THE B.A.S. SPEAKER

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The Boston Audio Society P.O. Box 7 Boston, Massachusetts 02215

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October meeting. The next meeting of the B.A.S. will take place at 6:30 pm on Sunday October 21, in Room 314 of B. U.'s Sherman Union at 775 Commonwealth Avenue. Enter the basement corridor from Commonwealth or from the rear service road, and use the elevator to ascend to the third floor.

The late starting time is to permit members to catch Harvard Prof. Leonard Bernstein's lecture on WGBH, which is scheduled from 4:00 - 6:00 pm. Peter Mitchell will speak on one or both of the two following topics; (1) the basic physics of phono cartridge tracking, including the relationships among compliance, tip mass, modulation velocity, and tracking force; (2) what some insufficiently-known facts about room acoustics and recordings may imply about loudspeakers and the use of equalizers, together with hints on how to modify your equalizer.

Next month. We tentatively expect to have the November meeting at Bose Corp. in Framingham, to hear some very illuminating demonstrations of the relationships between specifications and the sound you hear.

"The Unanswered Question." The long-awaited Charles Eliot Norton lectures on the poetics of music are being delivered by Leonard Bernstein on six consecutive Tuesday evenings (through Nov. 13) at the Harvard Square Theatre. Tickets are required but free, available at the theater after 2 pm on Mondays and Tuesdays. Later each week Bernstein is re-delivering his lecture at WGBH and the tapes (including many illustrative examples by the Boston Symphony, the most august audio-visual aid yet used by a professor) will be broadcast Sundays, Oct. 13 - Nov. 18, simulcast on FM and Channel 2, following Victor Campos' "Adventures in Sound."

Dues. WARNING: This is the final BAS mailing which will be sent to people who have not paid their dues for the 1973-74 membership. Send your check to the BAS P.O. box now before you forget it, and please fill out and include with the membership renewal the library form distributed last month.

Questionnaire. Fewer than a dozen questionnaires on servicing have been returned so far; this is inadequate for any useful analysis. Haven't you had to have anything fixed during the last three years? We can't compile a servicing guide for you unless we all contribute information to the common pool.

LM381A ICs. Al Southwick reports that the remainder of the BAS group order of LM381A preamp ICs have finally arrived from National. Got 'cm at the meeting.

BAS Dubbing Service. Apparently we have given some members the impression that to obtain a recorded tape through the BAS Dubbing Committee you have to buy a tape from the BAS in the process. T'aint necessarily so. We just assumed that you would prefer to get recordings on brand-new top-quality tape. But if you prefer you may supply your own tape and for the standard $2.00 service fee per program the Dubbing Committee will endeavor to supply you with tapes of Bernstein's lectures, Shop Talk, BAS meetings, or that classic out-of-print record or historic broadcast.

The operative assumption when the dubbing service was established was that members would pick up their tapes at meetings. If you insist on having tapes mailed to you (which we discourage because it makes extra work for the person doing the service for you), you should not only supply adequate postage but also a mailing container rugged enough to withstand the ravages which the Postal Service will obligingly subject it to.

Tapes. Speaking of tape, all of the Advent $CrO_2$ C-90 cassettes obtained in the BAS group purchase have been sold to members. We still have about a dozen reels of Maxell UD-35 tape available at $3. 81/reel.

Orchestra programs. Included in this mailing are the complete season's program schedules for the Boston Symphony and the Boston Philharmonia. These are supplied to encourage you to experience live (ultra-high-fidelity) musical sound and also to indicate possible off-the-air listening opportunities (the BSO live and the Philharmonia delayed).

Publications. Al Southwick's heavy schedule of work and recording will prevent him from writing Part U of his article on tape recorders for several months. So, to allay the impatience of those who want information on how to re-bias your recorder, we enclose a reprint of an article by J. Gordon Holt (in Popular Electronics) on setting up a recorder.

We also feature this month a brief test report by Jim Brinton on the Pioneer TX-9100 tuner, in which he warns of possible quality-control problems and stresses the importance (as with most other tuners) of using a good antenna in order to fully exploit the tuner's capabilities -- even for local reception.

TV Sound. Have you wondered whether the $17 Rhoades TE-100 Teledapter, which has been advertised in the back pages of Audio, is the solution to the problem of getting decent sound out of your TV and into your stereo system? It's not. It appears to be only an isolation transformer. It connects to the TV's speaker , thus picking up the audio signal after it has passed through the TV's lousy audio system. If we want to get better audio out of TV, it looks as if we'll have to design our own device to do it with.

