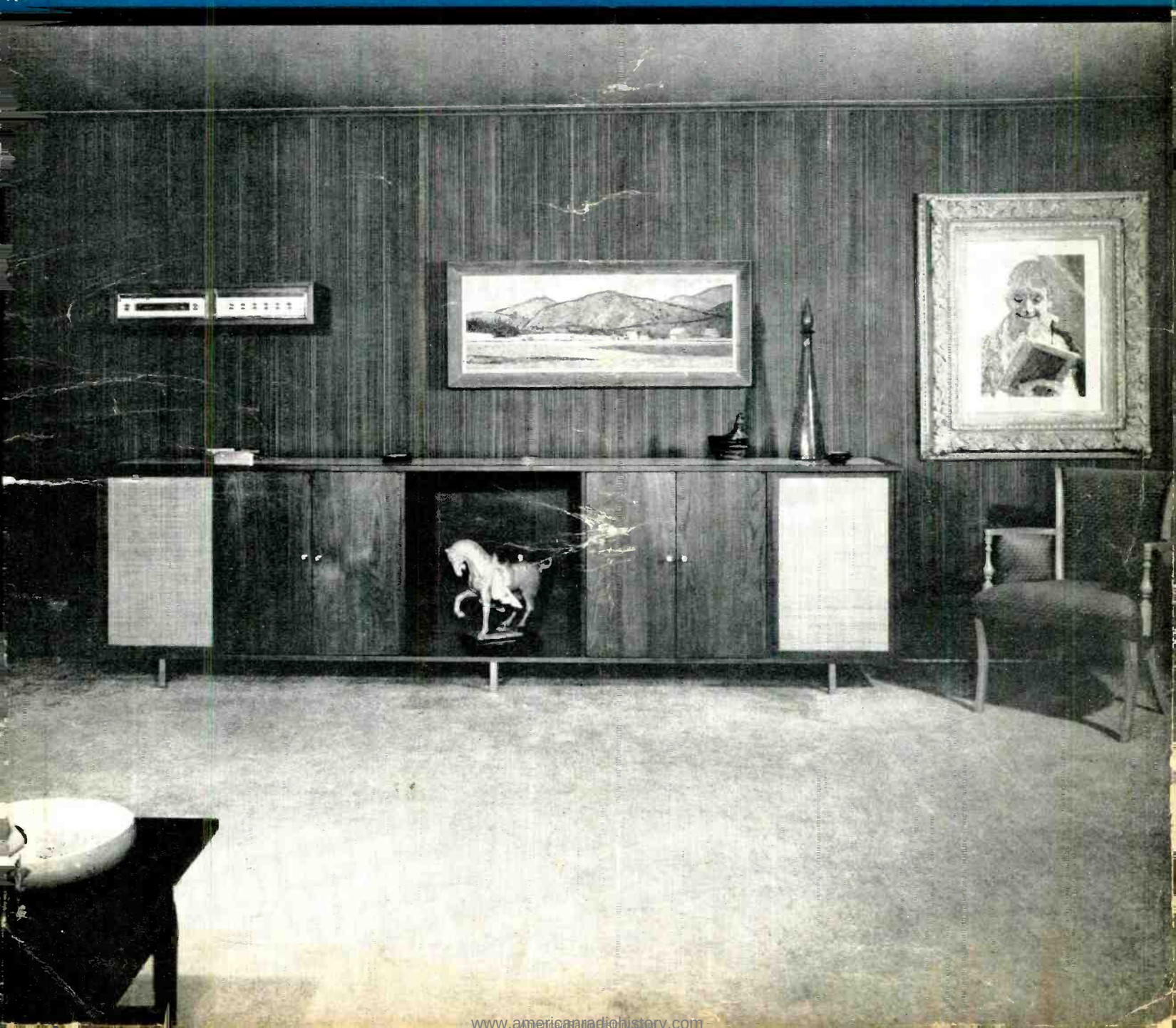
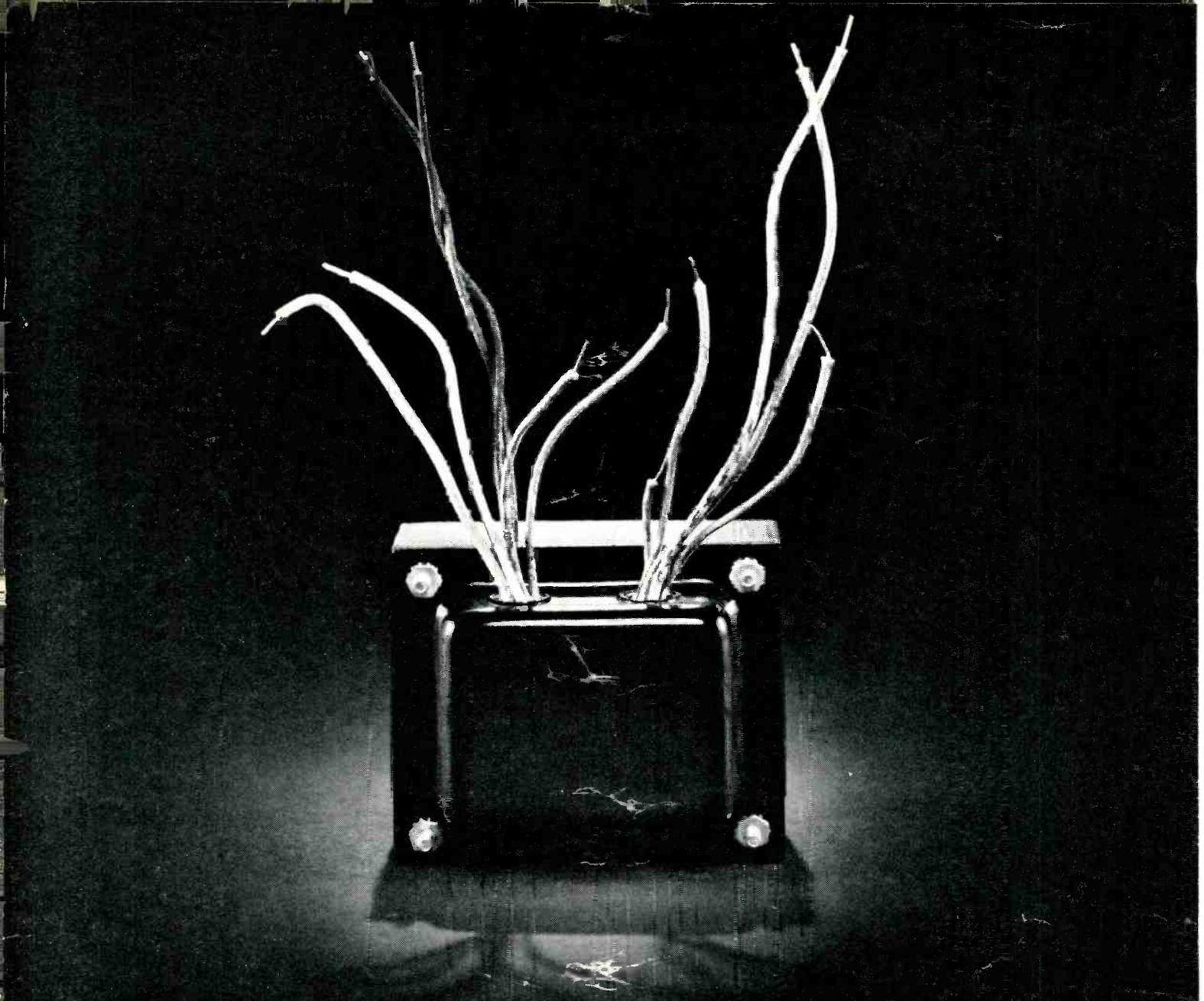
AUDIO

NOVEMBER, 1963
60¢

...the original magazine about high fidelity!





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Scott extravagances can be found in the powerful 80-watt 299D and the modestly priced 48-watt 222D, as well as the previously mentioned 200B. They can be found on all Scott Kits. Visit your favorite hi-fi dealer for a demonstration or circle the number below on the information card bound into the magazine, and Scott will mail you complete information on all their quality products.

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AUDIO

NOVEMBER, 1963 VOL. 47, No. 11

Successor to RADIO, Est. 1917

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AUDIO Profiles

AUDIO in General

AUDIO (title registered U. S. Pat. Off.) is published monthly by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary. Executive and Editorial Offices, 204 Front St., Mineola, N. Y. Subscription rates—U. S., Possessions, Canada, and Mexico, $5.00 for one year, $9.00 for two years; all other countries $6.00 per year. Single copies 60¢. Printed in U.S.A. at 10 McGovern Ave., Lancaster, Pa.

Second Class postage paid at Lancaster, Pa.

RADIO MAGAZINES, INC., P. O. Box 629, MINEOLA, N. Y.
Postmaster: Send Form 3579 to AUDIO, P. O. Box 629, Mineola, N. Y.

Coming NEXT Month

Construction . . .

● The Auditioneer. John Whitacre, chief engineer of station WILS in Lansing, Michigan, gives plans and describes a record auditioning setup which permits copywriters to listen at their desks so that copy can be integrated with the music program. This device can also be useful for small theater companies, or anyone who needs to integrate music and text.

● An Open-Baffle Parallel-Series Array. R. S. Oakley, Jr. describes a method for taking advantage of the excellent midrange of multiple speaker arrays in an open-backed infinite baffle.

Sound Reinforcement

● Controlling Sound Reinforcement Systems. David Klepper presents an approach to control console design and the importance of proper positioning of the operator.

and

Equipment Profiles . . .

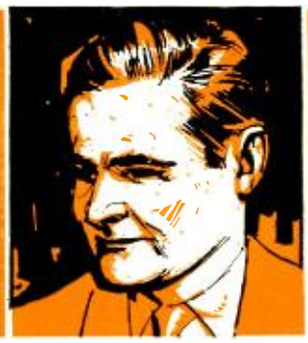
Sherwood 3000VI FM-stereo tuner
Korting 3000 stereo tape recorder
Fisher 500C stereo receiver
Shure M222 Studio Dynetic arm and cartridge

In the December Issue

On the newsstands, at your favorite audio dealer's, or in your own mailbox

AUDIO CLINIC

Joseph Giovanelli



Send questions to:
Joseph Giovanelli
2819 Newkirk Ave.
Brooklyn 26, N. Y.
Include stamped, self-addressed envelope.

British and American Power Ratings

Q. Once and for all, what is the difference between our method by which amplifier output power is rated and the method used by the Americans? James Wilkins, Surrey, England.

A. Here we enter what may be to some people in the field, a controversial subject. As far as I am concerned, the only meaningful method of measuring power output of an amplifier is to inject a sine wave into the input of the amplifier and measure the rms power out at a specified percentage of distortion. The easiest way to do this is to use a voltmeter connected across the output of the amplifier. The amplifier is, of course, loaded with a suitable resistive load.

Many manufacturers use this method of obtaining their output power data. There are some other standards used here, including the so-called "music power" standard. The confusion arises when the method by which the power output was obtained is not given in the manufacturer's literature.

I believe that in your country, you also use the method of obtaining output power based upon the sinewave input and upon rms output, but in most instances you use a lower distortion percentage as the reference. Thus for a given output configuration the power output rating would be lower in your country.

Tracking Force and Compliance

Q. I recently bought a cartridge that sounds right to me, but I have two questions about it. The manufacturer recommends a tracking force of 3 grams, although its published specifications show a compliance of 12×10^{-6} cm/dyne. I have been led to understand that high compliance cartridges should be used in arms that track at under two grams. The arm I now use will not track properly at that force. Does the arm in this case affect the output of the cartridge? Is the force of the arm affecting the stylus? Donald M. Goss, Brooklyn, New York.

A. If the manufacturer recommends a particular tracking force, by all means track the cartridge as recommended.

When the compliance is very high, tracking at forces greater than those recommended by their manufacturers will cause the stylus to bend up. The cartridge may then ride on the surface of the record. This is obviously not going to contribute beneficially to the sound of the recording.

More important, excessive tracking force will change the relationship of the stylus assembly to the remainder of the cartridge's signal-generating circuit. This may reduce output, decrease separation, reduce high frequency response, or a combination of these conditions.

Heat in Power Transformers

Q. I have a home-built power amplifier using essentially the same circuit as the power amplifier section of the Scott 99-D.

The circuit called for a power transformer rated at 700 v.c.t. at 130 ma. Because of the considerations attendent upon making a stereo version of this unit, I have just about doubled the current rating, using 700 v.c.t. at 250 ma. All voltages are correct as checked with a VTVM. None of the resistors overheats or changes value after as much as 4 hours of continuous operation. The voltages do not change either. No unusual distortion becomes noticeable. The problem is that the power transformer becomes extremely warm. It is not so hot that it cannot be touched, but it is very, very warm.

I have tried three different transformers, thinking of shorted windings. I have checked and changed the filter capacitors and made measurements a number of times, and done everything else I can think of, to no avail.

Can this be considered a normal occurrence for a transformer to run so hot? The previous amplifier I built used 6973's and never got that hot. Joseph Wolpin, Silver Spring, Maryland.

A. You should expect the power transformer to run very warm. You are operating it near its maximum capabilities. A transformer is not a completely lossless item. What losses there are will be in the form of heat. There are a number of commercial units available on which it is impossible to rest your hand after the unit has come to operating temperature.

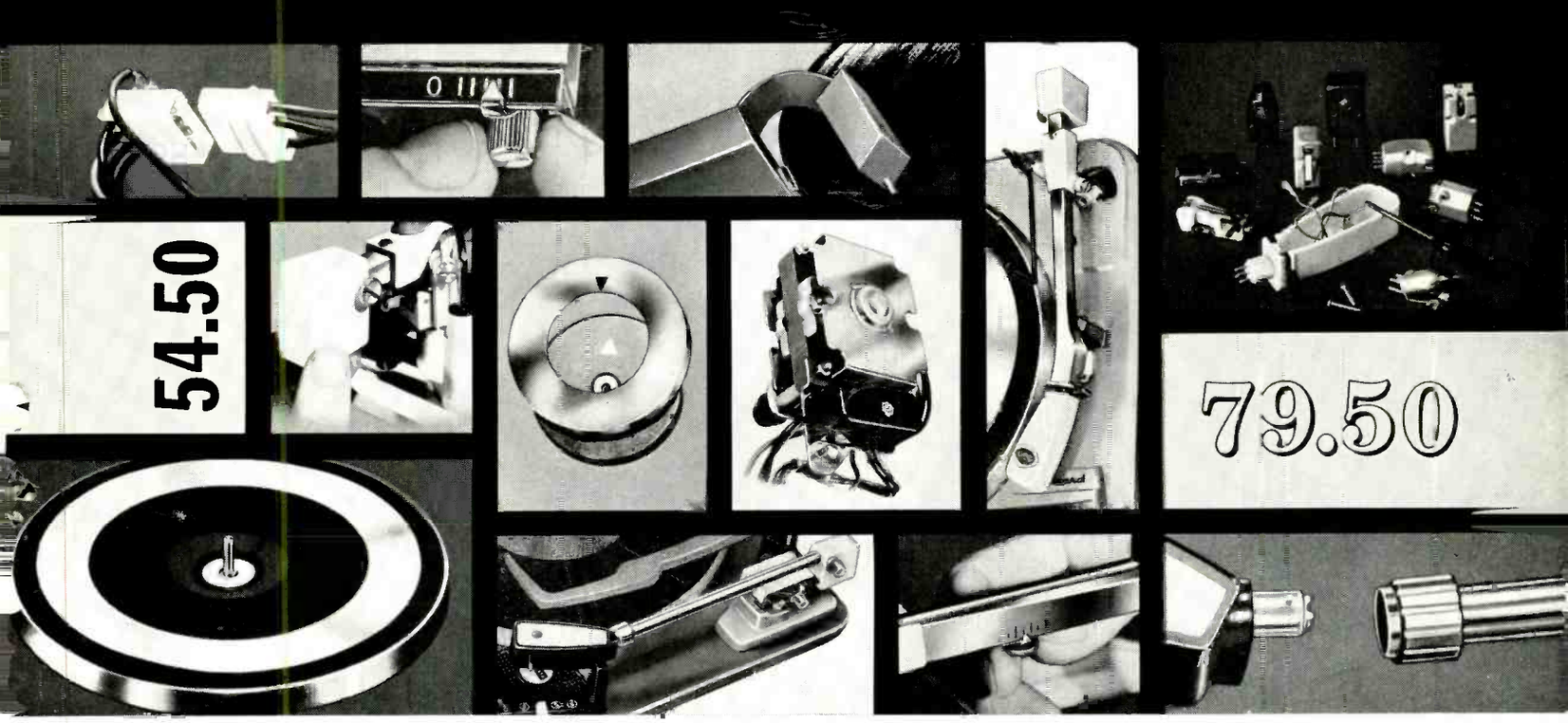
The current taken by your previous amplifier was less than that required by your present one. Because the transformer in your former unit did not have to supply as much power as your present transformer must, the heat losses in the transformer were less, and hence this transformer ran cool.

