride would be intolerable on anything but the smoothest roads. The same laws apply to the tone arm and cartridge, only on a smaller scale. It's as simple as that. It has been reasonably proven, to several BAS members at least, that high quality cartridges perform and sound much, much better in properly (lightly) damped arms. --Ed.]

There are other factors in arm-cartridge combinations which have not received sufficient attention recently: rake angle and vertical tracking angle (VTA). Ralph Hodges has recently mentioned rake angle in Popular Electronics, July, 1976. Many people believe that for proper playback a cartridge should have a VTA of 15°, and I have heard talk of a new standard of 20°, and even 30° to take into account groove springback or some such thing. I have demonstrated to many people, with Decca and Denon cartridges in my arms, audible effects of a change in VTA (or rake angle -- unfortunately the two are changed together) of one or two minutes of arc! Strangely enough, I find insignificant variation in thickness of discs. There are two major thicknesses, that of standard discs, and that of the super-thin pre-warped disasters. A much more serious problem is sample-to-sample variation among cartridges.

Turning to a different topic, I wish to make known my modification of the Rabco SL-8 and SL-8E. Audio Research has one of my arms, as do Magnepan, and FMI. Incidentally, Jim Winey has the best-sounding KMAL I have ever heard. He has removed all the silicon fluid and made several other changes.

The Shreve-Rabco Pickup Arm. The Rabco SL-8 or SL-8E is used as a source of parts. The outer gimbal is retained and the cones are used after their surfaces are improved. All the other moving pieces of the "conventional" part of the arm are replaced. A balsa arm with a magnesium breech block to hold the bearings is installed. There are slots in the balsa to adjust the overhang of the cartridge. The balsa arm is hand-built with internal bracing for strength and rigidity. The advantages of balsa are high strength for a given mass, and internal deadening, which means that vibrations from the cartridge cannot cause resonances in the arm. Miniature precision instrument bearings are chosen to have low mass and friction and to have no significant internal resonances. A special lubricant is used to permanently lubricate the bearings. The breech block and inner gimbal are precision-machined from magnesium. A nylon rod holds the counterweight. New lifting and centering mechanisms are installed. The carrier for the vertical contact wire is replaced with a low mass, easily adjusted device. The arm is very stable due to its new geometry; in order to make the stylus jump a groove it is necessary to tap the aluminum track with considerable force.

The total moving mass, excluding cartridge and counterweight, is less than 20 grams. The vertical moving mass is less than 16 grams, and the effective mass of the arm with any of the four lighter counterweights is no more than about 4.5 grams. Thus the arm is well suited to the low mass, high compliance cartridges to be developed in the future.

The result of all these changes is a straight-line arm with extremely low mass, low moment of inertia, low friction, and built with nonresonant materials. Vertical tracking angle is easily adjusted, even while playing a record (although this is not recommended). Under the proper conditions it is possible to hear the effect of a change in VTA of less than 2°.

The arm has no sound of its own. Dynamic range and transients are limited only by the rest of the system. The frequency response with a good cartridge is extremely smooth due to the absence of arm resonances. Clarity in complex passages and inner grooves is astonishing. The arm allows a cartridge to work at its best with complete freedom, and the sonic advantages are immediately apparent to the listener. The price for rebuilding the customer's arm is \$395. The price for a complete arm is \$545.

-- David Shreve, 3402 N. Oakland Ave., #106, Milwaukee, WI 53211

[Members should note that a comparable Rabco modification is offered by BAS member Dean Slindee, P.O. Box 55, Lansing, Iowa 52151. Write for specifications and prices. --Ed.]

## Where's Win ...

I am unable to ascertain the status of Win Labs. A friend in San Diego was in contact with Dr. Win last week. He told me that Win took a bunch of orders for his pickup at the Consumer Electronic Show in Chicago in June. He also intimated that Win's accounts receivable were not being received. This friend is the same person who has designed a tube power supply for the Win cartridge. An Australian friend also saw enough potential in the Win to design a rather elaborate tube type power supply for it. Nevertheless, my intuition guided me away from it. The complexities of a sound system get too great. I have recently had a sad experience with an expensive Paragon preamp, which emphasized the need to deal with rock solid, reputable, reliable firms.

I know of no audio shop in central California that carries the Win.

-- Dow Williams (California)

## Notes from Japan: High Quality Records

Audio Lab is a small company, headed by recording engineer and prominent audio critic Okihiko Sugano. The company recently began making discs and master copy tapes with dbx encoding. The equipment used for the mastering process is the following: dbx 142 (dbx II), dbx 187 Encoders; Scully 280 Tape Recorder; Neumann U87, Shoeps CMT-56 Microphones; Quad Eight LM6200, Ampex AM10 Mixers; dbx 122 Decoder; Altec 605B Monitor Speaker.

At the moment I am only sure of the availability of one dbx encoded record/tape, "Alone Together" (jazz), in four versions: dbx-1035 (dbx encoded disc) 3500 Yen, ALJ-1035 (non-encoded disc) 2500 Yen, ALT-30 dbx (dbx encoded, 2-track, 15 ips tape) 15,000 Yen, ALT-30 (non-encoded, 2-track, 15 ips tape) 15,000 Yen.

The company also produces a number of other high quality non-encoded discs and tapes. For additional information write: Audio Lab, 2-3-4 Sendagaya, Shibuya-ku, Tokyo-to 151, Tokyo, Japan.

Denon PCM discs started coming out about three and a half years ago. The PCM type II recorder (lighter, yet as good as the first model) was developed in the fall of 1974 and it has been in use in Europe due to its portability. PCM recordings are reported in Japanese audio magazines as having high resolution, excellent signal-to-noise ratios and low distortion. The following is a list of some Japanese PCM recordings available from Nippon Columbia, 4-14-14 Akasaka, Minato-ku, Tokyo-to, Tokyo, Japan.

Bach: Chamber music, OX-7021, 2500 yen

Mozart: Concerti I, OX-7022, 2500 yen

Concerti II, OX-7025, 2500 yen

String Quartet #14 and #16, OX-7034, 2500 yen

Beethoven: Piano Trio "Archduke", Suk Trio, OK-7035, 2500 yen

Liszt: Piano Collection, OX-7029, 2500 yen

Also available on PCM discs are these recordings of Japanese instruments:

Shamisen (3-stringed lute), WP-7005, 2200 yen  
Fue (flute), WP-7006, 2200 yen  
Taiko (drums), WP-7007, 2200 yen  
Shakuhachi (bamboo flute), WP-7008, 2200 yen  
Koto (harp), WP-7009, 2200 yen

Toshiba Dynasound specializes in pre-recorded cassette tapes, using Fuji FX stock. All tapes are 2600 yen and are available from Toshiba EMI Corp. , Tape Sales Div. , 2-2-17 Akasaka, Minato-ku, Tokyo-to, Tokyo, Japan.