Used equipment for sale. Teac A-1200U tape deck. Excellent condition, biased for Scotch 203 or its equivalent (such as Maxell LNE). Includes quiet Rotron fan, added to improve motor cooling at 3 3/4 ips. Rugged solenoid-operated transport. Price $125 firm. Laurie Cote, 7 31-3436.

Altec 803A 15-inch woofer and two Altec 802B horn tweeters. Steve Schwartz, 631-8800 or 427-8877.

Adventures in Sound. Contrary to the announcement in last month's newsletter, only the first and last Sunday programs in October are being rebroadcast on Monday evening. Starting in November the Saturday programs will cease and on Monday evenings Victor Campos will broadcast different master tapes than on Sunday afternoons. The broadcast times are expected to be 7:00 pm on Saturdays, 12:00 noon on Sundays (while Bernstein's lectures continue at 4:00), and 8:00 pm on Mondays, on WGBH (69. 7 MHz).

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| SAT Oct. 13 | Gershwin: Piano Concerto in F. Lowenthal, Abravanel, Utah Symphony (Vanguard)<br>Joaquin des Pres: "L'Homme Arms" Mass, and selected motets. Noble, cond. |
| SUN Oct.14 | Rossini: "La Pietra del Paragons" (The Touchstone). Newell Jenkins cond. (Vanguard) |
| SAT Oct.20 | Beethoven: String Quartet #15 in a, Op 132. Guarneri Qt. (RCA)<br>Liszt: Piano music. Earl Wild (RCA) |
| SUN Oct. 21 | R. Straus= "Der Rosenkavalier" Op 59. Bernstein, Ludwig, Berry, Vienna Phil. (Columbia, but recorded by Decca-London) |
| SAT Oct. 2 7 | Stravinsky: The Rite Of Spring. Bernstein, LSO (Columbia)<br>Gershwin: Piano pieces. Bolcom (Vanguard)<br>Karel Husa,: Quartet #3 (1968). Fine Arts. Qt. (Everest) |
| SUN & MON Oct. 28 & 29 | Bach: Saint Matthew Passion. Honneger-Moyse, Marlboro Festival (unreleased) |
| SUN Nov. 4 | Berlioz: Requiem. Abravanel, Bressler, Utah Symphony & Chorus. (Vanguard, recorded in the Mormon Tabernacle) |
| MON Nov. 5 | Handel: Water Music. Somary, English Ch. Orch. (Vanguard)<br>Rachmaninoff: Piano Concerto #2. Rubinstein, Ormandy, Philadelphia Orch. (RCA)<br>Beethoven: Wellington's Victory. Ormandy, Phila. Orch. (RCA) |
| SUN Nov. 11 | Chopin: Sonata #2 in b flat. Cliburn (RCA)<br>Bartok: The Wooden Prince (1915). Dorati, LSO (Mercury) |
| MON Nov.12 | Dvorak: String Quartet' in C,Op 61. Guarneri Quartet (RCA)<br>Brahms: Piano Concerto #2. Rubinstein, Ormandy (RCA) |
| SUN Nov.18 | Beethoven: String Quartet #16 in F, Op 135. Guarneri Qt. (RCA)<br>Rachmaninoff: Symphony # 2. Previn, London Symphony (RCA) |
| MON Nov.19 | Bernstein: Mass (1972). Titus, Bernstein (Columbia)<br>Renaissance music for brass. Eastman Brass Quintet (Candide) |

September meeting. Warned off by the announcement that the meeting would include such sleep-inducing topics as constitutional amendment, only 30 members of the BAS met on Sept 16. The start of the meeting was delayed due to lack of a quorum, so as the first order of business the members voted to change the quorum definition in accordance with the proposal in the preceding newsletter.

James Brinton, Treasurer, provided a thorough and informative financial report, including a prognosis of the coming year's expenses. Members then voted to increase membership dues to $12/year and to

have the membership year run from Oct 1 to Sept 30 for everyone. (Formerly members joining after April 1 paid a reduced rate. Henceforth, in accordance with the practice of professional societies such the AES, late joiners will pay the full dues rate and will be given the mull year's publications retroactive to October.) Members also voted to confirm the award of an honorarium to the five principal members of the executive committee in recognition of services to the society.