A power transformer could be designed to run cool even when it is to deliver 250 ma. To build it would require the use of a power transformer capable of supplying 500 to 700 ma. The size, weight, and expense of such a transformer commensurate with the benefits derived from its use, do not justify the time and effort involved.

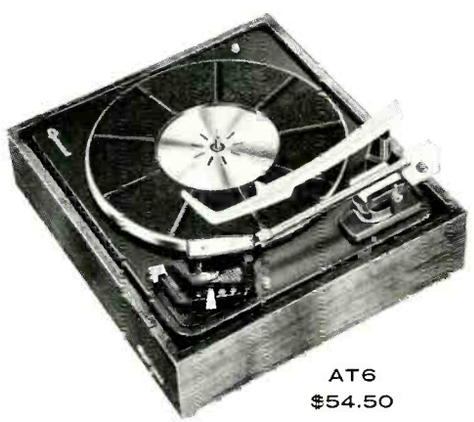
Excessive Treble Response

Q. My music system seems to have excessive treble response. This is not the fault of the speakers, because I have used several different kinds with the same results. It is present on all program sources. The highs are not distorted, but are very shrill and projected. Turning the treble control down

WHAT'S THE BEST THING ABOUT A GARRARD AUTOMATIC TURNTABLE?



TYPE A
$79.50



AT6
$54.50

It could be the tone arm—dynamically balanced...counterweight adjusted...tracking even professional cartridges flawlessly for flawless reproduction. It could be the turntable...over sized, heavy, and balanced. It could be the motor...Laboratory Series...on speed...double-shielded against hum, and free from rumble. It could be the automatic feature...at your service when you want it...foolproof, incomparably gentle to records. It could be *any* of these...precision components that you would previously have expected to select individually and have mounted together. Now, in the Automatic Turntable, Garrard has combined and integrated them for you. But we don't think any of these are the best thing about a Garrard Automatic Turntable. Most people realize after they own a Garrard, that the most important advantage it offers stems from a 50 year fund of engineering experience and a glorious tradition of craftsmanship...supported by superior manufacturing and quality-control techniques, and the industry's most comprehensive spare parts and authorized nationwide service network. These practical factors result in the enduring satisfaction which Garrard owners enjoy. Every time you play your Garrard, the pleasure and the pride you will derive from owning this magnificent mechanism will increase. We think *this* is the best thing about a Garrard Automatic Turntable!

There is a Garrard for every high fidelity system. Type A $79.50, AT6 $54.50, Autoslim $39.50. For Comparator Guide, write: Dept. GS-13, Garrard Sales Corp., Port Washington, New York.

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does not help. The only possible explanation I can think of is the fact that there are a number of glass bookcases in the room, which provide a large reflecting surface. Can you think of any other possibilities? How can the condition be remedied? Peter Spocrri, Brooklyn, New York.

A. First, set your tone controls to their flat positions and make a frequency response run on your preamplifier and amplifier. If the highs exhibit a rising characteristic, make separate frequency runs on both the amplifier and the preamplifier, in order to determine which unit is the culprit. Once this has been ascertained, use standard troubleshooting procedures to determine the reason for the treble boost.

If the original frequency run showed your amplifier and preamplifier to be flat, or if you took steps to make the equipment flat, and still the treble response is exaggerated, it is likely that the exaggerated high frequencies you hear are produced by room reflections.

To reduce them, use as many drapes as possible. They absorb sound, especially in the high frequencies. If you cannot use drapes or if their use does not eliminate the reflections sufficiently, there is an alternative.

If your speakers have tweeter attenuators, use them rather than the treble controls of the preamplifier. You should adjust the attenuator to suit your taste. If the speaker system does not possess such attenuators, you should incorporate them into the unit. If this is impossible, then about all I can suggest is that you place various thicknesses of material over the tweeter opening until you arrive at the amount of attenuation desired. The only bad part about this approach is that the attenuation will not be uniform over the range offered by the tweeter.

If you use the treble control, you can reduce the highs to suit your taste. However, the over-all sound will probably lack life, or "presence" because you have also attenuated frequencies which were not annoying to you. An over-all frequency response with the tone control set to suit the listener might show a reasonably flat response up to some frequency. Then a dip may occur, followed by a rise to approximately the zero reference point. Æ

THIS MONTH'S COVER

The cover installation shown this month was installed by Norman Rozak for Mr. William Stacy, 1005 County Line Rd., Highland Park, Illinois. Mr. Rozak informed us that the equipment is ventilated through an opening in the wall which allows the heat to dissipate into the crawl space above.

The record changer is mounted behind the left-hand pair of doors where space is also provided for record storage. Although this space is used for records it can easily be adapted to house a tape recorder.

The equipment used for this installation consists of a Sherwood S5500II stereo amplifier and S3000IV FM/MX stereo tuner, Garrard Type A turntable, Shure M7D cartridge, and two Sherwood Ravinia SR3 speaker systems. Installation and cabinetry by Rozak Bros., Hi Fi and TV, Highland Park, Illinois. (Photo courtesy of Sherwood Electronic Labs. Inc.)

NEW ALL-TRANSISTOR FOR PLAYBACK® PERFECTION

Transistors have changed the idea that old-fashioned vacuum-tube amplifiers could not be appreciably improved. First proof of what transistors could really do came to us five years ago when we applied solid state circuitry to specialized amplifiers for the telephone industry, the military, and other commercial and professional users. This early experience taught us that transistors had a revolution in store for future amplifier development; it was only a matter of time and a great deal of experimentation before we could make a more truly perfect amplifier available for studio PLAYBACK and serious home use.

Three years ago, at a time when most amplifiers were of the vacuum-tube type, we marketed our first all-transistor power amplifier for PLAYBACK applications. Today, the 351B model is credited as the most advanced single-channel amplifier of its type in the professional field. Shortly after the 351, we introduced the now famous 708A "Astro"—the only all-in-one stereo center with all-transistor power output stages. Now, after five years of actual production experience with solid state circuitry, we take pride in introducing the 360A all-transistor stereo pre/power amplifier . . . for PLAYBACK perfection.

WANT TO HEAR THE SOUND OF PLAYBACK PERFECTION?

That question contains a strong claim, but one that we have seen substantiated time and again during the many listening tests performed on the new solid-state Altec 360A Royale II stereo amplifier/preamplifier. In fact, the difference in perfection between this unit and even the finest vacuum tube amplifier is amazingly apparent. The lowest frequencies are unbelievably solid and life-like; snare drums sound like snare drums, an organ is an organ (you almost look for the pipes). Transient distortion, background hiss, and microphonics are conspicuous by their absence. Hum is so completely inaudible, even at loudest volumes, that we conclude there just isn't any. The highs are crisp, clean, transparent; for the first time, you hear a piccolo in complete purity because the amplifier does not contain, and does not need, a built-in bass boost for the lower end.

In short, the 360A is so far more perfect than the finest tube amplifier, we predict that others will hastily experiment and a rash of transistorized amplifiers will follow. But at Altec, experimentation is over! Five years of transistor amplifier production have literally put the 360A five years ahead of the home music field.

But no amount of words on paper can relate the somewhat startling audio revelation we had when we first listened to the 360A. The sound of perfection is not easy to describe. May we suggest a trip to your nearest Altec Distributor for a personal evaluation of this thing we call "transistor sound" (or perfection if you will).

NEW IN APPEARANCE, TOO!

The 360A is the first "keyboard" amplifier. Named for its unique musical-instrument type front panel keyboard control arrangement, the 360A offers operating convenience at one central front panel location, eliminating the universal objection to a miscellany of switches.

POWER • 70 watts (IHFM); 35 watts per channel.

INPUTS • 12, stereo or mono: magnetic or ceramic phono, tape head, stereo microphones, tape, radio, auxiliary.

OUTPUTS • 7, stereo or mono: left, right and center speaker outputs, left and right channel recorder outputs, center channel voltage output for auxiliary amplifier, headphone output jack.

KEYBOARD CONTROLS • Rumble filter, stereo-mono switch, tape monitor, channel reverse, hi-low gain, volume contour, scratch filter, phase reverse, headphone-speaker output switch.

OTHER FRONT PANEL CONTROLS • Input selector, channel reverse, independent bass and treble controls (friction coupled), blend control, balance control, volume control.

REAR PANEL CONTROLS • Magnetic-ceramic phono input selector, speaker impedence selector.

PRICE • $366.00 including cabinet. Only 5½" H, 15" W, 11¼" D.

SPECIAL FEATURES • Automatic reset circuit breakers for over-current protection of each channel and AC line. Diffused keyboard illumination plus daylight power indicator. Both headset and speaker monitoring for tape recording on front panel. Variable crossover type bass tone control for bass boost independent of mid-range.

PERFECT PARTNERS

FAVORITE OF BROADCASTERS
The 314A Emperor Royale FM Multiplex Tuner.

For FM stereo that will do justice to the Royale II, the 314A Emperor Royale FM Multiplex tuner is the answer. The 314A is a fully professional component which is offered in the Altec PLAYBACK catalog for network relay and rebroadcast applications. Among its distinctive features is a monophonic output for feeding a 351B all-transistor power amplifier for single-channel music distribution throughout the home. Price: $359.00, including cabinet.

Hear Altec's complete line of genuine studio PLAYBACK components soon at your nearest Altec Distributor (see your Yellow Pages).

Also, be sure to ask for your courtesy copy of the Altec Catalog, " PLAYBACK and Speech Input Equipment for Recording and Broadcast Studios," which illustrates how the big name record companies and broadcast networks use Altec equipment to achieve PLAYBACK perfection. Or, write for your free copy to Dept. A-11.

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LETTERS

Sennheiser Microphone Profile

SIR:

Allow me to make some comments with regard to your Equipment Profile on the Sennheiser MKH104 condenser microphone in the October issue.

Every European manufacturer of condenser microphones has been working feverishly on perfecting a usuable r.f. transistor circuit for the past five years, ever since disclosure of the patented makeup of such an amplifier more than four years ago by the Netherlands Broadcasting Co. Schoeps, Neumann, and AKG all have such units in preparation and all of them have displayed them at German industry and radio fairs for over 18 months.

One of the principal problems is how to make a *cardioid* capsule work with such a circuit and how to make the circuit stable, both with regard to temperature changes and proximity of units to each other, bearing in mind that we are dealing with r.f. One thing, however, written in your report that is absolutely misleading is that such a microphone has no "tube" noise. Of course it would have only "transistor" noise and that is no less of a problem than noise in tubes. To illustrate, the manufacturer's specification of the MKH104 indicate a self noise level of less than 10 μv, whereas that for the Neumann 269 microphone using an AC-701k tube is equal to or less than 8 μv. Since the Neumann microphone's output level is 1.55 mV/μbar and that for the MKH104 is 2 mV/μbar, we end up with identical signal-to-noise ratios for both. It might be pointed out additionally that the weighted noise level of the Neumann unit (and therefore an indication of its annoyance factor to the human ear) is less than or equal to 1.5 μV. This measurement is unfortunately not given in the Sennheiser data.

STEPHEN F. TEMMER, President,
Gotham Audio Corporation,
2 West 46th St.,
New York 36, N. Y.

And a Reply

SIR:

Discussions about a new product, such as a Condenser Microphone with integral r.f. circuitry, are usually welcome. However, one cannot base such a discussion on erroneous premises as Mr. Temmer has obviously done.

The figures given by Mr. Temmer, which indicate a seemingly more favorable weighted noise level figure for the Neumann M269, as compared with a similarly measured Sennheiser Model MKH104 Condenser Microphone, can be explained by two facts:

1. Measuring procedures used for evaluation of noise levels vary. The Neumann Company measures according to DIN (German Industrial Standard) 5045, while Sennheiser measures according to DIN 45.405. The latter standard is the one commonly used by the German broadcasting indunstry. As the Neumann Company itself acknowledges, the use of DIN 5045 measuring procedure results in values better by 10 db than those obtained with DIN 45.405.
2. In order to obtain a valid comparison of the M269 with the spherical (omnidirectional) MKH104 microphone, one must, of course, measure the sensitivity of the M269 in operation as a microphone with a spherical characteristic. This does not result in a reading of 1.55 mv/μbar, but rather one of 0.9 mv/μbar. The comparable sensitivity is therefore 4.5 db less than that asserted by Mr. Temmer.

If one takes these two factors into account, a 46-db signal-to-noise ratio for the M269 results. The MKH104, with its sensitivity of 2mv/μbar and noise level of 10 microvolts, also has a signal-to-noise ratio of 46 db. Furthermore, the unweighted signal-to-noise-ratio of the MKH-104 is 10 db better than that of the M269. Despite this fact, the M269, one of the Neumann Company's best microphones has a barrel diameter which is twice that of the MKH104.

In comparison with microphones using audio frequency circuitry, the MKH104 has, by virtue of its r.f. circuitry, numerous, considerable advantages:

1. Since the microphone capsule used with the r.f. circuitry presents a low impedance, microphones incorporating them are insensitive to the effects of humidity to a great extent. Consequent imperfections in insulation within the capsule have therefore very small effects, in comparison to cartridges in audio-frequency circuitry.
2. By utilizing r.f. circuitry, the low end of the response curve may be extended at will—in special cases, even down to 0.1. That of the MKH104 is below 20 cps.
3. Having no output transformer, the microphone is insensitive to interference from magnetic fields. It is also insensitive to other r.f. condenser microphones and sources of r.f. noise in close proximity, because the input is well shielded against r.f. pickup.
4. Power is furnished only by a single-voltage, low current source.
5. Sensitivity to mechanical shock is lower than that of tube circuitry.
6. Transistorization results in great ruggedness and long life expectancy.
7. The price is relatively low, especially in view of the total cost of a complete microphone system.