Stravinsky: Firebird (Complete), Ozawa/Orchestra de Paris, AAZA-5501  
R. Strauss: Ein Heldenblen Op. 40, Karajan/Berlin Philharmonic, AAZA-5503  
Rimsky-Korsakov: Scheherazade, Rostropovich/Orchestra de Paris, AAZA -5502  
Satin Doll, Jazz by Japanese musicians, ZA-500x  
Synthesizer music, by Japanese musicians, ZA-5005  
-- Norikisa Sayanagi (Connecticut)

## **Book Review**

Sound System Engineering by Don and Carolyn Davis, published by Sams & Co. /Bobbs Merrill Co. , and available by mail order from Audio magazine at \$19.95. (Better add \$2.00 for first class mailing, otherwise it takes over a month, sometimes two!). Somehow, I expected this to be a home audio publication (because of its advertising in Audio). I've seen some "high end" books before, but this is high, high end. It's geared to auditoriums, concert halls, professional rockers and sound stage types. It's absolutely filled with formulae and calculator-exercising material. It is well written and arranged for its purpose.

The good news is that it does cover some basics that are applicable to the home audiophile's interests. To wit: sound waves tend to bend toward cooler air; information about professional miking; impedance matching methods; bi-amplification; time delay systems; equalizing the sound system; and some beautiful illustrations on correct and not-correct methods of wiring in systems and their connections. The Definition of Terms section is very good, and for the first time I'm understanding the technicalese of audio. I think the book is somewhat over many of our heads in its original intention, but enough of it is applicable for our home systems to make it worth reading.  
-- Bill Tyrrell, Jr. (Pennsylvania)

## **In the Literature**

### Audio, October 1976

\*Annual Equipment Directory -- quite a big issue, but costs \$1.25.

\*A Dealer's View of Discounts and Service: interview with Ralph Sommer of Barnett Bros. of Philadelphia. (p. 28)

### AES Journal, July/August 1976

\*Microphone Considerations in Feedback-Prone Environments, by Robert Schulein of Shure. (p. 434)

\*Preliminary Results of the 1975 AES Audiometric Survey, summary of hearing tests conducted on AES members. (p. 455)

\*Role of Polymer Science in Developing Materials for Phonograph Discs, by RCA researcher -- lots about "polymer rheology" but nothing about Dynagroove. (p. 464)



### Popular Electronics, October, 1976

- \*Build Panamix: low cost 5-input stereo/mono mixer. Line level mixing only, too noisy for most mikes. (p. 50)
- \*"Stereo Scene": summer CES show. (p. 32)
- \*Test reports on ADC Accutrac 4000 turntable, Micro Acoustics 2002e cartridge, Phase Linear 200 power amp. (p. 72)

### Radio-Electronics, October, 1976

- \*Reel-to-Reel Cassette: Len Feldman examines the new Elcaset format. (p. 48)
- \*AM Stereo: Its Time Has Come: proposed compatible stereo broadcast system. (p. 51)
- \*"Mystery of the Failing Tweeters. " Len Feldman analyzes tweeter overload factors -- some interesting spectrum analyzer photos. (p. 58)
- \*Test reports on Shure M24H cartridge, Sansui RU-9900 tuner. (p. 69)

### Recording Engineer/Producer, August 1976

- \*As usual, the advertisements are interesting, beginning with that for the new dbx plug-in replacement for Dolby A cards in multi-channel rack systems; we note that replacing the CAT-22 is the K9-22, said to eliminate the hiss without putting too much of a bite on the wallet. (p. 21)
- \*Time delay and digital processing are extremely big in modern studios, and a good discussion of both is given Ken Schaffer on p. 55.
- \*Crown offers the EQ-2, an eleven band stereo equalizer with adjustable center frequencies in each band ( $\pm$  one-half octave). (p. 67)

### Stereo Review, October 1976

- \*Review of the new Angel "XDR" cassettes must be read to be appreciated, but high hiss (with some exceptions) and compressed or limited peaks hardly sounds like "extended range." However, even with consistently high recorded levels on the tape, distortion was not obvious. One quote is good: "Using a dbx 119 in its [above-threshold] expansion mode ... I was just about able to equal some of the disc's remarkable vigor, but it took literally all the expansion the dbx device could produce." Music for the masses, or for the automobile, but apparently not for the audiophile. (p. 12)
- \*Of interest for small systems might be the Onkyo 4500 receiver, which apparently uses their fine but inexpensive tuner (review, p. 31). And the Crown IC-150A maintains a straightforward approach to preamplifier design, but with much improved flexibility over the 150 model. (p. 48)
- \*A tabulation of cassette deck specifications on pp. 68-69 might be handy, but pour on the salt. There are errors in the table.
- \*Irving Kolodin displays his love for Tchaikovsky on p. 76.

### Tape Deck Quarterly, Summer 1976

- \*"A New Tape System. " Larry Zide analyzes the new Elcaset. (p. 6)
- \*The Case for Cassettes. (p. 10)
- \*Feldman lab reports on Pioneer CTF 9191, Technics RS-630US, Kenwood KX-720 cassette decks, Fuji FL-60 Low Noise cassette tape, Stax SR-44 headphones, JVC SEA-10 equalizer. (p. 25) TDQ is published by FM Music Program Guide, Inc., 20 Hampton Rd., Southampton, NY 11968. Cost \$1.50 per issue, subscriptions \$4.50/year or \$10/3 yrs. This is the same company that publishes FM Guide.

### Wireless World, June 1976

- \*Surround-Sound Decoders, Part I: CD-4 demodulator. (p. 42)
- \*Low-Noise Cassette Deck, Part 2. (p. 62)

db. September, 1976

- \*Theory and Practice: on crossover design. (p. 11)
- \*Broadcast Sound: on the problems of sending audio over the phone lines. (p. 16)
- \*The Signal Path: Part III, Digital/Analog Leveling Control, by the ubiquitous Walter Jung. (p. 31)

EDN, September 5, 1976

- \*Universal Building Blocks Simplify Active-Filter Design by General Instrument engineers. Article says that the "Active Filter Design Handbook" is available free of charge by writing on company letterhead to General Instrument Corp., Semiconductor Products Group, Hybrid Microcircuit Dept., 600 W. John St. , Hicksville, NY 11802. If you don't have the right type of letterhead, try it anyway -- it usually works. (p. 91)

Electronic Design, September 13, 1976

- \*Use Slew Rate Filtering to Discriminate Against Noise Spikes. Claims no phase or amplitude distortion. We have mentioned several articles on similar filters that might be useful as pop filters -- is anyone out there tinkering with such things? (p. 110)
- \*Digital Encoders/Decoders Enhance Audio System Sound. Hybrid Systems announces the availability of modular "Delta-sigma-with-memory" time-delay encoders and decoders for \$59. These are the input and output portions of the digital delay line in the Audio/Pulse Model One. But before you snatch up a couple to build one yourself, be forewarned that the production-line unit includes 2 each of the input modules and four each of the output, for a total outlay of \$360 before you begin to assemble the remainder of the circuit. (p. 138)