The present officers (Peter Mitchell, president; Alvin Foster, recording secretary; Joyce Brinton, corresponding secretary; James Brinton, treasurer) were nominated and re-elected, The Program Committee (Laurie Cote, Dennis Bayer, et al) volunteered to be responsible for refreshments henceforth. The BAS library and record rating service were not discussed due to the absence of the members developing those projects.

Andrew Petite introduced and demonstrated prototypes of the new Advent Two loudspeaker. ("Two" rather than "Three" because the original and Smaller Advents are in a sense the "same" speaker, having the same frequency response and sound character, differing only in size and loudness capability.) The Advent Two will cost $58, has a woofer resonance of 58 Hz (1 Hz per $), an impedance of 8 ohms, and uses different tweeters than the earlier Advents did.

Andy pointed out that one of the facts of life in the hi fi industry is that the most expensive single part of a loudspeaker, for most manufacturers, is the cabinet. The craftsmanship required to turn out thousands of identical boxes, with every external corner precisely mitred and every internal joint completely rigid and permanently airtight, is not cheap. Thus if the cost of an adequately rigid and acoustically non-resonant cabinet could be lowered it would be possible to employ significantly more costly woofers and tweeters without raising the total price.

The development of the VideoBeam TV has involved Advent in plastics technology; the TV projector cabinet and screen are both molded high-density polyurethane foam, a lightweight but very rigid polymeric material. Advent has chosen to apply this technology to the problem of the rising cost of high-quality wood cabinets. Such a process involves high initial set-up and molding costs, but low unit-to-unit production cost. As a result the total cost per cabinet is very high in small quantities but low in quantities of 100,000 or more. Anticipating the cost savings from large sales of the Advent Two, Advent is using in it a woofer similar to that of the large Advent (with its resonance frequency raised to 58 Hz by the small box size). To match the power-handling capability and efficiency of the woofer (similar to the efficiency of the large Advent, about 3 db more efficient than the AR-7 or Smaller Advent), two tweeters are used. Andy discussed the travails of mounting two tweeters so as to avoid the severe response ripples which would be caused by interference fringes in the overlapping radiation patterns of the tweeters. Both AR (in the LST) and Advent solved this problem successfully; some other multi-tweeter speaker manufacturers haven't.

The polyurethane cabinet is surfaced with a white injection-molded styrene exterior and a silver metal grille. The cabinet is surprisingly strong — you can stand on it — yet at 17 lbs it is much lighter than a wood cabinet of equivalent rigidity would be. Final judgment of the sound of the Advent Two will await extended listening in familiar environments; first reactions ranged from merely favorable to highly enthusiastic.

Notes on Product Testing. The subjective review of the Pioneer TX-9100 tuner being mailed this month makes the first mention we have seen of this tuner's multipath susceptability. You read about it here first because of what may be the beginning of an unfortunate trend on the part of commercial magazines, an increasing use of cable-supplied FM signals as source material for tuner testing. CATV and similar services cannot emulate real-world conditions like urban multipath and can say nothing at all about a tuner's long-range receiving capabilities for the obvious reason that FM signals are processed and amplified before being piped down the cable.

We would like to suggest that any review of a receiver or tuner at least note its performance with an outside antenna -- at least. For reference purposes, a pair of rabbit-ears would help simulate the sort of operation many urban apartment dwellers must suffer with.

And while on the subject, we feel that the media should pay more attention to product quality control. Users are much less apt to be interested in the performance of a factory-tuned "bogie" unit than in the foibles of one available from their local retailer. If the only unit which performs well is the one wheeled from magazine to magazine by the maker's public relations or advertising representative, the user has little chance of getting a realistic idea of product performance. And far from being rare, this practice is a common one in the audio industry.

A more helpful approach -- although one which would cause grey hair among marketing types and quality control engineers -- would see the audio magazines make blind purchases from retail stores of the units they wish to test. Not only would this make the devices tested more similar to those really available, but it would also remove much of the control manufacturers have over selection of the components tested. (After all, if a magazine waits for equipment to be brought to it, it is letting the makers decide its editorial policy, isn't it. Free press?)

Such a policy might be a bit rough on that group of editors whose systems consist of manufacturer freebies, but we feel the end user would certainly be getting a better deal.

A B.A.S. Test Report

# Balancing the Books on the Pioneer TX-9100 AM/FM Tuner

James Brinton Jr.

Glowing reviews in Audio and Stereo Review have made the TX-9100 tuner one of the hardest to procure items in Pioneer's line. They also have proven the axiom that there is no test as compelling as a unit performing in one's own home. While the tuner appears to meet its specifications, there are some areas that published reports have not covered, and so the notes that follow should prove useful.