THOMAS A. SCHILLINGER
SENNHEISER ELECTRONIC CROP. (N. Y.)
25 W. 43rd Street,
New York 36, N. Y.

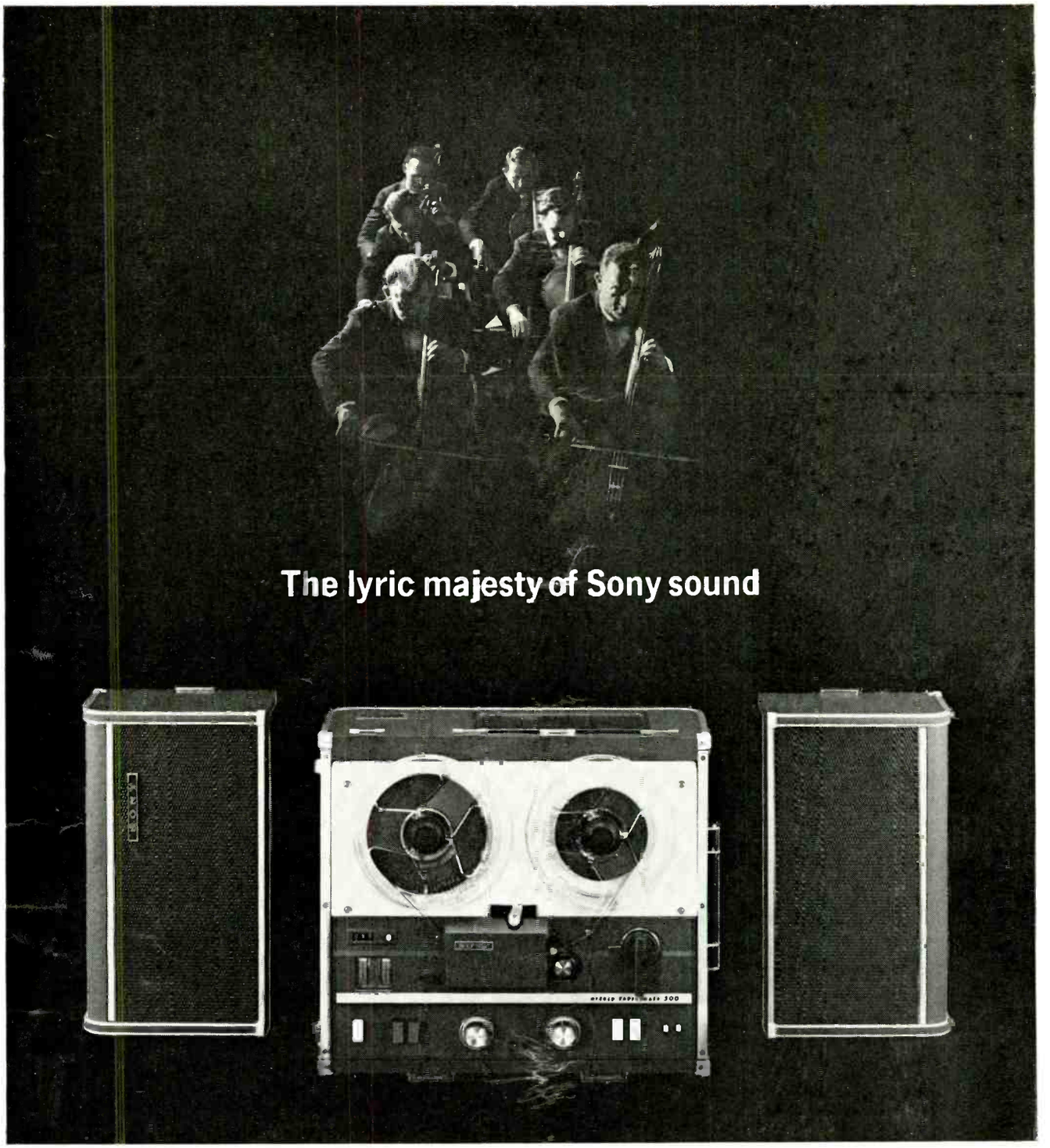
Advertising Words

SIR:

I admire good advertising but here are some of the words which bother me:

1. *Professional.* In this category I would place radio stations, sound recordings studios and the like. Most of them use equipment which generally has a line and/or bridging input and a line output at 600 ohms. They are conservatively rated and made for rack mounting. Most of the so called "professional" equipment in the advertisements would not fall into this classification.
2. *Special.* For example: Stereo records must be played with a "special" stereo pickup, or a special stereo multiplex tuner is required for receiving FM multiplex. To me this implies that a regular stereo pickup or a regular FM-MX tuner would not work.
3. *Ultimate.* This implies that no improvement can be made. Just what does this manufacturer say next year when his product is supposed to be better than last years "Ultimate?"

(*Continued on page 75*)



A magnificent new stereophonic high fidelity tape system; precise, versatile, complete in itself, the **Sony Sterecorder 500**, with the revolutionary lid-integrating speakers, may be purchased for less than $399.50 complete with two F-87 cardioid dynamic microphones.

Outstanding operational features distinguish the amazing new Sony Sterecorder 500: ■ Acoustical cone suspension speakers ■ Speakers combine to form carrying case lid ■ 4-track stereo and monophonic recording and playback ■ Vertical or horizontal operation ■ Microphone and line mixing ■ Sound on sound ■ Two V.U. meters ■ Hysteresis-Synchronous drive motor ■ Dynamically balanced capstan flywheel ■ Pause control ■ Contour switch ■ Automatic shut-off ■ Automatic tape lifters ■ FM stereo inputs ■ Multiplex Ready!

SONY. SUPERSCOPE® *The Tapeway to Stereo*

Sony tape recorders, the most complete line of quality recording equipment in the world, start at less than $79.50.
For literature or name of nearest dealer, write Superscope, Inc., Dept. 7 Sun Valley, Calif. *In New York, visit the Sony Salon, 585 Fifth Avenue.*

LIGHT LISTENING

Chester Santon

A Festival of Marches
Columbia Tape MQ 572

Boston Pops: Concert in the Park
RCA Victor LSC 2677

This column is being written while impressions of the 1963 New York High Fidelity show are only about a day old. There have been years when the New York show had relatively few new topics of interest to a record and tape reviewer. Certainly the emphasis on FM-Stereo in recent shows covered ground that had little to do with significant innovations in the playback process itself. It's a pleasure to report that anyone attending the 1963 affair with expectation of improvement in the playback chain did not emerge from the show disappointed. To mention just one area of improvement, the solid state amplifiers enjoying their first major public display did quite a bit to dispel the notion that audio shows have been similar in sound during the past few years. Previous shows had demonstrated the qualities of solid state preamps but 1963 was our first opportunity to check the performance of a variety of solid state amplifiers. After quite a few hours of listening to solid state amplifying devices at this year's show, I came away with at least one distinct impression. The changes in sound brought about by transistor design show up more readily in amplifiers than they do in solid state preamps. It would appear that the elimination of the amplifier transformer has more effect on the final sound than you get when the tubes are taken out of a preamp in favor of transistors. During the past year, most of us have had occasion to sample transistor sound on the basis of a solid state preamp going to a good tube-design amplifier. The latest show, on the other hand, included one display where a top-grade tube preamp was used as a control center to feed a solid-state stereo amplifier offering fifty watts in each far-from-cheap channel. This combination (after several listening sessions that included a sampling of more than one record label) gave me just as much "transistor" sound as any New York show display that was solid state in both amp and preamp. I have a hunch that any general swing to solid state, if and when it comes, will find many listeners hanging on to good preamps of tube design while they postpone that trip to Europe in order to be the first on their block with a top-notch solid state amplifier. Then, when their children are through college, they'll get the preamp.

The two recordings I'm gradually getting around to reviewing in this space can hardly be put in the same class with the best recorded material I heard reproduced at the show. For that matter, a great many current record and tape releases simply aren't in the same audio league with the best of the new components displayed at the '63 show. The same comment, of course, could have been made about some shows of the past, with the conspicuous exception of the two shows that followed the introduction of stereo pickups. With so much of the record industry's output geared to the mass market these days, knowledgeable exhibitors had to exert considerable care this year in choosing releases that could do justice to their equipment. In most cases, the reliance was still on the stereo disc instead of four-track tape wherever maximum frequency response was being sought for the equipment in use.

Perhaps the easiest way to classify the Columbia four-track tape and the RCA Dynagroove stereo disc compared in this review is to state that neither item is capable of demonstrating all the features of either the forty- or fifty-watt solid state amplifiers unveiled at the show this year. For that matter, neither of these releases (Ormandy and the Philadelphia Orchestra in the Festival of Marches and the Boston Pops in the other) would have done justice to the top amplifiers of tube design on display this year. In trying to evaluate the relative merits of stereo disc and four-track, reel-to-reel tape, I realize that the preferred procedure is to compare a given performance on the same label as issued in both the tape and disc version. Most record companies seem to hold the opinion that shipment of light music in both tape and disc form to a single reviewer would immediately bring on some horrible form of bankruptcy (or worse yet, the possibility of an objective comparison). Actually, these two items are close enough in relative merit to make a contest. To begin with, this reel is a little better than most and the stereo disc, though improved in relation to early Dynagroove, is still a notch or two below the best RCA has turned out in the past. So there are the makings of a contest here and it goes something like this. Both releases contain Charles Gounod's familiar bit of whimsey called "The Funeral March of a Marionette." The structure of the piece has several loud crashes that tower above the general level of dynamics and most of the sections of the orchestra have individual opportunities to display their tonal colors to good advantage. In the first runthrough at normal listening level, the disc had the edge. The tape delivered about four-fifths of the frequency spectrum exhibited by the disc, the missing part being the very top end. At this same volume, the other inherent advantages of tape did not register enough to counter the distinct disadvantage of the loss of top treble. The stereo disc had more sheen in instrumental color and more room sound although both recordings seemed quite similar in their miking distance. It was only when I turned up the volume beyond the usual listening level that the tape came into its own. Then the middle and low frequencies that tape can deliver so well without the disc maker's concern with overcutting in the bass region swung the balance in favor of tape. That's where we stand today although we know that both media—tape and disc—have delivered better sound in the past: the tape in the now discontinued two-track stereo reels duplicated at speeds slower than those in use today for four-track, the disc at 45 rpm with no more than 15 to 20 minutes of music on one side of a 12-inch disc.

Fast, Fast, Fast Relief from TV Commercials
Audio Fidelity AFSD 6112

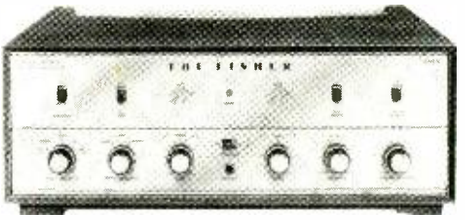
Don't let the heading of this review throw you. Audio Fidelity is not marketing a new squelch circuit designed to knock out both sound and picture when your nonfavorite televison commercial hits the screen. This stereo release contains a total of 33 takeoffs on some of America's best known and important (to the sponsor, that is) commercials seen in recent years in the video medium. Over the years, radio has had its share of inane advertising but it took television's added impact to bring the dramatized commercial to its present state of highly developed imperfection. Mercifully, many of the spoofs on this record are of shorter duration than the actual commercials being torn apart. Some of the commercials are disposed of with only a line or two of script and a cogent sound effect by Bob Prescott, the wizard who starred in Audio Fidelity's earlier humor-through-sound records (Cartoons, AF 7008 and Russian Roulette, AF 6103). In roasting the output of Madison Ave., AF president Sid Frey turned to top professionals who are thoroughly familiar with every twist and turn of ad agency operation. The album was written and produced by John C. Farris, a copywriter at one of the bigger agencies who first began to go "straight" when he started to submit material for radio comedians Bob and Ray. His voice appears in five skits as he assists actress Bryna Raeburn and actor Bob McFadden in tearing down some of the marketing industry's most sacred shrines. Between them, the Raeburn-McFadden team recreates with startling accuracy the familiar voices of such pillars of commercial TV as the South American coffee grower, the lady hopelessly in love with her hair and the low-suds-ing washer repairman. Most of the skits aim their comedy at wacky endings for the stock situations with Bob Prescott supplying the improbable and wildly out of control sound effects. The most effective use of stereo is found in the moving footsteps of the green-leafed giant and the sounds of a robbery echoing through a reverberant building as the friendly announcer at one side of the "screen" tells us how easy it is to get money at his bank. Not all the episodes hit the bullseye but enough of them do to make this release most interesting to everyone except the poor guys who have to put together this stuff with a straight face. The sound on the disc, naturally, is clean! clean!! clean!!!

The Boys From Syracuse (New York Cast)
Capitol STAO 1933

Tovarich (Original Broadway Cast)
Capitol STAO 1940

Capitol seems to have cornered the late-season activity in Broadway musicals. Both of these shows opened last spring but they've been rather slow in getting to records. "Tovarich," starring Vivien Leigh and Jean Pierre Aumont, had the misfortune to open well before the end of last winter's New York newspaper strike. The off-Broadway revival of Richard Rodgers' "Boys From Syracuse," carrying a far smaller budget, had smoother sailing in the seldom predictable seas of the New York theatre. Of the two shows, the Rodgers and Hart hit of 1938 offers the home listeners the greater value. What production of the present can boast melodies as winning as *Falling in Love with Love, The Shortest Day of the Year,* or *You Have Cast your Shadow on the Sea?* Which of recent seasons even approach the lilt and bounce of *Sing For Your Supper* and *This Can't Be Love?* The leading players of the New York revival, Ellen Hanley, Julianne Marie, Stuart Damon, and Clifford David, give the Rodgers tunes every break—they sing them without affectation.

The tardiness of "Tovarich" in making its appearance on record counters reflects a sense of caution that is rather recent on the part of record companies dealing in original cast albums. Only a few seasons ago, the major labels thought nothing of issuing a show on discs a day or so after its Broadway opening. The last two seasons, however, have seen an embarrassing number of instances where a show was recorded prior to opening, only to



There are only three finer control amplifiers than this $169.50* Fisher X-100-B.

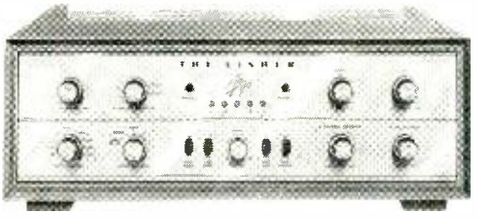
(The three below.)

There are only two finer control amplifiers than this $199.50* Fisher X-101-C.

(The two below.)

There is only one finer control amplifier than this $249.50* Fisher X-202-B.

(The one below.)



There is no finer control amplifier than this $339.50* Fisher X-1000.

Single-chassis, integrated stereo control-amplifiers are one of the great Fisher specialties. Their special design problem—that of combining the stereo power-amplifier section with the stereo preamplifier and audio control system in a single space-saving but no-compromise unit—has been solved by Fisher engineers to an unprecedented degree of technical sophistication.

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For your copy of the 44-page Fisher Handbook, see coupon on Page 11.

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In striking contrast to the industry-wide standard of 90 days, the Fisher Warranty is extended to all tubes, diodes and parts for a period of one year from date of purchase.