Electronics, September 16, 1976

- \*"New FETs Thunder into View". Everyone seems to be working on vertical power FETs, including U.S. companies Siliconix, National Semiconductor, Signetics, Intersil, Motorola, Fairchild, RCA; and Japanese companies Hitachi, Sony, Nippon Electric, Mitsubishi, and Yamaha. Soon it may be possible to have a VFET power amp and still boycott the goods of the Japanese whale killers. (p. 80)

Electronotes, September, 1976

- \*Very favorable review of the Handbook of Operational Amplifier Circuit Design. (p. 20)

High Fidelity, October, 1976

- \*Test reports on speakers Hartley Holton Jr., Lafayette Criterion 2005, Pioneer HPM-60, Scott PRO-100, GTE Sylvania GTE-412. (p. 53)
- \*Four Ways to Put Yourself in the Concert Hall: comparison of Audio/Pulse, Sound Concepts, Tapco 4400 spring reverb, Sansui QSD-1 Vario Matrix decoder. (p. 63)
- \*What You Should Know Before Buying a Speaker; ho hum. (p. 81)

Modern Recording, August/September, 1976

- \*The History of Recording, Part 6, 1950-1976, by Bob Angus. An interesting story of the tape recorder business. (p. 26)
- \*Behind the Scenes at Tanglewood. How the BSO broadcasts are done (but no mention of the distant mike placement). (p. 36)
- \*Me-Too-ism in Audio: Len Feldman contrasts AR's time-delay research with the general lack of originality among manufacturers. (p. 58)

\*Generation of Equal-Toned Pitches: IC dividers for electronic generation of near-equal-tempered pitch. (p. 69)

#### Wireless World, July 1976

\*Wideband Componder Design: square law circuit with 100 dB dynamic range. (p. 45)

\*Electrostatic Headphone Amplifier: Simple circuit uses quad op amp LM3900N. (p. 35)

\*Stereo Surround Sound Decoders, Part II: Performance measurements of CD-4 decoder using IC; test of nine CD-4 cartridges with spectrum analyzer photos. (p. 65)

\*Semiconductor Development: Description of two Sony devices, a V-FET and a LEC (low emitter impurity concentration) bipolar transistor. (p. 75)

-- Dana Craig and Harry Zwicker

### **ESS Mk. I Headphones -- a Listening Report**

When Phil Coelho of ESS spoke at a BAS meeting about the ESS Heil speakers, he brought with him a pair of Mark 1 stereo headphones, which were then a brand new product. These were left behind for evaluation by BAS members, and this report compiles our comments on the Mark 1's.

It may be significant that this "test panel" never gathered together in one place to listen under uniform conditions or to compare notes. Of course, headphones defy instantaneous A-B comparison because it's impossible for most people to wear two pair at once, but some of the variables might have been better controlled -- the comparative units, the source material, and the electronics. Even taking all the variables into account, the range of comments is a bit surprising, if not staggering.

Our listeners numbered six -- Ira Leonard, Mark Foreman and Al Foster (who listened together), Bob Graham, Bob Borden, and myself. Personal taste and physiology being what they are, it's not too surprising that Bob Borden at the one extreme could liken the phones to very tight vices while Mark and Al could pronounce them "very comfortable." After all, Bob was comparing the Heils with AKG's and Mark and Al with Koss Pro 4AA's. The more disconcerting extremes were to have Bob Graham assert that he's "not easily pleased" by headphones class the Heils as a superior headphone with smooth clean sound as "undistorted as I've ever heard from headphones," while Ira Leonard pronounced the sound "canned, raspy, and super-cavelike."

For the record, the Heils list at \$97 and weigh in at 22 ounces with fourteen feet of coiled cable and at eighteen ounces without. Although the ear-cushions surround the ear and provide a good seal, the drivers are vented at the rear, so the isolation from ambient noise is not high. More significantly, the headphones are unusually inefficient. Some of the panel -- including myself -- were able to drive them from the headphone jacks on our electronics, but others could not. ESS provides an adapter for hooking the headsets to the speaker taps of an amplifier, but Al Foster and Mark Foreman found this alternative unsatisfactory because it produced hum and hiss at their speakers. Bob Borden -- who could use them with his headphone jack -- nevertheless found the speaker tap adapter gave better sound. A separate headphone amplifier seems worth considering. Here's a tabulation of our jury's findings.

Ira Leonard, comparing with Yamaha HP-1S. Location of instruments seemed to be frequency dependent, with cymbals and other high-pitched instruments seeming more prominent and forward and the midrange sounding farther back. "Not a pleasant or a comfortable experience."

Mark Foreman and Al Foster, comparing with Koss Pro 4AA. Bass "fat" and boomy, though some bass notes seem to be missing, Nothing above 10 KHz. Pro 4AA's more natural and balanced.

Bob Borden, comparing with AKG. "After 10 minutes of listening, they induced pain within my ears." After that he could listen for over an hour "with no great discomfort and few sonic irritations." Pleasant, smooth sound with excellent transients but lacking transparency.

Bob Graham, comparing with AKG 60. Bass audible to 30 Hz. Revealed instrumental detail. Clearly superior to the AKG's. Also compared the Heils to other phones including the Stax SR-3 and found the differences subtle.

I will leave it to dispassionate audiophiles (those who have not replaced a component within two years) to decide if it's significant that the more favorable comments came from users of AKG headphones, and whether that says more about the headphones or about the users. As for my own comments, I will pass up this opportunity to find creative adjectives to describe what I heard through these headphones (Gordon Gow, are you out there?). I side with the thumbs-down crowd. I was always relieved to return to my Pro 4AA's after listening to the Heils.

-- Henry G. Belot

### **Full-range Heil Speaker Announced**

ESS has apparently completed its three-year development of a Heil woofer and is using it in a full-range Heil system called the Transar/ATD. The woofer portion of the system appears to be quite similar to that described by ESS President Philip Coelho at the January 1976 meeting of the BAS (see the February BAS Speaker for details).

A multi-way system, the full-range Heil uses a current source amplifier with the woofer in its feedback loop to further improve low frequency performance of what should already be, in theory, a very satisfactory driver. There are separate electronic crossover facilities for the higher frequency Heil drivers apparently forcing the user to a biamplified system approach.