Sound quality is the most important unspecified parameter, and like other good tuners, the TX-9100 is limited by the quality of available broadcast material. However, on a program prepared with as much care as WGBH/Victor Campos' "Adventures in Sound," the new tuner's high quality is obvious. Its frequency response is both smooth and extended while distortion at higher frequencies seems quite low. Using KLH-9 electrostatic loudspeakers in a biamplified system with AR-1 woofers, the TX-9100 sounds almost identical to a Marantz Model 20 tuner -- a unit no longer manufactured and said to be worth as much as $700 on the used equipment market. There is a clarity to the sound of these tuners which might be mistaken for a presence peak were it not that both are quite obviously flat in response. Quieting also is on a par with that of the Marantz; it isn't easy to tell which tuner excells since both are limited by broadcast quality. Certainly the Pioneer is at least as quiet if not quieter than anything in its $300 price class.

(The Marantz tuner is used as a standard because it is one of the few which has consistently outperformed the likes of the AR tuner, all Heath models, and indeed everything else compared with it.)

Subcarrier rejection is as excellent as advertised. The phase-locked-loop IC stereo demodulator (Motorola MC 1310P) effectively disposes of WCRB's noisome "birdy." Were it not for the lack of mercy the tuner shows the rest of WCRB's equipment, the station might finally become listenable. As is, stripped of masking interference and distortion, the station can sound worse than ever.

But despite its excellent performance in other areas, the TX-9100 appears to have a relatively high sensitivity to multipath. This sensitivity may not be unusual to tuners in its price class, but was a disappointment if viewed in the light of overall performance. Tested with a Finco log-periodic antenna in an urban location, the 9100's quieting quickly deteriorated in the presence of multipath; that of the Marantz did not. Antenna swings of less than ten degrees were enough to degrade the signal from the Pioneer.

Thus the TX-9100 may be a better choice for suburban use unless care is taken in antenna selection.

Pioneer also is having quality control problems since the recent expansion of its dealer network, and the resulting increase in demand for its products. The two TX-9100's purchased were no exceptions. The first was mechanically good, but had a rolled-off bass and a peaked treble response. The second unit sounded excellent, but featured a shattered center-of-channel tuning meter (It may be fair to note that this meter proved nearly redundant; far more exact tuning proved possible with the tuner's very narrow muting gate and stereo-indication light -- both functions of the demodulator IC's operation. Even with the meter-equipped unit, it quickly became simpler to tune using the light and the mute; when they operated, the meter was always dead centered.). Signal-strength metering, the more important because of the tuner's multipath sensitivity, also varied between the two units. On one, the meter proved quite insensitive to antenna swing and the consequent signal amplitude changes; it stayed pegged. With this unit, it proved more direct, though not simpler, to swing the antenna for minimum distortion and noise. Which is not to say that this isn't the way things should be done, but rather that the process would be simpler with a dependable meter.

Audio performance aside, the performance of the muting circuit was one of the most enjoyable features of the TX-9100. Its effect is uncanny; there is either sound or dead silence and neither thump nor click marks the transition. Muting is so abrupt it is sometimes necessary to tune slowly to avoid tuning past a station, but far from being a disadvantage, this is a real aid in spotting the center-of-channel frequency as noted above.

Be prepared to wait if you select this tuner. As noted, Pioneer is doing more business of late, and this has translated into shortages of many items. Since the published reviews of the TX-9100, the situation <u>in</u> <u>re</u> this tuner has become bad even by Pioneer's standards. The retail store where these units were purchased had ordered sixteen units and the three which were eventually received were weeks late.

This back-order situation makes Pioneer's quality control prob lems all the tougher on consumers. To get a working unit, it may be necessary to take delivery on a defective model and to have it brought into "spec" by Pioneer. In this coneection, note that the company does not repay freight charges to and from its factory. Even so, some audiophiles may find the tuner worth the effort.

A good antenna system is a must with this tuner because of its multipath sensitivity (In fairness, the comparison with the Marantz may be slightly unfair -- it is in a differing price class, built on a differing principle, and as noted, the Pioneer faired no worse than competing units selling at the same price.). For this tuner, the most important antenna specification would be front-to-back ratio.

Though gain, beamwidth, and front-to-back ratio are always related, at least to a degree, where other parameters are equal, chose the antenna with the highest rearward rejection.