*LESS CABINET. ALL PRICES SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N.Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT. ** PATENT PENDING

have the disc firm find itself stuck with the album when the musical folded a week or two after opening. In "Tovarich," Miss Leigh appears in her first musical, singing songs by a composer known only off-Broadway. Lee Pockriss had written only on local score prior to "Tovarich"—the 1960 production "Ernest in Love" (Columbia stereo album OS 2027) based on Oscar Wilde's "Importance of Being Ernest." Both the composer and star manage nicely in this familiar story of exiled Russian nobility working as household servants for an American family in the Paris of the 1920's.

Moon Gas

M-G-M 4119

Composers of popular melodies have yet to exhaust all the possibilities of electronic music making, especially when instrumental effects can be aided by the human voice. Vocalist Mary Mayo is joined by a group of musicians under the direction of pianist-organist Dick Hyman in this exploration of electronic music. Unlike the effects achieved by manipulation of tape on the part of the avant-garde composers working in "Musique Concrète," this glimpse of the future is provided by live (and kicking only mildly about their assignment) musicians playing a variety of electronic musical instruments. Two modified Lowrey organs, the Theremin-like Martinot, a super-electric guitar, an ondioline and a pure-tone oscillator with a dial operated by a telegraph key are the main ingredients in the accompaniment given Miss Mayo. A swinging rhythm section completes a distinctly offbeat release on which someone lavished a great deal of work.

Jack Hylton and his Orchestra

Capitol TAO 10323

When Capitol Records gained access some years ago to the huge vaults containing the 78-rpm master recordings of His Master's Voice in England, few of us suspected that we would some day be treated to unexpected treasures such as this. Here on one mono LP are the choicest selections in the repertory of the famous Jack Hylton Orchestra, the master recordings given a much better break with today's disc cutting equipment. The public acceptance that greeted the appearance of the re-issues of the Ray Noble Orchestra some months ago proved to Capitol that many record buyers do have memories that go back several decades. Few readers of this periodical are unaware of the fact that the Hylton and Noble recordings issued here in the Thirties on the RCA Victor black label were landmarks in sound whose importance transcended the undeniable appeal they had as musical entertainment. Anyone with access to the better grades of playback equipment of that time was quick to appreciate the fact that these two maestros enjoyed a frequency response and room ambience in their recordings that were unique in their day. It is my recollection, based on what I heard on the typical monitoring equipment used in the broadcast industry at that time, that Jack Hylton's large dance orchestra had a more life-like sound than did most of our symphonic ensembles on domestic classical recordings.

Hylton's crew was tops in showmanship during an era that nurtured, in addition to Ray Noble, such famous British bands as Bert Ambrose, Geraldo, Carroll Gibbons, Joe Loss, and Reginald Foresythe. His flashy "concert" arrangements of popular ballads became a fixture on the B.B.C. as early as 1926 and the band's broadcasts to America, in addition to its best-selling records, paved the way for a visit to this country in 1935. Hylton formed an American orchestra in Chicago (David Rose and George Wettling were members) for a lengthy engagement at the Drake Hotel. Represented in this recording are the great arrangements that the band made famous on two continents: *She Shall Have Music, Body and Soul, Just a Gigolo* and Franz Lehar's *Yours is my Heart Alone* with the German concert star Marcel Wittrisch miked in the vocal at a distance then used only in operatic recordings. This disc should be a revelation to your next door neighbor who has never suspected what the European record industry was able to do in the Thirties. Æ

Dollar for dollar, no one makes a tuner with greater sensitivity than the Fisher FM-100-B.

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FISHER CURRENTLY manufactures nine FM-Stereo-Multiplex tuners. And each is unquestionably the world's finest at its price. One comes in kit form (the KM-60). Another incorporates AM (the R-200). Two others have for some time been the world's only tuners with integral wire or wireless remote control (the MF-300 and MF-320 respectively).

The FM-100-B, though popularly priced, yields to no other in its ability to receive even the weakest broadcast signals with optimum noise suppression and interference rejection. Its sensitivity is 1.8 microvolts (IHF). Capture ratio: 2.2 db (IHF).

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AUDIO ETC.

Edward Tatnall Canby

SHOW TIME

What was new at this year's hi fi shows? This month is when we can give an afterview, in contrast to the previews of the spring and summer. Right now, the new equipment is already "old stuff," this being November; but even so, the significant aspects of this year's new production haven't yet had time to reach out into the home and become familiar. So it's a good moment for some brief and lovely generalizations.

As happens increasingly these years, I didn't find much "new" at the show. No disrespect to the manufacturers—far from it. The nature of the component hi fi world makes this inevitable. We are long past the heady days, the period of discovery, when a whole new area of home entertainment was being laid down in its various essential aspects. Just as Edison, the old-time basic inventor, has few successors in this much more technical age, so the whopping new innovations of the first years of component hi fi are pretty much over and done with. Now, we move forward by moving sidewise—expanding, multiplying—and by refinements, minor and major.

Indeed, the public relations people are hard put to it to drum up their "totally new" stories. (Just as always, we feel we must keep up the fiction that each year's models are a smashing breakthrough into new worlds of . . . well, uh, of something anyhow.) Very little is totally new in audio these days, and rightly so.

Thus after many an hour of systematic show-study last fall—I managed to "cover," however briefly, every exhibit at the New York Show—I came away impressed by almost everything; but I could only preserve in my mind three things that seemed to me of outstanding significance and of those, two are merely continuing important trends. That leaves one, if I can trust my slightly confused show-memory. One really important *innovation*—something basically new this year that promises major fruits in the future.

My three points are these: 1. More and more "solid state" (I couldn't help wishing someone with a humorous quirk would have thought to advertise his "liquid state" amplifier!); 2. new magnetic tape heads and new tapes to match—a revolutionary combination; and 3. a point more symbolic of a major and ill-defined area of home activity: home tape machines designed to make their own tape copies—one machine, not two.

1. Solid-State

"Solid state" posters were in evidence all over this year's show. The solid-state bandwagon is rolling hard. Even that old (and reasonable) combination "transistorized" is now out of style. The irresistible push, it seems, is to get rid of all non-solid elements (gaseous, liquid, and maybe plasma) and go the whole hog. I am not competent to judge this development on a technical basis except via the ear and via outward usefulness. So far, I've been waiting for the preliminary furor to pass and it's been four or five years since I worked with the first solid-state home amplifiers, the soon-to-be-defunct Vico line. In general terms, then, I'll merely make these points.

First, it's becoming clear that all of us home folks in a few more years are going to be transistorized down to our last tube, unless we hang onto our old equipment with exceptional obstinacy. Like my numerous friends who still play only 78-rpm records, and my hundreds of acquaintances who don't yet have stereo and don't like it. (Note the order of these last two statements.) In terms of designing, realization and manufacture, solid-state hi fi obviously has made big headway this year, and that is that.

But whether there is a "transistor sound" or not, I do not know, nor am I much concerned. This is one of those hollow arguments that ends up mainly in expressions of personal preference. Ideally, there ain't no such thing, just as there is only one ideal loudspeaker sound—flat and undistorted as per the generating signal. If there is, indeed, a transistor sound, then it is a vague form of single or compound distortion and, very likely it is temporary, reflecting the relatively young state of the art of taming these marvelous little monsters.

If I were buying hi fi, I wouldn't look for transistor sound. I'd look for hi fi.

2. Tapes and Heads

The new tape and new heads coming in this year begin to emerge together as a major technological revolution within the whole tape recording area. So it appears to me at this point. As yet, I scarcely know more than the outlines of what has happened and so cannot comment on the details—but you'll be interested in first impressions and first informations as they've so far reached me.

The basic innovator was the 3M tape cartridge as already discussed here and previously in these pages. But what most of us didn't at once see was that the research into a whole new plane of tape reproduction, miniaturized, would inevitably extend beyond the somewhat narrow area covered by the emerging cartridge changer-deck.

For here was a new tape-and-head combination that afforded basically new levels of performance. Tape that was scarcely bigger nor heavier than the cellophane ribbon you pull off your cigarettes and chewing gum packs, and, with new heads, able to put out at 1⅞ ips a quality of sound that before had belonged to twice or four times the speed. Applied to standard-size tape and to standard-gauge equipment of all sorts, the same performance is available in proportion. And so a new round in the series of advances in tape since its innovation has now set in, with all the consequences that may be imagined.

Thus 3M's new full-size tape, already sold in initial experimental form during the summer as LR 1278, is as I write on the point of standardization, as 3M's 202. Those who have tried it speak of its extremely fine grain, reduced hiss level ("more than 4 db and it sounds even better") and measurably lower distortion. Also improved head wear qualities, and of course, a gain in the highs at slow speed, allowing the significantly improved performance. All these points are debatable in detail (and the possible gain in the high end is less important if you plan to record at higher speeds—natch) but the fact remains that at this year's hi fi show the tape was all over the place—easily recognized by its peculiar silvery gray color. And, moreover, there were new heads to match, already trickling in.

The new head-making technique, if I get it straight, is ingenious beyond words—it really made me jump to hear about it. A "deposited" head gap, solid, not an air gap, put down directly upon the head metal in a non-magnetic deposited material which may be any thickness you want down to a theoretical one-molecule-deep layer! And the whole rigidly bound into one solid piece. Phew—what next?

I don't know myself just how recent this technique is in the field of tape-head manufacture; I heard about it too recently. But the implications jump at you. Head gaps have been an incredible problem, successively solved in actual physical gaps of tinier and tinier width. Now, assuming the new process really works, we can have heads with reliable solid-state "gaps" to match new fine-grain tapes, down as far as you want to go. It's already started.

Relevance to the hi fi shows? Simply this: that, if my guess is any good, by next year the new tapes (other companies are on the point of releasing their own equivalents) and the new heads to match will have started another move towards slower tape speeds, in all but the top professional levels where other factors than tape speed count most. And the "homier" the tape equipment, the more significant will the change be.

From the little miniature transistor portable recorders right up to the fanciest home machines—even the big ones that take 10½-inch reels—the new state of the art will begin to be felt by next year's shows. Maybe not extensively, for it will take more than a year to realize the furthest implications of basically improved tape-and-head configuration. But even by next year many a modest but significant minor change in electronics, notably in tape equalization, will have quietly been made to take advantage of the new developments. And in equally simple fashion, new-type heads may well slip into the old housings to revolutionize performance in existing models. This is the optimistic Canby guess, anyhow. And, I should add, even existing tape recorders should greatly benefit from the new tapes—some of them won't need any head change to do their best, and in any case the lowered distortion, the smoother, finer grain and easier high frequency response, the lowered head wear, the reduced tape noise, will benefit all machines of any age.

3. Tape Copying

Tape copying? One enterprising and, I think, slightly humorous manufacturer put out a four-reel home tape recorder this year which actually had me laughing, at the show, it looked so funny, with all those reels churning around at once and multiple tapes zipping in and out of heads. It is a standard-type home recorder but with an optional extension pair of reels; via the one capstan and head assembly a reel of tape is played and simultaneously recorded onto a second reel (each with feed and take-up reels, making a total of four).

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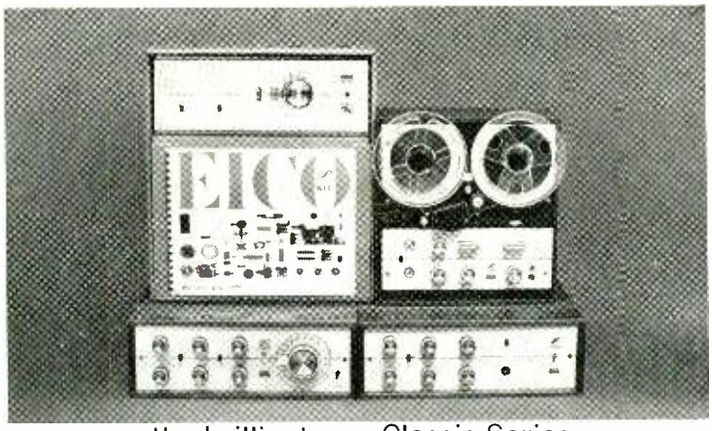

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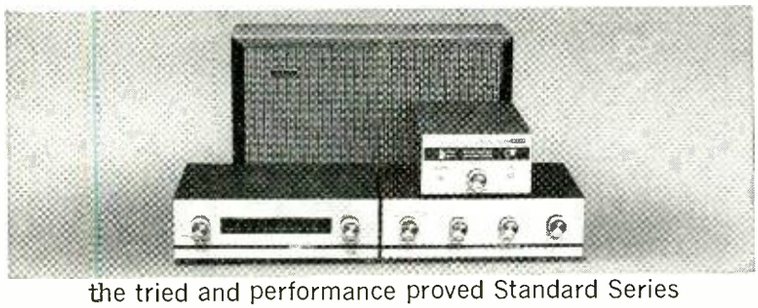

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505 Main

CALIFORNIA
ANAHEIM
Allied World of Music
912-916 S. Euclid
Henry Radio
931 N. Euclid Avenue
Stereo Mart
979 S. Los Angeles St.
AZUSA
Rancho Sound Co.
18532 E. Alosta
BAKERSFIELD
Milligan's Audio Visual
217 S. Chester
BERKELEY
Thos Tenney Hi Fi Shop
2984 College Avenue
BURBANK
Audio Mart
921 W. Magnolia Blvd.
BURLINGAME
Foremans
1409 Burlingame Ave.
CASTRO VALLEY
Calbar Custom Electronics
3223 Castro Valley Blvd.
CULVER CITY
Electronic Trading Post
4364 Sepulveda Blvd.
Hi Fi Matic Company
5554 Sepulveda Blvd.
FRESNO
Stephenson-Bradford Music Co.
624 W. Olive
FULLERTON
Pacific Recorders
1532 W. Commonwealth
GARDENA
Stereo Hi Fi Center
13996 S. Crenshaw
GARDEN GROVE
State Electronics
13225 Harbor Blvd.
GLENDALE
Medico Electric Labs
1111 E. Chevy Chase Dr.
Radio Lab
806 S. Central
GOLETA
Electronic Components of Oxnard
(Formerly Dow Electronics)
1505 S. Oxnard Blvd.
HOLLYWOOD
Franklin Electronics of California
5945 Gregory Avenue
INGLEWOOD
Newark Electronics Co.
4747 W. Century Blvd.
Olson Electronics of Inglewood
4642 W. Century Blvd.
LA CANADA
Audio Corner
655 Foothill Blvd.
LANCASTER
Loewen and Sons
755 Lancaster Blvd.
LIVERMORE
Calbar Custom Electronics
2184 First Street
LONG BEACH
Scott Audio Company
266 Alamitos
LOS ALTOS
Audio Center
293 State Street
LOS ANGELES
Beverly Electronics Co.
8413 Beverly Blvd.
Crenshaw Hi Fi Center
107 Santa Barbara Pl.
Electronic Components of Westwood
2008-18 Westwood Blvd.
Henry Radio
11240 W. Olympic Blvd.
Hi Fi Corner
7901 Melrose Avenue
Hi Fi Corner
669 N. Fairfax
Magnetic Recorders Co.
7140 Melrose Avenue
Ralke Company
849 N. Highland Ave.
MENLO PARK
McDaniel's Hi Fi
935 El Camino Real
NORTH HOLLYWOOD
Chesney Stereo Center
11335 Camarillo
Olson Electronics of N. Hollywood
5356 Lankershim Blvd.
OAKLAND
True Recordings Co.
3883 Piedmont Avenue
ORANGE
Fidelity Sound
238 South Glassell
PALM SPRINGS
Pat Barbara Music
121 S. Palm Canyon Rd.
PALO ALTO
Mardix
2103 El Camino Real
PASADENA
Electronic Components of Pasadena
(Formerly Dow Radio)
1759 E. Colorado Blvd.
High Fidelity House
563 S. Fair Oaks
Stereo Mart
3205 E. Foothill Blvd.
REDONDO BEACH
Griffey Electronics
235 N. Pac. Cst. HiWay
RIVERSIDE
Audio Designers
4010 Merrill Street
SACRAMENTO
Industrial Sound & Telephone
2001 El Camino Ave.
McCurry Camera Stores
8th and Eye Street
McCurry Camera Stores
Country Club Center
McCurry Camera Stores
Southgate Center
SAN BERNARDINO
George Barns & Son
3358 N. "E" Street
SAN DIEGO
Electronic Equipment Distributors
3686 El Cajon Blvd.
High Fidelity House
1635 University Ave.
Recording Center
3941-5th Avenue
Telrad Electronics
3453 University Ave.
Wrights House of Hi Fi
5140 El Cajon Blvd.
SAN FRANCISCO
Lakeshore Hi Fi
222 W. Portal Avenue
Skinner Hirsch & Kaye
229 Kearny Street
Zack Electronics
1424 Market Street
SAN MATEO
Foreman's
111 East Fourth Ave.
Foreman's
202 Hillsdale Mall
SAN PEDRO
Bowers Music
810 South Gaffey
SAN RAFAEL
Catania Sound
1541 Fourth Street
SANTA ANA
Campbells Photo-Audio Center
2122 N. Main Street
Hi Fidelity Associates
1812 N. Main Street
SANTA BARBARA
Audio Center
3321 State Street
Electronic Components of Santa Barbara
(Formerly Dow Electronics)
5857 Hollister Avenue
Westen's, Inc.
800 State Street
SANTA MARIA
Electronic Components of Santa Maria
(Formerly Dow Electronics)
222 W. Main
TUJUNGA
Woodall Cameras
7165 Foothill Blvd.
VISTA
T.V. Craftsmen
516-518 E. Vista Way
WALNUT CREEK
Stevenson Electronics
1531 Locust Street
WHITTIER
Oxbow Electronics
15914 E. Whittier Blvd.
WEST LOS ANGELES
Bel Air Camera
933 Westwood Blvd.