For those without access to a February Speaker, here's a brief description of the woofer: instead of a typical cone, the Heil woofer uses five Lexan diaphragms supported by four graphite drive rods. The combination of high sonic propagation velocities through the drive rods, the low mass and short excursions of the diaphragms should make for exceptionally good bass transient response. ESS also claims that the structure virtually eliminates the possibility of diaphragm resonance. A single voice coil is used to control the drive rods, also reducing moving mass. Last January, Coelho estimated the moving mass of a Heil woofer at about 12 grams; the new structure should result in a somewhat lower figure, and even the former was well below that for typical cone woofers.

ESS has not announced the unit's price yet but early estimates pegged it at about \$800.

-- Jim Brinton

## September BAS Meeting

### Business Meeting

For the first time in quite a while, the BAS met at the GTE Laboratories in Waltham. Our meeting there was made possible by Cizek Audio Systems, which footed the bill, provided refreshments, and gave an impressive presentation. While Roy Cizek and his new speaker were the major attraction, this was also our annual business meeting. Officers for the new year were nominated and elected en masse: Jim Brinton, Alvin Foster, and Harry Zwicker continue in their familiar roles as President, Recording Secretary, and Treasurer respectively. Frank Farlow replaced Joyce Brinton as our Corresponding Secretary. Joyce was voted a perpetual membership in the Society for her steadfast contribution to the BAS in both the present and prior administrations. A motion to vote perpetual memberships to Jim Brinton and Al Foster had to be declined because the bylaws require officers to be dues-paying members, but Bob Borden was accorded the honor in thanks for his tireless work during the last two years. Bob has coordinated the publication of the Speaker, devoting an enormous amount of energy to such matters as copy editing, technical typing, proof-reading, typesetting, paste-up, and getting all of these activities to come together on schedule every month. Now he must end his active participation in such matters, and he'll be sorely missed. Several members will jointly try to fill his shoes.

The largest part of the business meeting was devoted to establishing the new dues rate. Harry Zwicker's report appears elsewhere in this issue, but a brief explanation of how the new dues rate came about is appropriate here. As you know the dues you pay go almost entirely to defray the Society's expense in publishing the newsletter. During 1976 postage rates went up, and are subject to further increase. The situation is further clouded by our losing the services of Bob Borden, who was able to get many publication services performed at nominal rates. The search is on for volunteers and low-priced replacement services to keep our expenses in line, but some increase is inevitable. Using conservative estimates the Executive Council recommended raising dues to \$13.50 but that figure seemed too conservative to a sizable majority of those present who noted that the figure fell a little short of the projected expenses. Admittedly these projections are guesswork at best and the real figures could go either way, but the consensus was that slightly higher dues were better than a shortfall.

Another possible financial hazard lies ahead. It may be necessary to charge admission or ask for voluntary contributions to pay for meeting halls. In the past we've managed to find meeting rooms that were free, but good rooms are hard to find on that basis and some former wells of generosity have run dry. Rental of the GTE location was \$80 and our meeting there this month was made possible by Roy Cizek. If you know of a place, speak up.

Jim Topali is now Refreshments Chairman. Jim will try to spread the burden around by forming a roster of people, each willing to supply refreshments once or twice a year, just as we currently apportion the "Speaker-stuffing parties." If you can help, give him a call. The larger the pool of volunteers, the less the burden.

Finally the Speaker has a new Editor-in-Chief in the person of Mike Riggs, and he also needs a larger pool of volunteers to keep the publication coming. We need people to write these meeting notes, to serve as Coordinating Editors once or twice a year, and to help in any of the other tasks involved. If you can type, do pasteup, key-punch (for the mailing labels), or anything at all, please let Mike know. We need all the help we can get.

This month's "Thieves' Market" included some new records from Scott Kent (French Harpsichord and a recital of Donanyi piano music), Ira Leonard had two Insight records, Jim Richardson took orders for recording tape (Scotch 177 at \$4.78 for 3600 feet, 407 for \$9, and NAB flanges and screws at \$13.50 a dozen); Larry Kaufman offered to squeeze an extra 1200 feet on your 10 1/2 reels -- local members only --, and Al Foster had twenty reels of Maxell UD35 on 7-inch reels.

Cary Lu is looking for information on a Sony portable reel-to-reel recorder that resembles the famous Nagra film recorders in appearance. It's known as the model 510 in Japan and the 520 in Europe. It's a battery operated, 2-track, and 3-head machine and weighs about fifteen pounds. Response is claimed to be  $\pm 3\text{dB}$  to 25,000 Hz, and the price in Japan is about \$530. Its main limitations are tape capacity (5-inch reels) and availability (it isn't). Cary Lu wants to know if the latter problem will be cured. Sony, are you out there?

And for those of you who bought TDK Super Avilyn cassettes through the BAS, you can breathe a little easier. The samples we obtained do not appear to be among those exhibiting excessive dropouts. However, Peter Mitchell reported that SA seems to exhibit higher print-through than chrome.

### Meeting Feature

A quartet of Roy Cizek's new speaker systems could be heard before the meeting, during intermission, and afterward, and comments throughout the room were highly favorable. Cizek took a degree in music and music theory from Indiana University, but he minored in physics and it was the technical side of his nature that finally won out in his professional life. Designing speakers began as an avocation, prompted by his dissatisfaction with the speakers he heard. First he built them strictly for his own pleasure, then eventually people paid him to do it. He designed several house-brand speakers during twelve years or so in the Midwest. He moved to Boston two-and-a-half years ago and after an aborted venture with AEI is now in business for himself as Cizek Audio Systems. The first speaker from this firm is a two-way acoustic suspension system with a ten-inch woofer and one-inch tweeter, available in wood or vinyl finish for \$196 and \$176 respectively (from Tweeter and Eardrum locally).

So far, so good, and so what? All seems pretty average to this point. But what members heard in the back of the room was not "so what" or "average." The Cizek speaker easily lived up to its advance notices on "Shop Talk." So how does a designer turn a seemingly stock formula into a system that's a sonic standout? That was the question Roy and mathematician Mark Gailus addressed in their presentation.

One major innovation in Cizek's design is embodied in the crossover network. By now we've seen ample demonstration that many fine speakers present very complex loads to the amplifiers that drive them. Several of the amps we've seen in the last year have been designed with these complex loads in mind. These difficult-to-drive loads result in part from the fundamental resonances in the drivers, which produce peaks in the impedance curve. If you consider one driver in isolation, its resonance is not a major problem; connect a tweeter directly to an amplifier and its resonance will be damped electromagnetically. The problem comes when the speaker manufacturer treats his drivers as though they were fixed-value, purely resistive loads. By putting resistors in line with a driver he isolates it from the amplifier. Not only does the impedance peak remain, but the mechanical resonance goes undamped.

Furthermore, the crossover in most two-way speaker systems is operating near to the resonant frequency of the tweeter. Because the crossover doesn't compensate for this, some speakers tend to be rough within the crossover range. Output fluctuates rapidly as the drivers go in and out of phase with one another, and fundamentals tend to be subtracted while distortion products can be reinforced. These fluctuations are masked on chart recorders which may scan too fast to reveal them, or sometimes these variations aren't properly observed.