On the other hand, the Pioneer is a highly sensitive tuner and will repay the cost of a good antenna not just with first class local sound, but with good long distance reception too. With a Finco FM-4 Yagi array, the tuner easily logged stations in the Connecticut River valley and beyond. WFCR in Amherst was received with as good quality as WGBH, although the one was about 60 miles away (across rugged country) and the other only about 13 miles from the listening location. Some Hartford and Norwich, Conn., stations were very listenable in mono.

Two final caveats; the AM section frankly doesn't work very well -- not that this is a major issue, but it is fair to ask why so many high-quality Japanese tuners are being delivered with low caliber AM. For most of us, AM is a side issue at best, and we would probably rather save the money. Finally, the TX-9100 runs somewhat hotter than the average tuner; place it where it is well ventilated.

For the budget minded, it must be noted that the TX-9100 is less apt to be discounted than are many competing units for a couple of reasons: 1) its popularity makes it possible to sell without discounting, and 2) waiting periods are long and quantities are short, making for a miniature economy of scarcity. But for a lot of audiophiles, the reproduction of FM achieved by the TX-9100 will make it worth all the trouble.

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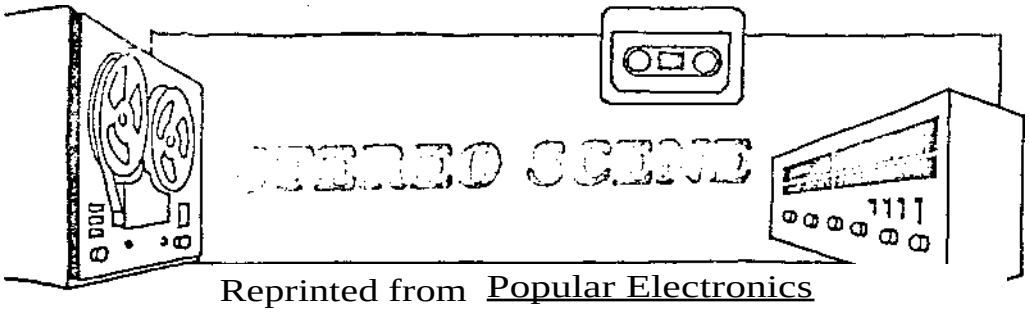
Information of the stereo demodulator IC used in the TX-9100 appears in Radio-Electronics, August 1973. Commercial reviews of the tuner's performance have so far appeared in the August 1973 Audio and in the November 1973 Stereo Review.



Reprinted from Popular Electronics

**Fourteenth in a Monthly Series by J. Gordon Holt**

# SETTING UP A TAPE RECORDER

LAST MONTH, we discussed the sorry state of affairs regarding adjustable audio components—that is, components that call for factory adjustments prior to delivery to the customer. We pointed out that. while FM tuners (and similar components) can often be improved by a careful touch-up of their alignments, they are usually delivered in pretty fair shape; but tape recorders usually are not. Finally, we suggested that it is worthwhile for any tape recorder owner to learn to do his own setups. so he doesn't have to trot his recorder down to the local audio shop every time he changes tape brands or types. This month. we'll expand on that suggestion by giving a practical. hopefully succinct description of how to go about doing your own recorder setup adjustments.

First of all, how do you know whether or not your recorder needs adjustment? That's simple. If you can hear any difference between an original signal and the playback from a tape of that signal, chances are your recorder needs work.

One of the most common misconceptions among amateur tape recorder fans holds that one tape is better than another because it sounds better. This is only a half truth. To understand why, consider for a moment the FM tuner.

Broadcasters of FM must adhere to very stringent standards (established by the FCC) with regard to frequency accuracy (on the dial), bandwidth, modulation levels. and the frequencies and intensities of the piggy-hack signals that convey storecast and stereo-signal material. Since all stations adhere to the same set of standards, a perfectly aligned tuner receives them all equally well, at least within the limits of its capabilities.

Not so a tape recorder! Recording tapes adhere to certain dimensional standards. but their magnetic characteristics differ rather widely from one brand to another and even from one type to another within a brand line. Consequently. there cannot be a perfectly adjusted recorder. The best one can hope to achieve is adjustments that are perfect for one specific kind of tape. Other kinds of tape will then perform strictly in relation to how similar their magnetic properties are to those of the tape for which the recorder was set up. A new tape that is substantially different from that used for the recorder setup will make the recorder behave very poorly, even though the new tape may be potentially better. This is why simply trying different tapes on your recorder will not indicate which tape is best: it will merely show which one (if any) your recorder was adjusted for at the factory. And since setups done at the factory are rarely as accurate as they could be, we shall now see how to go about doing them yourself.