COLORADO
BOULDER
House of Music
1779 29th Cross Roads, North
COLORADO SPRINGS
Dick Jurgen's High Fidelity and Sound
530 South Tejon
DENVER
Burstein-Applebee Co.
1237 16th Street
Davis Audio-Visual, Inc.
2149 South Grape St.
Electric Accessories Co.
1620 Blake Street
Electric Accessories Co.
262 Fillmore Street
Empire Stereo & Hi Fi Center
1100 Broadway
Gramophone Shop
2904 E. 3rd Avenue
Howard Sound Corp.
843 Broadway
Lloyd's Hi Fi Shop
410 S. Colorado Blvd.
Sound in the Round
562 S. Broadway

CONNECTICUT
HARTFORD
Stereo Shop Inc.
229 Asylum Street
NEW HAVEN
David Dean Smith
262 Elm Street

DELAWARE
WILMINGTON
Radio Electric Service Co. of Delaware
3rd and Tatnall Street

DISTRICT OF COLUMBIA
WASHINGTON, D.C.
Custom Hi Fi
1811 Columbia Rd. N.W.
Electronic Wholesalers
2345 Sherman Ave. N.W.
Kitt Music Company
1330 G Street, N.W.
Shrader Sound
2803 M Street, N.W.

FLORIDA
FT. LAUDERDALE
High Fidelity Associates
1620 N. Federal Hwy.
MIAMI
Electronic Wholesalers
9390 N.W. 27th Ave.
Flagler Radio Co.
1068 West Flagler St.
High Fidelity Associates
3180 Biscayne Blvd.
High Fidelity Associates
3396 Coral Way
Sound Box
11503 S. Dixie Hwy.
PENSACOLA
Grice Electronics
300 E. Wright Street
TAMPA
Viviano Stereo Center
1538 S. Dale Mabry

IDAHO
IDAHO FALLS
Hart's Inc.
633 Safstrom Drive

ILLINOIS
AURORA
Cook's Hi Fi
47 Fox Street
CHAMPAIGN
Radio Doctor's Hi Fi
811 W. Springfield
CHICAGO
Allied Radio Corp.
100 N. Western Ave.
Allied Radio Corp.
2025 West 95th St.
Allied Radio Corp.
921 North Rush St.
Educational Specialists
915 W. Wilson Ave.
Freid's
3801 W. 26th
Musicraft
48 E. Oak Street
NewarkElectronicsCorp
223 West Madison
Ralph's Hi Fi
5310 W. North Ave.
Schwartz Bros.
8533 S. Cottage Grove
EVANSTON
Allied Radio Corp.
602 Davis Street
OAK PARK
Allied Radio Corp.
7055 W. North Ave.

INDIANA
INDIANAPOLIS
Pearson Platters
Devington Center

IOWA
WATERLOO
Farnsworth Electronics
201-205 E. Mullan Ave.

KANSAS
DODGE CITY
Dodge Music
203 First Avenue

KENTUCKY
LOUISVILLE
Gatchel's
431 W. Walnut St.

LOUISIANA
BATON ROUGE
Ogden Park Record Shop
618 N. 3rd
LAFAYETTE
"Prof" Erny's Music
1508 S. College
SHREVEPORT
Koelemay Sales Co.
2530 Linwood Avenue

MARYLAND
BALTIMORE
Hi Fi Shop
320 W. Baltimore St.
High Fidelity House
5123 Roland Avenue
BETHESDA
Audio Center
4962 Fairmount Ave.
SILVER SPRINGS
Federated Purchasers
1310 Apple Avenue
TOWSON
Hi Fi Shop
Towson Plaza

MASSACHUSETTS
BOSTON
De Mambro Radio
1095 Commonwealth Avenue
CAMBRIDGE
Minute Man Radio
28 Boylston Street
HOLYOKE
Del Padre Audio
270 High Street
NORTHAMPTON
Del Padre Audio
28 Main Street
SPRINGFIELD
Del Padre Audio
999 Worthington St.
Soundco Electronics
147 Dwight Street
WELLESLEY
Music Box
58 Central Avenue

MICHIGAN
ANN ARBOR
The Music Center
304 S. Thayer Street
DEARBORN
Almas Hi-Fi Stereo
15031 Michigan Ave.
DETROIT
Almas Hi-Fi Stereo
7104 W. 7 Mile Road
High Fidelity Workshop
16400 W. 7 Mile Road
Lobby Hobby
17300 Woodward Ave.
Newark Ferguson Electronics
20700 Hubbell Avenue
Pecar Electronics
11201 Morang
EAST LANSING
Tape Recording Ind.
1101 E. Grand River
GRAND RAPIDS
Audio Distributors
2342 S. Division Ave.
Electronic Sound
2249 S. Division

MINNESOTA
MINNEAPOLIS
Audio King
913 West Lake Street

MISSOURI
KANSAS CITY
Burstein-Applebee Co.
1012 McGee Street
Burstein-Applebee Co.
301 East 55th Street
Improved Method's Corporation
8325 Wornall Road
McGee Radio Co.
1901 McGee Street
ST. LOUIS
Aeolian Co. of Missouri
1004 Olive Street
Aeolian Co. of Missouri
39 Crestwood Plaza
Aeolian Co. of Missouri
7754 Forsyth Blvd.
Van Sickle Radio-Electronics, Inc.
1113 Pine Street

NEBRASKA
OMAHA
J B Electronics Hi-Fi-Stereo
1618 Cass Street

NEVADA
LAS VEGAS
Garehime Music
115 N. 3rd Street
RENO
Art Rempel Sound Supply Co.
460 S. Wells Avenue

NEW JERSEY
ALLENTOWN
Federated Purchasers
1113 Hamilton Street
CAMDEN
Radio Electric Service Co. of Penn.
30 Market Street
CLARK
Scholl Electronics
1113 Raritan Road
CRANFORD
Stuart's Audio
8 Alden Street
JERSEY CITY
Massa Sales & Service
434 Central Avenue
LYNDHURST
A Custom Stereo Center
530 Riverside Avenue
MENLO PARK
Bamberger's
Parsonage Rd.
MONMOUTH
Bamberger's
EatontownShoppingCtr.
MONTCLAIR
Perdue Radio Company
10 South Park Street
MORRISTOWN
Paramount-Morristown TV & Radio Sales
33 South Street
NEWARK
Bamberger's
131 Market St.
Lafayette Radio Electronics
24 Central Avenue
Sound Reproduction
34 New Street
NEW BRUNSWICK
Hi Fi Haven
28 Easton Avenue
PARAMUS
Bamberger's
Garden State Plaza
Gem Electronics
385 Route 17
PLAINFIELD
Lafayette Radio Electronics
139 W. 2nd Street
SHREWSBURY
Federated Purchasers
483 Broad Street
SPRINGFIELD
Federated Purchasers
U.S. Route 22
Gem Electronics
Route #22
TOTOWA BOROUGH
Sim-o-rama Sound Service
572 Union Blvd.
TRENTON
House of Hi Fi
961 Princeton Avenue
WESTFIELD
Stuart's Audio
17 Elm Street

NEW MEXICO
ALBUQUERQUE
Sound By Hi Fi House
3011 Monte Vista Blvd., N.E.
LAS CRUCES
Mannie's TV
802 S. Solano

NEW YORK
BRONX
Gem Electronics
565 East Fordham Road
Lafayette Radio Electronics
542 East Fordham Road
BROOKLYN
The Audio Exchange
1065 Flatbush Avenue
Gem Electronics
59 Willoughby Street
BUFFALO
FM Sound Equipment
1241 Main Street
Purchase Radio & Hi-Fi Corp.
(Lafayette Radio Associate Store)
747 Main Street
FARMINGDALE, L.I.
Gem Electronics
34 Hempstead Turnpike
FOREST HILLS
Gem Electronics
101-10 Queens Blvd.
HUNTINGTON STA., L.I.
Rite Electronics
1946 New York Avenue
JAMAICA, L.I.
The Audio Exchange
153-21 Hillside Avenue
Lafayette Radio Electronics
165-08 Liberty Avenue
MANHASSET
The Audio Exchange
451 Plundome Road
NEW YORK
Audio Unlimited
715 2nd Avenue
Carston Studios
125 East 88th Street
Consolidated Radio Sales
768 Amsterdam Avenue
G. Schirmer
4 East 49th Street
Gem Electronics
202 East 44th Street
Harvey Radio Co.
103 West 43rd Street
Harvey Radio Co.
1123 6th Avenue
Hi-Fidelity Center
1797 First Ave. (at 93rd St.)
Leonard Radio Inc.
69 Cortlandt Street
Leonard Radio
1163 Avenue of the Americas
Lyric High Fidelity Center
1221 Lexington Avenue
Macy
Herald Square
Packard Electronics Corporation
33 Union Square West
Rabsons—57 Street Inc.
119 West 57th Street
Sonocraft
115 W. 45th Street
Terminal Hudson Electronic's Inc.
48 West 48th Street
Terminal Hudson Electronic's Inc.
212 Fulton Street
ROCHESTER
Craig Audio Labs
139 North Union Street
SYOSSET, L.I.
Lafayette Radio Electronics
111 Jericho Turnpike
TUCKAHOE
Boynton Studio's
295 Main Street
WHITE PLAINS
The Audio Exchange
203 Mamaroneck Ave.
YONKERS
Gem Electronics
1937 Central Avenue

OHIO
AKRON
Olson Electronics, Inc.
69 West State Street
CINCINNATI
Customcrafters Audio
2259 Gilbert Avenue
Steinberg's
633 Walnut Street
CLEVELAND
Audio Craft Company
2915 Prospect Avenue
Olson Electronics of Cleveland
2020 Euclid Avenue
Olson Electronics —Southland
6813 Pearl Road
COLUMBUS
Electronic Supply
814 West 3rd Avenue
Jimmy Rea's
479 West Rich Street
Palmer Electronics
1589 W. Fifth Avenue
DAYTON
Custom Electronics
1918 South Brown St.
Klopf's Music Shop
323 Salem Avenue
FAIRBORN
Custom Electronics
419 West Dayton Drive
KENT
Dayho Electronics
411 Longmere
SPRINGFIELD
Gene Tavenner
32 E. Harding
YOUNGSTOWN
Hi Fi Center
2802 Market Street

OKLAHOMA
NORMAN
Thomson Sound
315 W. Boyd
OKLAHOMA CITY
Audio Specialties
2608 N. Pennsylvania
Larsen Music Co.
314 Park Avenue
TULSA
Sound Unlimited
3745 S. Peoria

OREGON
EUGENE
Oregon Typewriter & Recorder
1111 Willamette Street
PORTLAND
High Fidelity Unlimited
2816 S.W. Sam Jackson Park Road
Oregon Typewriter & Recorder
500 S.W. 5th Avenue
Oregon Typewriter & Recorder
1061 Lloyds Center

PENNSYLVANIA
PHILADELPHIA
Radio Electric Service Co. of Penn.
701 Arch Street
SWARTHMORE
Hi Fi Studio
8 Park Avenue
WILLOW GROVE
Radio Electric Service Co. of Penn.
29 York Road