A crucial innovation in the Cizek speaker is the addition of an impedance-compensating shunt network to each driver. Thus the woofer's rising midrange impedance is flattened, and the tweeter's resonant impedance peak disappears. To the outside world the speaker appears as a constant-impedance resistive load. This improves the power transfer from one's amplifier and makes the behavior of the crossover network predictable. The drivers are in phase throughout the crossover range, so their output combines smoothly. The user also gets an unusually flexible set of contouring controls.

The Cizek speaker includes three contour controls. The High Frequency Contour (H.F.C.) control is a five-position switch which allows the user to introduce a variable roll-off of the extreme high frequencies, useful in controlling presence in close-miked recordings. The High Frequency Level (H. F. L.) control allows one to raise or lower the entire response of the tweeter -- including the contour selected on the H.F.C. control -- with respect to the bass. This is especially helpful in matching the speakers to the room. Most unusual is the woofer Q control, which allows one to choose a Q of 0.6 or 1.0. The 0.6 setting sacrifices some deep-bass response (down about 4dB at the 38 Hz resonance) but provides exceptionally clean transients. Those who like to hear lots of pedal from their pipe organ recordings will prefer a Q of one. This flattens the deep bass and pushes response a little above flat from about 38 to 150 Hz, resulting in a little overhang on transients and a sound that's not quite so "tight." It also lowers the speaker's efficiency.

The Cizek speaker was originally designed to please its maker and was not for sale. Many of the usual design parameters (a speaker to sell for x dollars and so on) did not apply. Since Roy likes lots of power, one feature of the finished product is relatively good power handling abilities. He rates the system at 150 watts music power with the woofer capable of handling 100 watts continuous. The system can put about 104dB SPL into an average room.

One factor in this power-handling capacity is the woofer which C. A. S. makes itself. It has a very long two-layer voice coil which won't run out of the gap even under abnormal test conditions. Another factor is again the crossover design and the choice of drivers. Because tweeter and woofer are in phase in the crossover region, they can be operated more conservatively than in other designs. The tweeter can be down 6 dB at crossover rather than 3 dB as in other designs using it, because the woofer is reinforcing the tweeter during crossover. Hence less excursion is needed from each driver to produce an equal sound level.

This sharing of the work load has additional advantages for the woofer. Woofers are subject to cone breakup at the high end of their response, where they're crossed over. Because it's not excited so heavily in this area and because Cizek's woofer includes a rubber ring a little way out from the voice coil, breakup is a much smaller problem.

The tweeter is a stock Peerless brand one-inch dome radiator with good dispersion to about 12 kHz and non-directional response to 8300 Hz or so. It was selected with the crossover design in mind rather than on the basis of tested "flat" response -- meaning response connected directly to an amplifier. Each tweeter is tested for dispersion, frequency response, distortion, sensitivity, and the location of its fundamental resonance before being accepted for production. It is mounted unusually close to the woofer to take advantage of its coherence with the woofer. If it were mounted at some distance, there would be audible interference effects at modest off-axis angles.

### Questions?

Victor Brociner, when he discussed the Avid speaker at a BAS meeting, spoke of cavity resonance. He said that when tweeter and woofer were mounted within a wavelength of one another there would be a resonance in the tweeter response. Peter Mitchell wanted to know if this didn't apply to the Cizek system and why Roy chose a front-firing design. Cizek feels that cavity resonance is a small matter, and calls it not detectable even in an anechoic chamber unless you can find the mike position where it's seen and would have hardly any effect in a living room. The other point is more basic in Roy's mind. He feels one can't design a speaker properly by working backwards from its intended integrated room response. He feels he can hear what's going on in a millisecond, and the first sound one hears from a speaker is its on-axis anechoic response. Therefore anything which detracts from this is an undesirable aberration. Rear and side-firing designs produce time delays that smear transient response. That may sound "smoother" or "more like a concert hall," but certainly not "accurate." In support of Cizek's position, Scott Kent asserted that it's the job of the recording engineer to get the room balance correct and then the speaker's job to reproduce what the recordist picked up.

Roy's design method is to begin in the anechoic chamber to check on-axis response down to 500 Hz, then move outside to check frequencies below that. He measures power response to check dispersion, measuring in a reverberant chamber and off-axis in the anechoic chamber and outside. But the final test is the ear. It was Alvin Foster who found the fluctuation in the 1400-1600 area which led Roy to slow down his chart recorder and run it by hand to find the discrepancy.

Some questions were raised about the Dahlquist speakers and their approach to phase coherence. Roy and Mark were skeptical about locating the drivers in different planes, noting that that can work at only one frequency and only when the drivers themselves are coherent to begin with. Drivers don't have such clean phase characteristics that such an approach can do much. However, Mike Riggs pointed out that the Dahlquists seem to have unusually good "depth-imaging" and that they do make claims for their crossover contributing to the sound. This seemed more plausible to Mark, who said that, in fact, the Cizek system has exceptional depth-imaging, but no multiplane drivers. Simpler is better, he said.

As for the future, there's a less expensive two-way on the drawing boards with a fundamental resonance at 45 instead of 38 Hz. It will have a smaller enclosure and price -- around \$115. They're also looking at a three-way system, although, on the whole, they feel a two-way is preferable. The problem with two-ways is getting the crossover low enough to achieve optimum dispersion from the woofer. The three-way should have better midrange dispersion and a little better power-handling ability. If the present Cizek speaker is any indication of what this company can do, these new speakers will be real winners. -- H. G. Belot



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## Tape Machines for Stereo Field Recording

Cary Lu

This article is based on personal experience with the following tape machines:

- Sony TC-153SD cassette (about \$370)
- Nakamichi 550 cassette (\$500)
- Stellavox SP7 5-inch open reel (over \$3500)
- Nagra 4S 5-/7-inch open reel (over \$4000).

Obviously there is a wide variation in the costs of these machines, and the philosophies behind them are so different that none is directly competitive with any other. What they have in common is that they will all run off batteries and will record in stereo while slung off your shoulder or in any other position. If you don't need these features, a conventional tape deck is more satisfactory and generally cheaper. My comments are directed to the suitability of each machine for field recording.

### Sony TC-153SD

This is a cassette deck with features very similar to those of a home deck. It runs on four D cells or on an internal ac supply. The ac supply produces faint but distinct hum in recording and playback. To save batteries for long recording sessions, I wound up using a small dc power supply (Heathkit IP-18—\$25 as a kit).

The Sony has a reputation in some circles for bad wow and flutter. My unit came with a little wow which rapidly grew worse; after a while the transport would actually stop momentarily. After replacement of the drive motor (under warranty), the problems were cured, and neither this machine nor the Nakamichi shows significant audible wow and flutter on music. (Most TC-153's seem to be okay, but two other owners have told me of similar experiences; both had the motor replaced.)