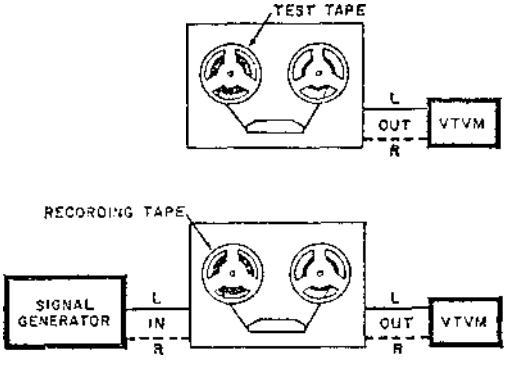
You will need a test tape for a machine having the same head configuration as yours. That is, a 4-track tape for a 4-track machine. or full-track tape for a mono or two-track stereo machine or for a quadriphonic machine. Suitable tapes are available from Ampex Corp. or any Ampex dealer. Next. you'll need an ac VTVM sensitive enough to read full scale with 18 millivolts input. You may be able to rent or borrow one from a local audio or TV repair shop. or you may purchase one of the less-expensive versions made by Heath. Eico. Lafayette, or Allied-Radio Shack. Finally, you'll need a source for midfrequency and high-frequency sine waves. This too can be rented or borrowed, but a very inexpensive one (called the "Mini-Gen") may be purchased for $15 from Century General Corp.. 570 Seventh Ave.. New York, NY 10018. You will also probably need several sizes and kinds of screwdrivers, but the only way to find out just which ones is to start the job.

## The Better, the More. Generally, the better the recorder, the more internal adjustments it has. Generally, also, you can ignore most of them. For setup purposes, all you'll

need to find are these (one per channel): Bias Adjust. Record Level. Meter Calibration, Record Equalization (one per speed). Play Equalization. and, in semi-professional machines or those equipped with Dolby. Playback Level. Some recorders have fewer adjustments; some have more. (You may have, for instance, a tape selector switch to select two sets of perfect adjustments for two kinds of tape.)

The cardinal rule of all equipment diddling is this: If you don't know what something adjusts, leave it alone. Do not, under ally circumstances, adjust something unless you know what it is supposed to do and have some means of observing what it does. There are no exceptions to this rule, so don't try looking for one.

The first step, then, in a tape recorder setup is to locate and identify all the necessary adjustments; and the best way to do this is by using the service manual for your recorder. Usually, you can buy one of these from the factory at a price which the manufacturer assumes will scare off anyone who who doesn't run a service center. Pay the




Instrumentation setups for playback (above) and record-circuit alignment procedures.

price anyway. If the manufacturer refuses to sell you a manual, your local audio shop may allow you to peruse theirs for long enough to find out how to expose the adjustments and to make a sketch showing their locations.

Some service manuals don't tell you how to get at the internal adjustments. If they don't, it's probably because getting at the adjustments is simple and straightforward. usually requiring nothing more than removal of the cabinet. To do this, unplug everything from the recorder, including any little plugs that don't seem to do anything. (Fuse caps count as plugs; so remove them, usually with a slight counterclockwise rotation.) If you think you'll have problems re-locating any of the connections later, make a sketch of what goes where before yanking them out.

Next, put a pillow on the floor and set the recorder, face down, on the pillow. if the only screws on the bottom (or back) of the case are those in the centers of the rubber feet. remove them. If there are four cr more others visible, remove them instead Now, gently work the cabinet up off the recorder, being careful not to force it. If it encounters an obstacle that you can't work around, you probably forgot to unplug some thing. Let the cabinet go back to its original position and remove the offending object before trying again to lift off the cabinet. If it still won't come off, give up. Replace it. and put the screws back in. Don't overtighten the screws; use your fingers. not the palm of your hand to turn the screwdriver.

Assuming you get the cabinet off. now locate all the adjustments you have to work with. In some instances, it will be necessary to remove a metal shield to get at them Drop all screws into an empty tin can as you take them out so they won't get lost, and note the length of each as you remove it Some with identical heads may be longer than others and must be put back in the right place—make a rough sketch as a guide for reassembly.

Now, since you're going to have to be making adjustments while the tape is running, prop the recorder up on your work table so that all the internal adjustments are accessible and the deck is positioned in such a way that its reels will stay in place while turning.