RHODE ISLAND
CRANSTON
Sound-o-rama
758 Reservoir Avenue

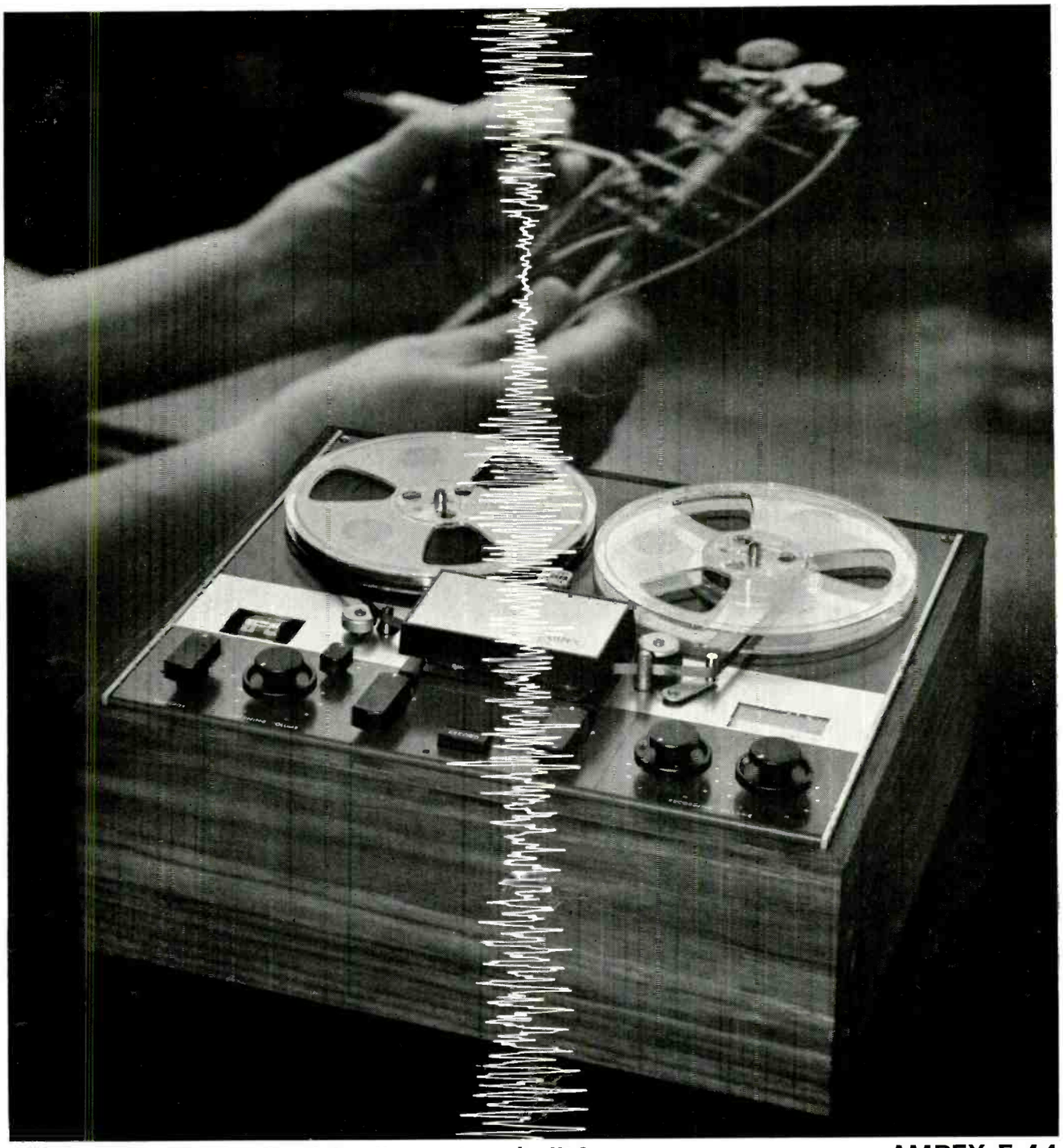
TENNESSEE
KNOXVILLE
McClung Appliances
310 Georgia Street, N.E.
MEMPHIS
W & W Distributing Co.
644-46 Madison Avenue

TEXAS
AUSTIN
High Fidelity
1610 Lavaca
BEAUMONT
Brock Audio
2293 Calder
DALLAS
Ernstroms
4356 Lovers Lane
Hillcrest High Fidelity
6309 Hillcrest
Home Music Associates
4518 N. Central Expressway
EL PASO
The Howell Company
2873 Pershing Drive
FT. WORTH
Audio Associates
4802 Camp Bowie
HOUSTON
Audio Center
1424 Westheimer
Busacker Electronic Systems
1216 West Clay
Hi Fi Kit Shop
2326 Bissonnet
Sound Equipment Co.
2506 Crawford Street
Sound Equipment Co.
3727 Westheimer
LAREDO
Cowl's Music Center
1212 Hidalgo
MIDLAND
May-Duncan Music
219 N. Main
Midland Camera Co.
317 N. Colorado
SAN ANGELO
Accurate Sound
15 N. Tyler
SAN ANTONIO
Bill Case Sound
3522 Broadway
Sterling Electronics
3903 San Pedro
Vandergrift Audio Co.
6740 San Pedro

UTAH
OGDEN
Hi Fi Shop
2323 Washington Blvd.
SALT LAKE CITY
Clark Music
28 East 1st South
George F. Webb Sales
937 E. 33rd South St.
House of Music
156 South Main

WASHINGTON
BURIEN
Hess Recorder Co. Stereo Center
650 S.W. 152nd Street
LYNNWOOD
Cascade Electronic Supply
P.O. Building
RICHLAND
20th Century Sales
260 Williams Blvd.
SEATTLE
Electricraft
1408 6th Ave.
SPOKANE
20th Century Sales
W. 1021 First Avenue
TACOMA
Paulson's
1101 South K Street
Paulson's
6111 100th S.W.

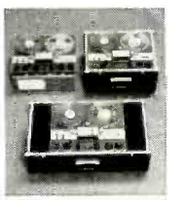
WISCONSIN
MILWAUKEE
Allied Radio Corporation
3555 S. 27th Street
Allied Radio Corporation
5314 N. Pt. Washington Road
Flanner and Hafsoos
2500 N. 108th Street
Hi-Fi Center
4236 W. Capitol Drive
Photoart Visual Service
840 N. Plankinton Ave.
Wack Sales Co.
3131 W. North Avenue
RACINE
Edward's Sound
856 Washington



What new recorder is virtually custom-built?

AMPEX F-44

The F-44 is a brand new 4-track stereo recorder from Ampex. It's Ampex through and through. And there's this, too: at every stage of manufacture Ampex tunes, adjusts and aligns each F-44 to obtain its maximum performance—far beyond minimum specifications. Thus, no two F-44s are quite alike. Each is virtually a custom-built recorder. Each performs to the utmost of its capabilities. And each gives you the best possible sounds today—and for many years to come. As an F-44 owner, you'll receive from Ampex a record of the individual performance specifications of your own F-44. This record shows the frequency response curve, the signal-to-noise ratio, the flutter and wow, and the crosstalk rejection measurement. And it is signed by the Ampex engineers who tuned and adjusted your recorder. The new Ampex Fine Line F-44 also features a new special design hysteresis motor for smooth, quiet, accurate operation; an easy-to-read point-to-point record level meter for each channel; multiple sound-on-sound capability; new simplified controls; and the Ampex one year warranty. See and hear the new F-44 at your local Ampex dealer (listed opposite). Brochure? Write: Ampex Corporation, Redwood City, Calif. Worldwide sales and service.



AMPEX

Looks absolutely zany—but I'm not after describing it in detail since I've merely looked at it and had thoughts. Thoughts as to the far-reaching implications.

The point is, simply—*should we copy any tapes in the home other than those of home-made or amateur material?*

Should we, as thousands do, copy taped records, taped broadcasts, (surreptitiously or even wide-open), tapes of live professional performances? Should we copy commerically released tape recordings? And—as is done thousands of times—should we copy copies of these, or copies of copies of copies, circulating in many hand-to-hand tape pipe-line?

Well, I rather suspect that nobody can say with precision. The copyright laws, as we know, are outdated and thus difficult to interpret to the point of utter confusion in the whole area of "mass reproduction," not only in sound but in numerous other modern forms unknown in the days of the 1909 copyright law.

The plain fact is that, right or wrong, legal or illegal, the practice of copying anything and everything on home tape recorders has grown fantastically these last years. It is obviously quite impossible to stop it cold at this point, nor to do very much to curb it in the sanctity of a million private homes! At the moment, all anybody can do as far as I can see in the way of braking this genial and profitable (for the tape and tape machine makers) enthusiasm is 1. get after anybody who tries to *sell* tape copies for purposes of worldly gain—if unauthorized, this is clearly illegal—and 2. chase those hardy advertisers who dare imply that their tape machines can take down your favorite music from all sorts of easily available and oh-so-familiar sources.

They can, indeed, these machines. It's no lie, and not even an exaggerated advertising claim! But the tape people are going to have to be wary about saying such things out loud. At least until somebody brings an all-inclusive suit and gets the whole thing settled—but this probably won't happen until the copyright laws themselves are involved in their upcoming alterations, and so the whole thing is likely to be put off anyhow, or will get itself tossed back where it started.

I wrote a piece for another magazine last summer about taking down stereo off the air on your tape recorder. It was the other magazine's idea and, bless me, until this very moment I never even thought about the "legal" implications of my weighty words. Don't think I did, anyhow. Should I even suggest in print that one can, indeed, take down broadcasts of any old sort on one's own tape, with impunity? Well, one can, that's for sure, whether rightly or wrongly.

When I saw that four-reeled, double-headed monster at the New York show, blithely demonstrating how easily it could copy any old tape right in the home, all by itself, without a second machine, I did more than smile. I began to wonder. So should you.

My own thoughts: *You can't stop it and there's no use setting up Prohibition.* It'll never work.

Better by far to let'er rip, let 'em record, within liberal but strict bounds. Laws? The laws will have to be made to fit, somehow, sooner or later. Don't ask *me* how.

COLLECTOR'S ITEMS?

In the course of monthly record reviewing over the years, I've been put on many a mailing list—including the files of a number of industrious individuals who carry on record auctions, by mail. One has just come in—the 176th auction held by one George Pluck of Waterloo Village, Grass Lake, Michigan, which closes on a date that will be past when you read this. (I expect he'll be in the midst of the 177th by now.) These record auctions are in a way significant—for the dealer in collector's items is, so to speak, on the other side of the coin from the producer of new records.

It is significant to me, at least, that with few exceptions the gentlemen who mail me their auction notices deal entirely in 78's. It is perhaps even more significant that though large numbers of them are still from the acoustic era, almost entirely opera or sentimental songs à la McCormack (he also sang opera, of course, and beautifully), an increasing number are electrically recorded. However, in most catalogues they are still electrical singles, not albums. And the electrical singles, like the acoustics, are listed by the artist, not the composer. That is as of fifty years ago.

Mr. George Pluck, for instance, lists not one 78-rpm album that I can find in his 176th auction. Nor is there a single LP record. But he offers two record *catalogues* as collector's items in themselves—a Columbia catalogue for December, 1913, and a Victor catalogue for May, 1914. In other words, to find a catalogue old enough to be a "find," you must go back an even half century. (I've got the 1936 Gramophone Shop Encyclopedia and all subsequent editions, but I don't suppose they prove much—yet.) And to find an LP that is auctionable in the fashion now being so actively carried on by Mr. Pluck and many others, you'll just have to wait for another twenty years. Funny thing.

Five or six years ago I sorted out my fair-sized collection of familiar 78 albums into those that obviously were junk, or had been replaced by clearly preferable performances on LP, and those which for musical or sentimental reasons I wanted to keep. Space didn't allow for nearly enough of these latter. 78 albums are outrageously uneconomical of space and weight when your home is overflowing with LP's and tapes. So, I tentatively sounded out someone as to what I might get in cash for a group of the really superior 78's I had on hand, recordings that were outstanding in their time and, surely, would never be replaced musically. As I remember, the figure came to around ten cents a disc. I was shocked. I could not even give the things away, as a matter of fact. I tried that, as a more dignified solution to the problem.

I flatly could not bring myself to dispose of these records in such a demeaning manner; it would be an act of rudeness towards their distinguished producers, both musical and engineering, which was beyond my performing, space or no space. So I still have them. I own a good number of 78-rpm albums (many, as private collections go) and I intend to keep them forever.

I solved the storage problem quite neatly, if unalphabetically. For years I have used the 78 albums to fill up open spaces in my LP file, reserved for future LP releases. Keeps the LP's tight and flat and preserves the 78's too. As the LP spaces fill up I move the 78's out—until the next new record case is built. Then back they go.

I have at least a vertical yard of 12-inch 78 singles, too, mostly dating back before I did record reviewing and mostly bought with my own small cash reserves as a college student. Some of them—I hope—are priceless. I wouldn't know. It is more than I can do to find out whether they are merely priceless *to me*, or are worth money to others. None of them is standard oper-

(*Continued on page 77*)

R-212

This tape is not for amateur sopranos, party capers, dictation or music-to-play-bridge-by

It's Soundcraft Golden Tone for your serious recordings

Created for discerning ears and critical equipment, Golden Tone reflects the highest degree of technical perfection in tape manufacture today. It has exceptionally low modulation noise—a superior signal-to-noise ratio of 77 db—at least 7 db better than other tapes. Its high frequency output is 25% greater than its nearest competitor. And, its dynamic range is the widest found in any tape for home recording. Astonishing specifications indeed... possible because Golden

Tone is also a physically perfect tape. There are no edge burrs. No skew, cupping or curling. Always perfect tape-to-head contact. No drop-outs either, and no low speed or editing squeal. The cost? Only slightly more than ordinary tapes, but worth it if you take your recording seriously. Available on 1½ mil Acetate, 1200 ft.—1 mil Tensilized DuPont Mylar, 1800 ft.—½ mil Tensilized DuPont Mylar, 2400 ft. Write for Golden Tone brochure; ask for Golden Tone at your dealer.

REEVES SOUNDCRAFT
DIVISION OF REEVES INDUSTRIES INC

Main Office: Danbury, Conn. • New York • Chicago • Los Angeles • Foreign Div.: 25 Warren St., N.Y.C. • Canadian Reps: Vancouver • Toronto • U. K. Reps: Soundcraft Magnetic Ltd.

EDITOR'S REVIEW

FM BAND DEGRADED!

ON MAY 24, 1963 the Federal Communications Commission issued a report and order, Docket No. 14376, which amended the rules for telemetering devices and wireless microphones so that these devices can now operate at frequencies in the FM band. Frankly we were unable to understand why this change was necessary after reading the report, all that we could find was a brief reference to the availability of many excellent receivers in this band and possibly a more reasonable antenna. Hardly enough reason to degrade the existing FM band.

Why do we say that the FM band will be degraded? Simple; any signal that competes with the regular signal will affect the signal-to-noise ratio adversely. In mono this is no problem for most of the component-quality tuners available; for stereo transmission the problem may be more serious.

Let us look at what the new rules allow. First of all the rules permit wireless microphones a field strength of 50 microvolts per meter at a distance of 50 feet with the normal antenna of the wireless microphone. The last provision is significant in that it makes the practical radiation levels from these devices the maximum permissible. Actually, the amount of degradation may be small in most cases, but any degradation of FM-stereo reception is serious because of the present difficulty in achieving good signal-to-noise ratios. Somehow it doesn't make sense, on the one hand the FCC inaugurates stereophonic FM transmission with full awareness of the problems involved, and on the other hand, a short time later, permits transmission which could limit the usefulness of the newly-inaugurated medium.

Fortunately, at present there are not too many transmitters in use, or available, in this new band. Unfortunately, the ability to receive on a standard FM tuner will undoubtedly attract many users who would not purchase the limited-purpose receiver required in the previous band. We may certainly expect a greatly increased demand for these transmitters—with a resultant increase in interference.

How did it happen that the FCC took this step without strong protests from FM listeners and broadcasters? We don't know. In fact we were not really aware that the step was being seriously considered until it was too late. Can anything be done about it? Frankly we doubt it. On the other hand it won't hurt to try. We suggest that all of you who are concerned about encroachments on the FM band write to:

Chairman,
Federal Communications Commission,
Washington 25, D. C.

THE SHOW IS OVER

Every year, at the conclusion of the New York High Fidelity Show, we inventory the impressions we had about the show, and about trends in the high fidelity industry. Guess it's habit, but here we go again.

First and foremost we must report that transistors are here to stay—the component industry seems firmly committed to them. This year, as we predicted last year, there were many more transistor products shown. Not many power amplifiers, but some integrated amplifiers and several receivers. In spite of the increased number of transistor products, in our opinion the trend is not as yet a stampede. Most manufacturers showed both tube and transistor lines, with many transistor units "not yet in production." Still a certain amount of wait-and-see.

Another trend we observed was the broadening of tape machine lines, and the increasing number of manufacturers with tape machines. It seemed to us that tape machines are getting ever closer to the point of being truly competitive with phonographs. They still haven't arrived as yet, but the way is being marked out clearly what with slower speeds, cartridges, and higher quality heads. It won't be too long now.

The other trend, the one towards more "packaging," we commented upon last month. That trend is *very* strong.