The power supply is interlocked to the transport controls so the machine cannot be left on inadvertently, running down the batteries. This seems to be responsible for the one-second delay before anything happens when it is turned on. Visibility of the controls is fairly good, though it may be necessary to bend over the top of the machine to see settings when it is on its shoulder strap. Under the often rough and ready conditions of field recording, the recordist needs frequent and absolute reassurance that everything is set properly. But, the toggle switches on top stick out, making the machine difficult to pack and to transport, as one has to protect the switch levers from being bent. It also makes their settings susceptible to accidental change. To a lesser degree, the same problem occurs with the transport control levers.

The Sony's level controls are sliders, just as bad and difficult to set as virtually all sliders in consumer equipment. (Except on graphic equalizers, designers should stick to rotary pots, unless

they can afford to use high-quality professional sliders.) The limiter's action sounds good on tape, but has a strong damping effect on the VU meters. The instruction manual says to set levels with the limiter off, then turn it on. This is the best way to use it, but with its strong effect on the meters, you may not know where your levels are when the sound level changes during recording. This is not much of a problem recording off broadcasts or records, where the sound comes already limited and compressed. For live recording, only experience will teach the user to set optimum levels using standard VU meter ballistics. (This is particularly true for cassette recording, where there is little room for error. In open reel, the additional headroom and the availability of three heads for direct tape monitoring makes a VU meter much more acceptable.) There is a headphone jack, but its output level is too low for any of the two dozen headphones of all impedances and styles that I have tried. It's best to use an external headphone amplifier for field recording, but this forces one to carry an additional box.

### Nakamichi 550

This machine is designed for field recording, yet it is big and bulky. It uses eight D cells or ac and doesn't hum when run off its external ac adaptor. The power switch is a pushbutton, very easy to turn on by accident when putting the unit in its case, and the user has no indication that the unit is on, as the position of the switch is barely visible. The same visibility problem applies to the other switches (tape selector, Dolby, limiter)—one has to look or to feel carefully to know what the machine is set for. Toggle or slide switches would be a great improvement. On its shoulder strap, one cannot see the transport control levers, because all the levers are simply flat on the top. I suggest adding a bump or two to the play and record levers for faster operation.

Headphone output is sufficient for all dynamic headphones, but the level is set with a slider that is even worse than the Sony's recording level controls. Suppose a user is recording on the run and needs a little more level in his headset—not too much, or the acoustic perspective will change, but enough to override the ambient noise. There's no way: it is not possible to make a small level adjustment. Fortunately, the record level controls are good rotary pots. The peak reading meters are good and the limiter's action affects the meters only when actually limiting.

The Nakamichi has externally adjustable Dolby level controls (for matching tape output levels, not for changes in bias or equalization) and a built-in Dolby reference oscillator. It is the only machine discussed here without a built-in speaker (the speakers in the other three are useful only for very rough checks). It does have three microphone inputs, for left, right, and center—a handy feature if used with care. The booklet supplied with the machine recommends using three mikes for many different situations. Some of the suggested setups look good; others seem likely to cause phase interference problems.

The Nakamichi has two unusual tape end indicators. One senses the rotational speed of the feed hub and flashes an LED when the hub reaches a speed set by a slider adjustment. Second, the left meter can be switched to show the percentage of the tape used up (it also operates off the feed hub). These indicators are useful, as the smoked plastic cover makes the cassette hard to see and the turns counter is located far back on the unit, making it less visible than those of other machines I have used. The counter on the Sony is in a much better place.

### Summary of Sony and Nakamichi

The Sony and the Nakamichi share two problems: neither provides much acoustic isolation for the cassette well, so mechanically noisy cassettes can at times be loud enough to be heard by the microphones, and both machines have unbalanced microphone inputs with 1/4-inch phone jacks positioned a little too close together for comfortable use of a pair of Switchcraft's Cannon plug adapters or of input transformers (for balanced use).

If one doesn't plan to field record at all, neither machine is a good choice. If one wants the capability for field recording, particularly where there's time to set levels carefully, the Sony is a reasonable choice. For extensive field recording, the Nakamichi is the better unit, despite its cost (and discounts are hard to find).

Both the Sony and the Nakamichi sound good when used properly. I can hear little audible difference between the two when each is used with its best tape (Sony ferrichrome and TDK SA, respectively). Residual noise seems mainly to come from the playback preamps, which sound similar. The Nakamichi has a little better high end and a quieter microphone preamp, neither of which is very significant in normal operation.

The Nakamichi has mike preamps with unusually wide dynamic range, suitable for use with standard condenser microphones. But the Sony has a microphone attenuator switch that achieves the same end. (In both cases, one has to provide power for the microphones.) Sony uses a ferrite head, Nakamichi a form of permalloy. The usual arguments on respective merits apply. Protective cases are optional, and Nakamichi's provides much more protection than Sony's, which fails to cover the switches.

The Nakamichi is distinctly noisier than the Sony during recording. Its motor whines, and there is a click from what seems to be a reed relay, which drives the tape-end indicator. These noises are minor and very unlikely to be picked up by microphones. Generally cassette machines make plenty of noise as they shut off, and their transport switching is never quiet. These noises can be intrusive in some situations. The open-reel machines described below are essentially silent in all operations.

Several other portable stereo cassette machines are available. Uher has two versions of their machine. My limited experience with it suggests that it is a very small, well made machine that unfortunately is not in the same class as the others, because it lacks noise reduction. Yamaha has a very pretty machine, styled for home use more than for field recording, with the most awful slider controls I have ever tried. JVC has a machine I have not seen. Teac will have a machine with features similar to the Sony's this fall. It will be slightly smaller, with rotary transport controls rather than piano keys. The Nakamichi 350 will also be available this fall, smaller than the 550 and with fewer features. It will have a single level meter showing the higher level of two channels and will sell for \$350, plus \$100 for a case with integral battery pack.

### Stellavox SP7

The Stellavox is a very distinctive recorder, probably the most flexible and modular tape machine ever made. It is very small and beautifully finished. It is convertible from full-track mono to half-track stereo and has continuously variable speeds from 2 to 30 ips. (A quadriphonic version is available.) Until recently, different headblocks were required for optimum performance at each standard speed (3%, 7½, 15 ips). There are forty different headblocks available, for nearly every combination of speed, track configurations (including five-track), and two film synchronization methods. Battery power is by twelve AA cells. Special preamplifiers are available for super-sonic recording at 30 ips.

The APS ac power supply (external) is occasionally noisy. The plugs are all Preh types, incompatible with any other machine on the American market, so the user needs a box full of adapters. Although Cannon microphone plugs can be installed, they will displace the mixer input. The standard microphone inputs are designed for 12-volt condenser mikes (Sennheiser MKH, Schoeps, or Neumann KM 70 series, which are not marketed in the United States). For dynamic mikes, external 20 dB gain preamplifiers are usually necessary and are available in a very small package powered by the condenser microphone supply.