The Purpose of It All. Briefly, here's what you'll be doing. First, you'll adjust the playback circuits so that a full-volume signal recorded equally on both stereo tracks will reproduce at full level and in proper balance Then, you'll check to make sure a tape recorded with industry-standard equalization —a commercially pre-recorded tape for instance—will play hack with the requisite flat frequency response. You'll use the test tape for both of these checks.

Then, going to the record circuits. you will first set the bias current for the recording tape you'll be using and then adjust the recording equalization so that the tape gets exactly the signal it needs in order to reproduce properly through the play section you have just set up to the industry standard.

Next, if your machine has Dolby or provisions for monitoring off the tape while recording. you will adjust the recording level so that input and output signals are at the same volume level. Finally, you will tune up the meter calibrations so that the meter indicate maximum recording level when a tape is actually being recorded at maximum level.

The playback adjustments are essentially the same for all tape machines since the

object is to make the recorder respond predictably to any tape made according to the industry standards for that speed and format. If you have a service manual, follow all of the setup instructions described therein. If not, proceed as follows.

Connect the VTVM to either of the recorder's Line Output receptacles. Demagnetize and clean the heads. load the test tape, and locate on it the middle-frequency tone (400 to 1000 Hz) identified as "Normal Maximum or Zero VU" level. If there is a playback volume control (or two) with a knob on it, turn it (or them) up full. Then play the zero-level test tone and adjust the internal Play Level or Output Level pot until you measure 1.2 volts on the VTVM. Do this for each channel. If there are no internal Play Level adjustments, use the main Play Volume control(s) to produce that output figure. Leave them at these settings for the remainder of the procedure.

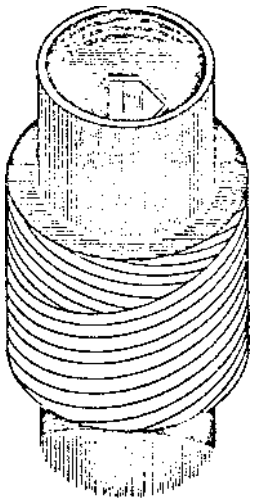
Next, check the playback frequency re• sponse by means of the test tape, adjusting the Play Equalization control (if there is one) to obtain the flattest possible response. Don't touch head alignment unless the high-end response falls below specifications by more than one dB or so. Even then, head alignment should be approached with caution since it can be tricky—especially if you don't know which screw to adjust. Follow the service manual.

Test-tape equalization tests are recorded at 10 to 15 dB lower than the zero maximum so change the VTVM's range accordingly. If it is not possible to get absolutely flat response from the test tape by means of the equalization pots, the best compromise is to match the level at 7 to 8 kHz to the level at 400 or 1000 Hz. That completes the play adjustment. and if you did it right, it should not have to be adjusted again until the play head is replaced. Let the test tape wind all the way through at play speed (rather than rewinding it) and then remove and store it.

The technique for the record setup. will depend on whether or not you have a service manual and whether or not your recorder has the separate play head necessary to monitor from the tape while recording. If you have a manual, follow it, regardless of what kind of recorder you have. If you don't have a manual, but you do have a three-headed recorder, here's how to do the setup.

Connect the VTVM to either Line Output, load a tape of the kind you will he recording on most of the time, and feed a mid-range (400 to 1000 Hz) signal into the appropriate Line Input, adjusting level until the recorder's volume indicator reads zero or thereabouts. Then start recording at the machine's high speed and switch the monitor selector to Tape. Adjust the record level a bit if necessary in order to get a VTVM reading directly on one of the meter's decibel calibrations near the right end of the 1-volt scale.

Bias Adjustments. Some recorders have adjustments for Bias Purity or Waveform, Bias Traps, Bias Frequency, and so on. Leave these strictly alone. Find the one identified as Bias Current or, simply, Bias.



Some equalization adjustments are made on a coil with hexagonal hole in molded slug.

for the channel you are adjusting. and slowly rotate the screw until the measured output from the tape is maximum.

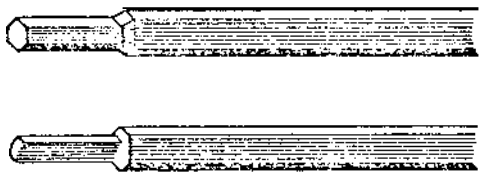
Reduce the input signal to a level 10 dB below the Zero point, switch the oscillator to 10,000 Hz, and watch the measured output from the tape as you slowly adjust the Bias screw clockwise. If 10,000 Hz diminishes in level, make a note to yourself that "Clockwise Bias is Increase." If it increases, make a note that "Clockwise Bias is Decrease." This is so you will know which way to turn the screw when the next step calls for increasing the bias.