We should like to take note of the exceptionally fine audience that attended the show this year. There did seem to be a seriousness and interest which warms the cockles of those of us who have been following these shows for some time. Indeed, checking with several dealers after the show we were informed that their cockles were warmed also—there was a delightful spurt of sales in audio equipment. Perhaps one of the reasons for this turn of events was that the rooms didn't seem as crowded as in previous years, thus permitting the audience a good opportunity to talk with the manufacturer. Whatever the reason, it did seem to be a more receptive audience.

THE BINGO CARD

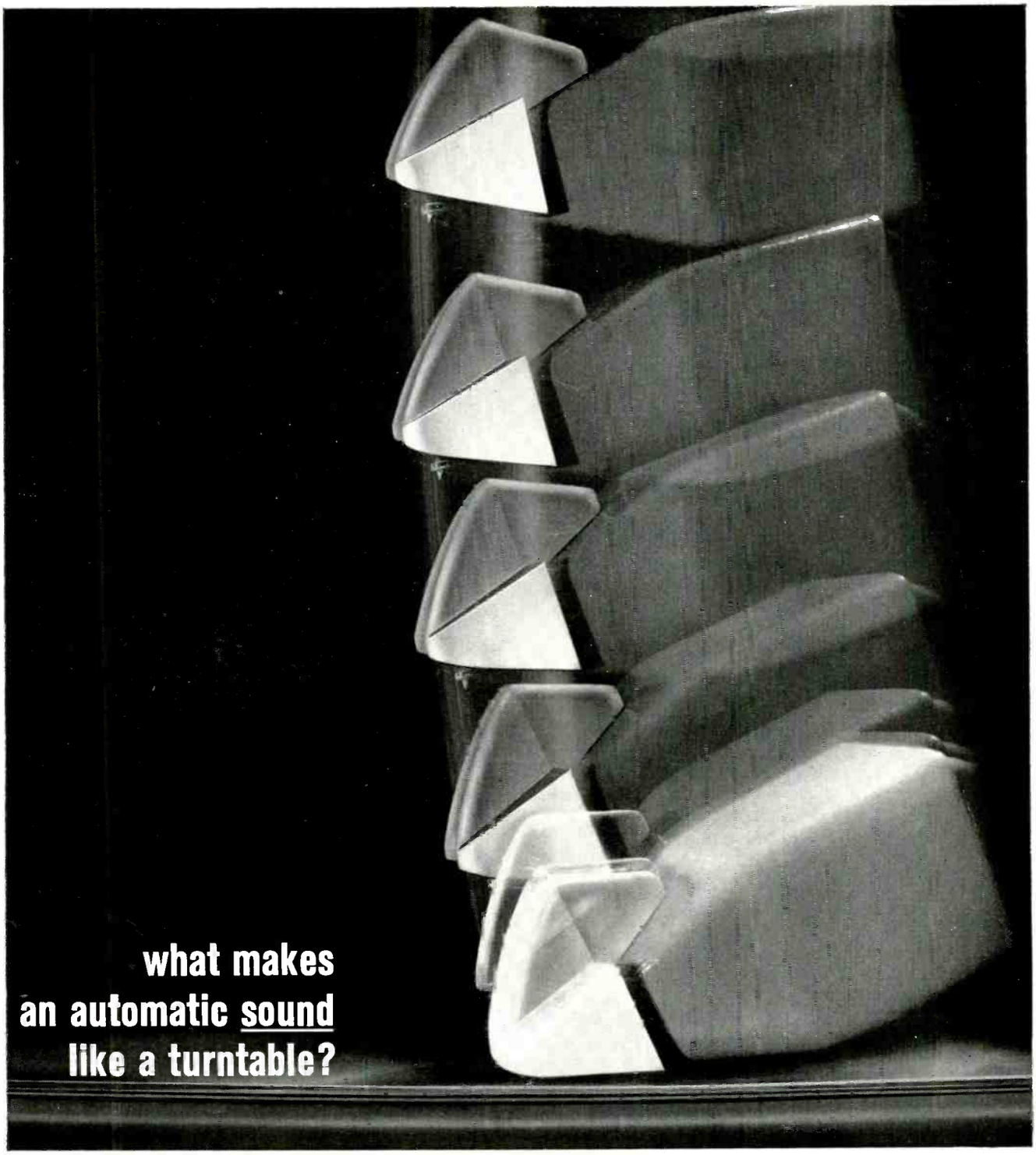
In the magazine business, the card used for requesting manufacturers' literature is called the bingo card. You can hazard your own guess as to the origin of that name. Our purpose in bringing up the subject is to apologize for an error on our part.

It seems that some of the manufacturers who advertize in AUDIO send literature only to "professionals," engineers, technicians, and other qualified people who gain their livelihood in the technical field related to audio. That is the reason that we have a line on the card asking for your affiliation. Unfortunately, for a period of time our staff had neglected to transmit this information to the manufacturer and thus some of them did not send out literature to those of you who should really get it. We goofed and you are the only one who can remedy it. If you requested literature about a product some time ago, and you haven't as yet received it, and you are a "professional," please write the name of the product at the bottom of the bingo card in this issue and we will do our darndest to see that amends are made. Please don't forget to fill in your affiliation.

COMING EVENTS

Philadelphians were disappointed recently when the Greater Delaware Valley High Fidelity and Camera Show scheduled to take place there was called off because of a local strike. However all is not lost—we understand that the show has been rescheduled and is now supposed to take place November 8, 9, 10 at the Benjamin Franklin Hotel. We hope it takes place as scheduled this time.

Another scheduled show is the Toronto High Fidelity Show at the Park Plaza Hotel from October 30 through November 2.



The U38!

expressly designed for automatic turntables

The new generation of automatic turntables tracking and tripping at lower and lower forces demands this new kind of cartridge. Demands a "floating stylus" that protects your diamond and record as it plays...demands complementary electrical characteristics which maximize the use of forward-looking circuitry whether vacuum tube or solid state. The U-38 meets these demands and makes your automatic **sound like** a turntable. With Pickering's famous plug-in replaceable stylus assembly you get a cartridge with a life-time of trouble free performance. Pickering and Company, Inc., Plainview, New York.

Pickering

U38 cartridge with
AT Stylus...2-5 grams tracking force
ATG...1-3 grams

Plug-in head assembly for
Garrard Type A and Model AT6

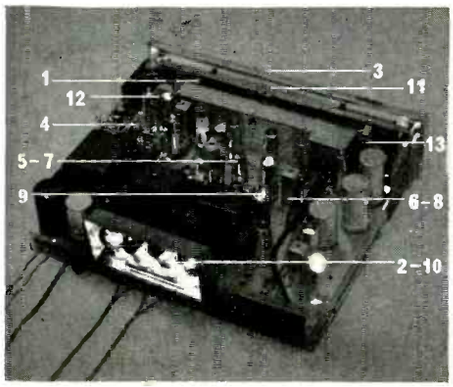
should Sherwood increase its prices by 20%

?

the superlative new S-8000III FM stereo receiver priced at $319.50

Years ago, Sherwood high-fidelity tuners and amplifiers were evaluated by highly-respected, totally-impartial research companies as either the finest designed or the best valued on the market. ■ Although we were pleased by such endorsements of pure quality in design and performance, the really significant fact was that *other leading components carried higher price tags.* ■ *Subsequent Sherwood components have received ratings indicating features and performance equal or superior to brands carrying price tags at least 20% higher.* ■ A current example of Sherwood design superiority is our new S-8000III receiver. Sensitivity is rated at *1.8 microvolts.* Capture effect is an *outstanding 2.4 db.* ■ No other FM receiver can claim the 80-watt music-power rating of the S-8000III, and only one other (priced $50 higher) offers the professional D'Arsonval zero-center tuning meter that's standard with Sherwood. ■ We still believe that our old-fashioned policy of superior engineering and realistic prices is best for both you and Sherwood.

SOME OF THE S-8000III FEATURES THAT MAKE THE DIFFERENCE



1. Zero-center tuning
2. 80-watt music power
3. Complete stereo control center
4. 1.8 μv. (IHF) sensitivity
5. Wide-band 3-mc. gated beam limiter
6. 1-mc. band pass balanced ratio detector
7. 2.4db. capture effect
8. 1/3% distortion at 100% modulation
9. Interchannel hush
10. Long-life Novar output tubes
11. 8-inch professional-type tuning scale
12. Silk-smooth flywheel tuning
13. Positive stereo broadcast identification

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HIGH FIDELITY

STEREO RECEIVERS ■ TUNERS ■ AMPLIFIERS ■ STEREO INDICATOR LIGHTS ■ SPEAKER SYSTEMS ■ CONTEMPORARY CABINETRY

15-deg. Vertical Angle—A Key to Better Stereo Sound

B. B. BAUER*

The 15-deg. vertical angle was selected as a standard before the effect of lacquer springback was fully known. It turns out that this angle is best nevertheless, and the audiofan may be able to do something about correcting his pickup.

SINCE THE ANNOUNCEMENT in the February, 1963, issue of AUDIO[1] of the discovery of springback in stereophonic disc recording, due to lacquer and cutter elasticity, and of the means for controlling the effective vertical recorded angle[2] by appropriate cutting stylus design and cutter tilt, many people have asked: What determined the choice of the 15-deg. vertical angle standard? What is its effect on recording technology and on the quality of reproduction? What can I, as a user, do about this? Here, an attempt is made to answer these questions.

Stereophonic Modulation

Everyone knows that stereophonic 45-45-deg. modulation requires that the stylus tip move up-and-down as well as laterally. With respect to the lateral motion, its character is identical with that of monophonic records so that the shaping of the arm and the lateral orientation of the cartridge are identical to those used with monophonic pickups. Pickup designers long ago learned to shape the arms so as to diminish lateral tracking error to negligible proportions.[3]

With respect to the up-and-down motion, intuitively, one might think that it should be perpendicular to the record. With this idea in mind the European engineers designed their cutters with a perpendicular (0-deg.) cutter-tip motion. The 0-deg. orientation, however, turns out not to be the best one to use. We show later that a greater modulation capacity in the vertical mode exists with a forwardly-inclined modulation plane. Also, with simple pivoted transducers, perpendicular motion is not possible, and simplicity is the key to quality in the design of cutters as well as pickups. It was this latter thought, no doubt, that had guided the design of the Westrex 3C cutter which has a vertical angle of 23 deg.

Fig. 1. CBS Laboratories MLS-915 stylus for recording 15-deg. angle with a Westrex 3C cutter.

After considering the geometry of contemporary cutters and pickups, the Engineering Committee of the Record Industry Association of America recommended an inclination of 15 deg. for the Stereophonic Vertical Modulation which was adopted as an RIAA Standard in 1961. At the time, the Committee was unaware of the fact that the vertical *recorded* angle is different from the vertical *recorder* angle, because of the springback phenomenon which was to be discovered later.[4] It will be shown next that this discovery does not weaken, but actually strengthens the recommendation of the Committee.

The Recording Problem

The discovery and correction of longitudinal springback in stereophonic recording resulted from an attempt to produce a test record for use in measuring I.M. distortion and transient response of pickups in the vertical mode. As described in the February paper,[1] a conventional Westrex 3C cutter system with a 23-deg. vertical *recorder* angle actually produces a 0–3-deg. vertical *recorded* angle (although this varies somewhat with frequency) and an additional cutter tilt of 14 deg. together with a special stylus are needed to produce a 15-deg. modulation slant. The Square Wave and Intermodulation Test Record No. STR-111 was recorded in this manner, and described at the International Convention of Audio Engineering Society in the Fall of 1962[4]. At the same meeting of the Society, in a paper which attempted to defend the 0-deg. vertical cutter angle, C. R. Bastiaans[5] showed that the maximum vertical modulation capacity would be diminished with conventional cutter styli if the cutter were tilted. Bastiaans suggested that this might be overcome by using a special stylus with slanted cutting facet, but concluded that this would not be an attractive proposition.

Of course, Bastiaans had no way of knowing that the STR-111 was cut with just such a special stylus, shown in *Fig.* 1, previously developed at CBS Laboratories and named the MLS-915 Stylus. In the interim a myth has arisen that vertical modulation capability of a record is diminished by the inclination of the Stereophonic Modulation Plane. I will now demonstrate that with the MLS-915 stylus the inclination of this plane actually increases the capability of disc recording in the vertical mode.

First, disregarding lacquer or stylus springback, assume that the stylus moves vertically at a 0-deg. angle. Then the

* *CBS Laboratories, Stamford, Conn.*

[1] B. B. Bauer, "Vertical Tracking Angle Improvements," AUDIO, February 1963.

[2] Effective Vertical Recorded Angle is the name recently chosen by the EIA recording committee for the vertical inclination of modulation that I had called "Vertical Modulation Slant" in my February article.

[3] B. B. Bauer "Tracking Angle in Phonograph Pickups," *Electronics,* March 1945, p. 110.

[4] B. B. Bauer, A. Schwartz and A. J. Gust, "Transient Response and Intermodulation Studies in Phonograph," *Journal AES* Vol. II,, No. 2, p. 110–114, April 1963.

[5] "Further Thoughts on the Geometrie Conditions in the Cutting and Placing of Stereo Discs," *Journal of AES,* January 1963.

maximum possible vertical modulation velocity v_o is equal to the groove velocity V, as shown in *Fig.* 2. If a square wave is recorded on a velocity basis (such a wave is triangular on a displacement basis,) the vertical modulation displacement is equal to the distance traveled longitudinally in the same interval of time, and the downward angle of modulation is 45 deg., just clearing the heel of the cutter.

Next, we slant the vertical recording angle by 15 deg., taking care to leave the cutting facet of the stylus vertically oriented with respect to the record. A small amount of calculation shows that "vertical" velocity v_{15} along the inclined stereophonic modulation plane

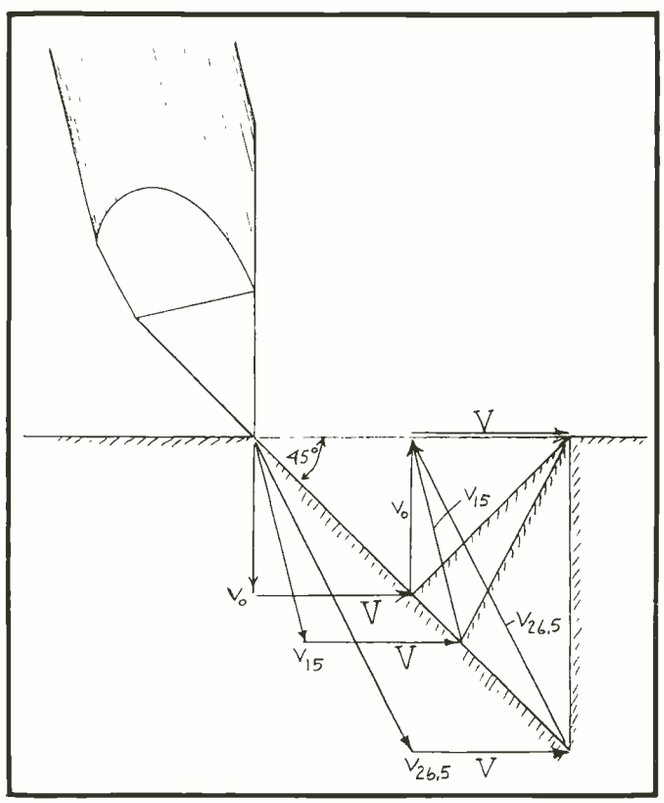


Fig. 2. The proper cutter inclination provides a greater safety factor for vertical modulation.

now may be increased by a factor of 1.41, or 3 db, before the downward angle of the modulation cut becomes 45 deg. The upward angle of modulation is still positive, which means that this is a practical cut. As a third possibility we slant the vertical recording angle to 26.5 deg., which is arc tan 0.5, again leaving the cutting facet orientation with respect to the record unchanged. This time we can increase the "vertical" velocity $v_{26.5}$ along the stereophonic modulation plane by a factor of 2.24 or 7 db. The upward angle of modulation is then vertical. It is not intended to imply that such heavy modulation would be practical or even desirable, but merely to point out that a 26.5-deg. angle provides a greater safety factor against groove overload in the vertical mode than does a 0-deg. cut. Any further increase of recording angle will reduce the maximum theoretical modulation.