Headphone output is ample but normally adjustable internally only, although a control can be added on a side panel. Power is switched via transport controls. Visibility of all controls is very good. High grade peak meters are used.

The Stellavox is much more common in Europe than the U.S., where it has a reputation for fragility. Many owners have constant problems with the electronics modules coming loose and causing noisy contacts. On the east coast, Larry Mericka in New York (telephone 212-246-9094) provides excellent service, and his repair of the module loosening problem seems effective.

### Nagra 4S

In its various forms, the Nagra has long been the standard for location film production around the world. It is superbly made, very finely finished, and very rugged. There are stories of Nagras continuing to work after being stepped on by elephants or after being dropped out of airplanes taking off. (A head alignment check is probably a good idea after such an incident.) It is about the same size and weight as the Sony or the Nakamichi and much bigger than the Stellavox. Nagras sold in the United States normally have Cannon plug inputs. The microphone preamps are switchable for most kinds of professional microphones, condenser and dynamic. Provision is made for external noise reduction and both Dolby-A and dbx units are available in packages specifically designed for and powered by the Nagra. Headphone output is ample and level is controlled via step switching rather than by a continuously variable control. This is to provide definite headphone levels so the recordist's ears can act as a level monitor in addition to the meter. The meter is unusual: two needles—red and green—are in the same housing and swing together. They take a little getting used to but have an excellent peak-reading action. Power is by twelve D cells or by external ac supply. The controls and switch settings are excellent: everything is absolutely positive, and all settings are instantly readable. Nothing protrudes, and toggle switches are recessed to prevent accidental change. Power switching is by transport control with an additional toggle switch to select battery or ac power. The high cost does bring many unusual and useful features, but there are some problems. Many of the external ac supplies are noisy (I trust the Heathkit power supply mentioned above more than the Nagra ATN supply), and the Cannon connectors for the 12-volt condenser mikes have the signal leads reversed with respect to everyone else's wiring.

### Summary of Stellavox and Nagra

The Stellavox and Nagra are difficult to compare. For example, the Stellavox's extreme flexibility of track configurations may be more or less important than the versatility of the Nagra microphone preamp. Both are three-head machines (and often have a fourth for synchronizing signals). Both can be converted to 10½-inch reels, but of course they can no longer be slung over the shoulder. In the Nagra's case, the price of the adapter (\$900) may make one pause. Without an adapter, the Stellavox will take only 5-inch reels, but the Nagra will take 5-inch reels with its cover closed and 7-inch with the cover open. If size isn't a problem, special covers are available which will close over 7-inch reels. More used Stellavoxes than Nagras are available, some for less than \$2000.

A third track is optionally available with either the Stellavox or the Nagra. Normally used for recording film synchronizing signals, it can nevertheless record audio of limited bandwidth and is therefore suitable for use as a cue track. Both machines have built-in reference-tone generators.

Though the Sony and the Nakamichi are acceptable if a little clumsy, for routine home hi-fi use, the Stellavox and Nagra are not. A standard three-motor solenoid tape deck is much more convenient. As one might expect from battery operation, the Stellavox and Nagra compete with each other for the world's slowest fast forward and rewind.

I know of only two other portable stereo open-reel machines, both taking 5-inch reels. Uher has a two-head machine priced at about \$700. The Sony TC-510-2 is a recent machine, available

in Asia and Europe but not in the United States. It would sell for about \$600 in the U.S. I have no experience with either machine.

Note that all of the open-reel machines described here (Uher and Sony as well as Stellavox and Nagra) are half-track machines, rather than the quarter-track commonly found on consumer machines. The track arrangements are not compatible, although there is enough overlap to hear signals playing each format tape on a different format machine, provided the quarter track is recorded in one direction only. (Naturally, one can order quarter-track heads for the Stellavox; one can also order a half-track configuration, rarely found in the U.S., which does overlap the quarter-track format.)

### Cassette Versus Open Reel

As for the sound quality difference between the cassette and the open-reel machines described here, these machines perform about as well as good ac-operated tape decks in their respective formats. Using these machines in the field shows up the cassette versus open-reel differences more than taping from records or FM, because of the nature of live recordings. Still, listening to recordings I have made of folk music with the Sony and Nagra in parallel, I am quite happy with the Sony cassette recordings unless the Nagra tape is available for direct comparison—even listening with the very critical Stax electrostatic headphones. For example, the sound of the guitar picks is recorded very well by the Nagra, but runs into the limiter of the Sony. Reducing the recording level of the Sony will increase the relative noise. The reason I don't object to the Sony tape is that all records of guitar music I hear seem to have their levels clipped in the same way. All of this assumes one can listen to the original tape; if one has to make copies, the superiority of open-reel is much more audible, both for noise and for motional stability.



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### A Modified Version of the Dynaco PAT-5

Michael Riggs

Dynaco seems to think their typical customer is someone with a copy of Stereophile in one hand, a soldering iron in the other, and a minimum balance at the bank. They may be right; that's a fair description of me, and I certainly buy a lot of their equipment. I put up with cheap parts, an occasional corner cut too close, and slovenly quality control because most of what they make is well designed, functional, and relatively inexpensive compared to other components of similar performance. And one can always do something to correct the parts and the bad adjustments.

Frank Van Alstine, the congenial proprietor of Jensens Stereo Shop, is in the business of making those "corrections," and then some. A few months ago, he did the works on my PAT-5, turning it into what he calls an "FET-5 Mk. IIc." He replaces all components in the signal path with mil-spec parts (1% metal film resistors, silver mica capacitors in the RIAA network, and tantalum caps elsewhere), the idea being to eliminate from the circuit what Van Alstine refers to as "passive side effects." He also replaces the phono transistors with Siemens BC 413C and BC 414B transistors (for Q201 and Q202, respectively), removes stabilization capacitance from the phono circuit, and extends its bandwidth. In addition, he modifies the Phono 2 input as described in Dyna's manual for 6 dB more gain. This is achieved by reducing the feedback in the circuit by 6 dB. (I haven't tried it, but Van Alstine says high-output moving-coil cartridges, such as the Denon 103, can be run directly into this input without additional preamplification.) In the power supply, Dyna's 100- $\mu$ F filter capacitors are increased to 1000  $\mu$ F, to provide a larger current reserve, and the supply capacitance on the phono boards is doubled. Jensens replaces the output circuit with a wide band (dc to almost 2 MHz), direct-coupled design built around a hybrid FET IC op amp, said to be several times faster than the stock LM-301. There's no stabilization capacitance, except when the tone controls are switched in (in the stock version, the defeat switch just takes the pots out of the circuit). The very latest change, which my unit doesn't have, removes another coupling capacitor and two resistors and lowers the output impedance to 2 ohms. A final touch, minor but nice, is the replacement of Dyna's philips grounding screw with a convenient thumbscrew.