Go back to the midfrequency from the oscillator, bring the record level meter reading back up to Zero, and adjust the VTVM's range switch so that the meter is on-scale to the right. Once more, adjust the Bias for maximum output from the tape and again adjust the Input level until the VTVM reads right on one of its decibel calibrations near the right end of the 1-volt scale. Then, very slowly, turn the Bias screw in the direction to increase it. You will observe that the measured output from the tape will decrease as you increase the bias. Increase bias until the measured output has

decreased by exactly ½ dB (1 dB in a machine with 15-ips speed). Now, repeat the above steps for the other channel using the same speed.

You will probably notice, now, that there is a change in volume when you change the tape monitor switch from Input to Tape and vice versa. The next adjustment will fix that. Still feeding the midfrequency tone to the tape, adjust the Record Calibrate or Record Level pot for the channel you have the VTVM connected to until there is less than ½ dB of measured difference when you operate the monitor switch. Then connect the VTVM and signal generator to the other channel and repeat the procedure.

With some recorders, the VU meters will be automatically calibrated by the time you have completed the procedure thus far. To check this, record the midfrequency signal on your blank tape at an input level necessary to get back (in Play mode) the same level you got from the Zero-dB part of your test tape. This recording level should coincide with the Zero-VU indications on the recorder's own meter. If it doesn't, adjust the internal Meter Calibrate pot for each channel.



Here are two varieties of plastic adjustment tools for coils: hex (above, and oval.

Record Equalization adjustments must be made for each of the recorder's speeds. Because of the substantial amount of treble boosting that normally takes place when recording (to compensate for inherent losses of the medium), response measurements at high frequencies must be made at a level considerably below zero dB. For adjustment purposes, a level of —10 dB (below zero) can be used for a speed of 7½, while —15 and —20 dB are appropriate for 3¾ and 17/8 ips, respectively. Measurement of the actual high-end range of a machine will usually necessitate using even lower levels.

Record Equalization. To set Record Equalization, select a midfrequency tone, set the monitor switch to Input, and adjust the input level until the VTVM at the Line Output reads about the requisite amount below the 1.2-volt zero-dB level. Select a high-frequency tone, adjust the input level if necessary for the same low level, and switch the monitor back and forth between Tape and Input, adjusting the appropriate Record Equalization until the Input and Output levels match. Then do the same for the other channel and other speeds.

One important note: some recorders use a molded "slug" threaded into a coil form for equalization adjustments. Unlike potentiometer adjustments, which cover their full range in less than a full revolution. these slugs may need several turns. Many of them cannot be adjusted with an ordinary screwdriver. Some have a hexagonal hole in them and require a special plastic tool of the kind sold in radio supply stores for TV i-f transformer adjustment. Others have a roughly oval hole and require yet another kind of tool. It is essential. though. not to try to use anything other than the proper tool. A small screwdriver may look as if it would work, but it may split the slug in half, making it impossible to adjust from then on. Then the entire coil has to be replaced.

A final note about two-headed recorders. Without the ability to monitor from the tape while recording. all recording. circuit adjustments in these machines must be made with a tedious record—rewind--play procedure. One way of getting around this is to use two machines side by side. with the one being adjusted doing the recording (with its capstan bypassed) and the other pulling the tape and playing it back as the adjustments are made on the first machine.

With cassette recorders, the very slow running speed makes it possible to adjust the high-frequency response by varying the bias current; and this is the way it should be done. Service manuals for cassette machines usually specify that record equalization be set by measuring the equalization itself rather than by measuring its effect on tape playback. Once this is set. "equalization" adjustment is a simple matter of recording a midfrequency tone and then a high-frequency one of the same amplitude. playing them back. and making appropriate adjustments of the bias each time until both play back at the same level. Watch the input level, though. This must be at least 15 dB below the normal maximum Zero level indicated on the record meter.

Of course, no amount of care in setup can make any recorder perform better than its inherent potential, so don't expect an inexpensive machine to produce playbacks that are indistinguishable from the original signals. But if yours is a machine for whch the manufacturer claims really high-quality performance, careful setup can make it truly difficult to distinguish between the original and the playback. Even if there is a difference. though. it's nice to know the recorder is doing its best for you, and that you aren't at the mercy of the local audio repair shop every time you want to switch to a different kind of recording tape.