Al Foster tested my PAT-5 before I sent it to Jensens. THD through any input was unmeasurable (i.e., more than 65 dB down, or less than 0.05%). Gain through the phono inputs was 37.5 dB, with a signal-to-noise ratio of more than 70 dB, unweighted with shorted inputs. C-weighting improved the reading by about 5 dB, a figure just barely worsened (by 1 dB) by the replacement of the shorting plug with a cartridge. The RIAA equalization was also within spec, being -2.8 dB at 5 Hz, -0.4 dB at 30 Hz, +0.3 dB at 400 Hz, flat at 1 kHz, -0.2 dB at 5 kHz out to 14 kHz, -0.5 dB at 20 kHz, and -0.7 dB at 30 kHz.

With a high-inductance cartridge attached, the circuit showed no symptoms of cartridge impedance interaction. As claimed by Dyna, phono input capacitance seems to be below 10 pF. In fact, the only area in which the preamp fell short was phono overload—47 mV at 1 kHz, about half what

Dyna specs. This turned out to be the result of a bad zener in the power supply. Because the unit's sound was essentially identical to that of another PAT-5 I'd owned, I doubt that this flaw was causing any significant sonic problems. In addition to the standard measurements, A1 subjected the unit to his white-noise test, which it flunked.

When my PAT-5, now FET-5, returned from Minnesota, I again toted it to Al's basement lab. We could find only a few measurable differences. The right channel of the high-level section now has 1.5 dB more gain than the left channel. The RIAA equalization is better—within 0.6 dB over the audible range. Response is -0.7 dB at 5 Hz, flat at 30 Hz, +0.4 dB at 400 Hz, flat at 1 kHz out to 14 kHz, and +0.1 dB at 20 kHz out to 30 kHz. The power supply defect has been fixed, and the phono stage now overloads at a respectable 135 mV for 10 volts out at 1 kHz. Clipping occurs at 400 mV for 5.8 volts out at 10 kHz, at 420 mV for 3.1 volts out at 20 kHz, and at 600 mV for 1.3 volts out at 50 kHz. Obviously, it doesn't pass Al's voltage bandwidth test. It does, however, pass the white-noise test.

The sound of the modified unit is considerably better than that of the stock preamp. Subjectively, the noise from both sections is slightly lower. Highs are much smoother and cleaner (the slight edge that was there before is gone), the bass goes deeper with better definition, and the overall sound is more open and detailed, with better depth imaging and greater clarity. A slightly overetched quality heard previously has also vanished. Through AR LST's, Large Advents, and Koss ESP-9's, the sound of the modified phono section is identical to that of the Power Systems and AGI preamps.

Van Alstine says that the high-gain phono input sounds better than the normal-gain input with any cartridge that doesn't overload it. The overload point at 1 kHz should be about 50 mV, which is adequate most of the time. With a Sonus Blue Label (nominal output: 0.8 mV/cm/sec), the sound does seem to be cleaner and more transparent, except on high-level, high-frequency transients, such as cymbal crashes, which sound slightly harsh, overbright, and not very well defined. In addition, the overall sound is a little more forward. I find the sound of Phono 1 more natural, but users should experiment and arrive at their own conclusions.

I have not been able to make a thorough evaluation of the high-level section, so I don't really know whether it is superior to that of a stock PAT-5. I can, however, now hear a very subtle difference in the sound with the tone controls switched in (set to flat with a scope and a square-wave generator). A very slight fuzz is added to the music. Before the modification, I could hear no change.

A few caveats are in order. The preamp will now pass dc, so it should not be used with amplifiers that have direct-coupled inputs (e.g., the Crown DC-300 or the Phase Linear 700 through its "direct" inputs). Fortunately, such amps are rare, and for those who have them Van Alstine will install output coupling capacitors in the preamp. If you aren't sure, just send a schematic of your amp to Jensens, and they will make the diagnosis. (All Dyna amps, by the way, have capacitively coupled inputs.) Switching between Phono 1 and Phono 2 now causes a woofer-busting blast, so it should be done with the volume turned all the way down. Switching in the tone controls also causes a pop, but not a dangerous one. It is also likely that the modified unit is more susceptible to RFI, though I've had no trouble in that regard. And finally, both Abbott Lahti and Dyna have expressed concern to me about the stability of the modified version. Van Alstine listens to each unit before shipping it, and neither our tests nor Dyna's have exposed any signs of instability, but that doesn't mean that problems can't appear later or under extreme temperature conditions.

There's even some dispute over the sonic merits of the modification. Bob Tucker of Dynaco thinks the stock unit sounds better, provided the correct 301 IC's are used. He recommends the Microsystems devices, which Dyna will supply on request to anyone who has a different brand in his PAT-5. A1 Foster has heard a stock PAT-5 whose phono section sounds like the one in mine,



though it's the only one of four he's heard that does. It may be that replacing the stock phono transistors with the Siemens units (which Dyna only occasionally uses), insuring that the IC's are Microsystems 301's, and increasing the filter capacitance in the power supply will do about as much good as the complete modification. I don't know. Experimenters are encouraged to report their findings.

I, for one, am quite happy with what I have. My only complaint is that there's not a good high-pass filter in the preamp. Dyna says people don't want them enough (if at all) to pay for them, and Van Alstine doesn't want to add another tuned network, which he says would reduce overall definition. He has told me, however, that the Jung IC filter (described in [The Audio Amateur](#) and available as a \$12 kit from Old Colony Sound) can be run off the PAT-5's power supply, provided the values of the bleeder resistors on the supply board are adjusted for the increased current draw. An ambitious individual could install the filter directly in the preamp. Alternatively, it could be built with an external power supply and inserted in the External Processor Loop. Either way, I suspect the benefits would substantially outweigh the disadvantages, if indeed there are any.

Jensens charges \$150 to modify a PAT-5, or the owner can buy a mod kit for \$120—a route Van Alstine does not encourage for the novice. The third alternative is to buy an FET-5 outright for \$389. Jensens offers a thirty-day, money-back satisfaction guarantee with this last option. They warrant their modifications for one year, parts and labor, and the entire unit if it is new. All warranty work must be done by them. For further information on Jensens' PAT-5 modifications or others (ST-400, ST-410, ST-150, FM-5, ST-70), write: Jensens Stereo Shop, 2202 River Hills Drive, Burnsville, Minnesota 55337.

Recently another source of Dynakit modifications has appeared. Judging from the blurb sheet, Underground HiFi's mods are similar to Jensens' and cost about the same, but I'd need more details than I now have to make any certain pronouncement. Their address is: 324B Broadwater Road, Arnold, Maryland 21012.