The reader might query the effect of the 37-deg. vertical recorder angle obtained by tilting the Westrex 3C cutter 14 deg. and the resulting 15-deg. effective vertical recording angle which it produces. This is where the lacquer and the stylus springback come in.

In the paper "The Vertical Tracking Angle Problem in Stereophonic Record Reproduction,"[6] I had estimated that from 20 to 40 per cent of the modulation springback angle was caused by the stylus elasticity, the balance being accounted for by the springback of the lacquer. Recent tests appear to indicate that this latter figure is a more likely one. Therefore, approximately 9 deg. of the springback appears to be caused by the stylus and the remaining 13 deg. by the lacquer. Thus, with a *manifest recorder* angle of 37 deg., the Westrex 3C cutter has an *effective recorder* angle of some 28 deg. and an *effective recorded* angle of 15 deg. Hence, the recommended 14 deg. cutter tilt in cooperation with a MLD 915 stylus provides a near-maximum vertical modulation capacity in stereophonic recording. Any attempts to increase the effective vertical recorded angle above 15 deg. is likely to introduce mechanical problems and diminish the modulation safety factor of the disc.

[6] Presented at the IEEE Meeting of the EIA, February 6, 1963, scheduled for publication in the IEEE *Transaction on Audio*, March–April, 1963.

The Pickup Problem

There is no general agreement as to the preferred vertical tracking angle from the point of view of a pickup designer, and it is doubtful if such an agreement could be achieved universally. With ceramic pickups intended principally for use with record changers, a low angle is desired to diminish the overall height of the arm and thus to improve the clearance between the arm and the overhead record stack. A low angle also diminishes any frequency modulation which would occur with gross stylus motions stemming from record warp. With magnetic pickups, a high angle would facilitate the clearance problem for the magnetic structure and the coils. Last year the vertical tracking angles of fourteen pickups were measured at CBS Laboratories. Seven of them were of the piezo-electric variety, intended for use with home phonographs, and they embodied angles varying from 10 deg. to 25 deg. with an average of 16.5 deg. The remaining seven units were of the magnetic type intended for use in high fidelity components. They had angles varying from 25 deg. to 42 deg., with an average of 31 deg. These results closely parallel those published by Madsen[7], and tend to suggest that the vertical tracking angles of many pickups are likely to have been influenced by convenience in arranging the transducer parts, rather than by keeping in mind any particular set of cutter angles.

In a more recent study, Darrell[8] lists 25 pickup cartridges of various types with vertical tracking angles from 0 deg. to 32 deg. The lowered upper figure suggests that pickup manufacturers are beginning to take action to bring their product into conformity with the known effective vertical recorded angles.

Some people have asked, how could it be that despite the vertical tracking errors that are apt to occur sometimes, stereophonic records sound as well as they do. The answer to this query is the same as that given in my 1945 paper[3] about lateral tracking angle errors: Other sources of distortion in the reproducing system are even more important than those arising from tracking errors. Fortunately, not too many pickups have grossly excessive tracking errors; those that do, *do* produce audible excess distortion at the inside grooves of highly modulated stereophonic discs.

What can an Audiofan do?

If you are happy with the sound of your system, then, of course, there is

[7] E. R. Madsen, "Vertical Tracking Angle—A Source of I.M. Distortion," AUDIO Magazine, November, 1962, p. 21–24.

[8] R. D. Darrell, "The Case of the Tilted Stylus," *High Fidelity*, May, 1963.

nothing to do but enjoy it. The majority of pickups have a correct enough vertical angle so as not to contribute significantly to the distortion with either the older or the newer stereophonic records.

But now that you have been alerted to the vertical tracking problems, you may begin to notice distortion at the inside grooves of highly modulated records. If distortion is perceptible with monophonic as well as stereophonic records, a worn stylus is the most likely culprit. Eventually, even diamond styli wear out and the rubber pads in which most stylus lever assemblies are mounted tend to harden with age, so that it is a good idea to replace the stylus assembly every so often.

The next most likely possibility is an oversize radius stylus, which would tend to emphasize tracing distortion—the stylus radius becoming comparable with the curvature of groove modulation—and this can be remedied by making sure that the stylus radius is 0.7-mil. or smaller. Many manufacturers make available a ½-mil. radius stylus which should be used whenever possible with pickups capable of tracking at 2 grams or less. This, by the way, will help your monophonic as well as stereophonic records.

If none of these remedies solve the problem then look for erroneous vertical tracking angle as a possible culprit. Initial guidance may be obtained by consulting the tables published by Madsen[7] and Darrell[8], but you will find substantial angle variations between given types of pickup. Unfortunately, the vertical tracking angle is not easy to measure; the best way requires measuring distortion using an STR-111 test record, but this is beyond the usual means of an amateur. The next best way is by visual examination. The angle at which the stylus lever comes out of the cartridge is not always a reliable index of vertical tracking angle, as often there is a bend between the visible portion and the actual pivot point. It is more accurate to let the arm rest on the record with the turntable stopped, and to push the pickup arm up-and-down gently while observing the stylus tip position with the aid of a magnifying glass. Is the to-and-fro motion of the tip about the same as the up-and-down motion of the pickup? Then the vertical tracking angle is 45 deg. With a 27-deg. angle the tip will move half as much to-and-fro as the pickup does up-and-down. With 14 deg. the to-and-fro motion is only a quarter of the up-and-down motion. With a 0-deg. angle the to-and-fro motion is nil, but you won't find many of those! One of the most important advantages of this test is that it takes into account the normal position of the stylus under the bearing weight of the arm, and also the angle of mounting of the cartridge in the arm proper.

In some cases of excessive vertical tracking error it is possible to make a significant improvement by changing the vertical pickup orientation. Normally the clearance between the cartridge shell and the record is not excessive, but often there is enough room to play with. The arm itself can be adjusted up or down so as to just clear the record. Also the cartridge may be remounted in the arm. I have done this with one of my pickups which had a grossly excessive vertical angle by loosening the mounting screws, wedging a small object between the cartridge and the arm shell, and retightening the screws as shown in *Fig.* 3. Keeping in mind that the stylus-tip should be oriented approximately perpendicular, or preferably with a slight backward orientation to the record, it became necessary to modify the stylus lever by supporting the tip end with a small screwdriver, while applying a slight pressure with the thumb-nail as shown in (B) of *Fig.* 3. The final arrangement, shown in (C) diminished the excessive vertical angle by some 5–10 deg. and improved the vertical orientation of the stylus. This procedure served to clean up the inside groove distortion materially. However, I do not recommend that you try this approach with your pickup unless you are quite handy, and willing to risk catastrophic damage to the stylus in the event of a slip!

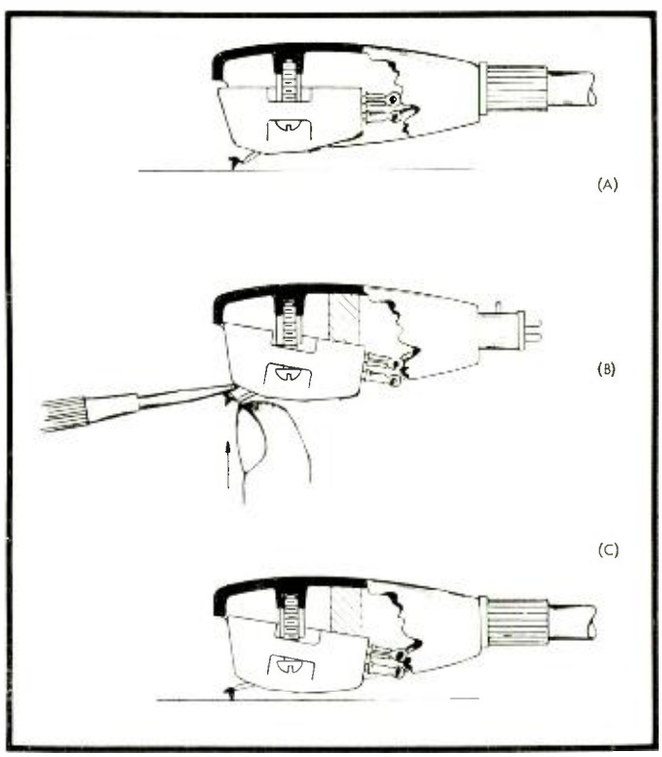


Fig. 3. Improving a pickup with excessive vertical tracking angle.

Perhaps the best solution, after all, if you are suspicious of the vertical tracking angle, is to replace the cartridge with one made by a reputable manufacturer who will assure you that his product design conforms with the latest and best recording practices.

Conclusion

Some of the aspects of the 15-deg. vertical tracking angle controversy is reminiscent of the days a quarter of a century ago when a battle raged between the "straight" and the "offset" cartridge proponents. The latter won, of course, even if the improvements in sound quality were modest, simply because it cost no more to do the job right. Today no pickup manufacturer in his right mind would make a pickup which could not maintain the stylus within a few degrees of a lateral error-free tracking orientation. History is apt to repeat itself in connection with the vertical tracking angle. Those who have not as yet converted to the 15-deg. standard may argue against it even if most everyone will benefit by it. The fact that the listening improvements may be modest does not mitigate the general principle that superb over-all quality is obtained by attention to every detail. It simply makes no sense to play 2.5-deg. records with 40-deg. pickups. The acceptance of the 15-deg. standard is on the way—its improvements already are being felt. **AE**

Remote Control with Light

WILLIAM G. DILLEY*

A two-channel remote control using a light-actuated gain control

THE ADVENT OF STEREOPHONIC PLAYBACK has been accompanied by many additional requirements not needed in the monophonic system. Among these is the requirement for balance between two or more playback channels. Whereas level (or gain setting) alone satisfied a single system, two or more channels require, not only level setting, but a balance of levels between the sources. A variety of items has appeared on the commercial market to satisfy this requirement, such as meters, to establish equal levels for electrical inputs. Most of these devices, however, assume *identical* systems as a basis for their operation. It is obvious that identical signal levels fed to two speaker systems of different efficiencies will not result in equal, or balanced, outputs. In addition, a change in program material (tape, record, FM, and so on) is usually accompanied by a change in balance, requiring, therefore, resetting of the balance control.

An effective (and comfortable) way of accomplishing this task would be that of providing gain controls at the listening position. Both level and balance could then be fingertip controlled. The unit to be described satisfies this requirement in a unique and economical manner.

* *577 East Avery St., San Bernardino, Calif.*

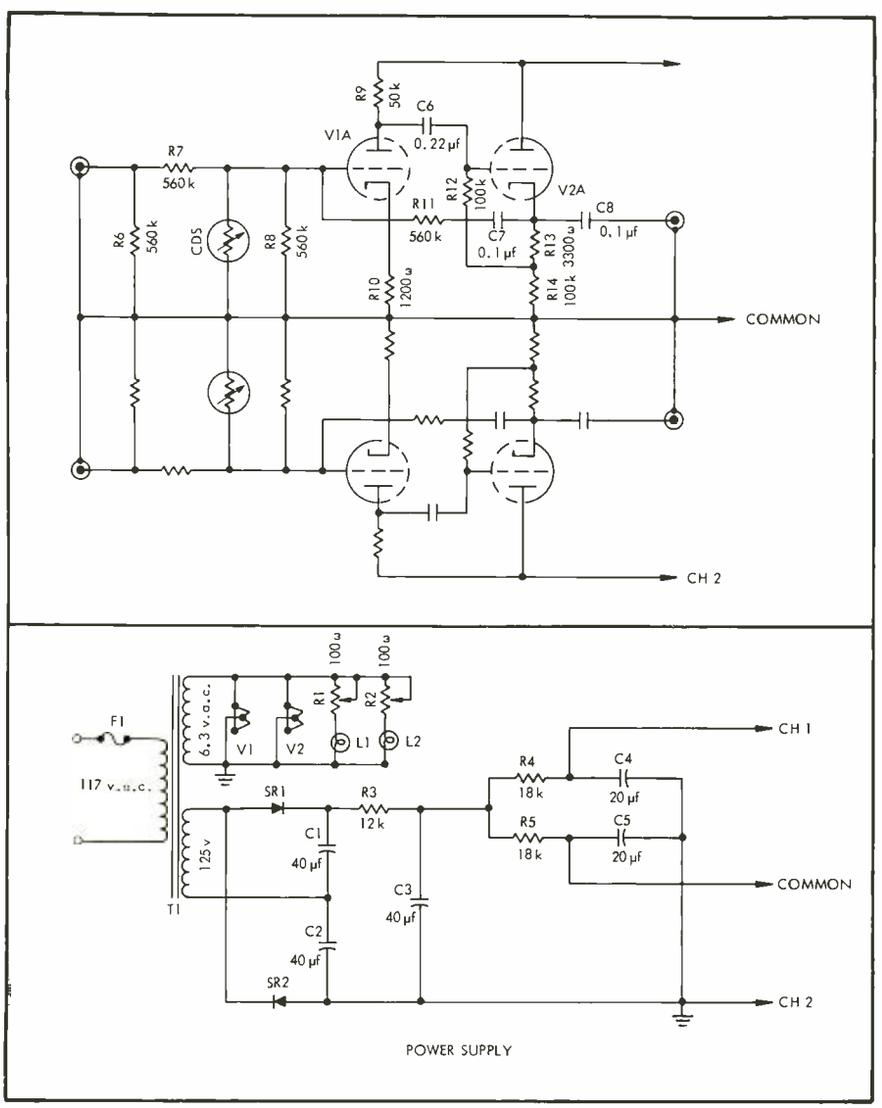


Fig. 1. Schematic of light-controlled remote control.

Design Considerations

There are many methods by which the electrical signal may be controlled from a position remote from the speaker system—the most common and conventional being the use of a preamplifier-control center with a low-impedance output that allows signal cables to the operating location. This arrangement, however, requires space (and housing) at the listening position, and, usually requires furniture revamping either at the amplifier console (after removal of the preamplifier) or at the listening location. For this particular requirement, a light-actuated gain control[1] appears to offer distinct advantages over conventional approaches. Such a design would allow all components to remain in their normal positions and would require, only, the installation of two potentiometers at any desired listening position.

In accordance with the criteria discussed, the completed unit should be inserted between the preamplifier-control unit and the main power amplifiers and possess a gain of approximately one. This arrangement would provide master gain and balance control for *all* sources selected through the preamplifier-control. The inserted unit should, ideally, introduce no additional distortion or limit the frequency bandwidth capability of the existing system. Practically, the following were chosen as design criteria to be achieved in the completed amplifier:

Frequency reponse:	20 cps to 20 kc ± 0.5 db
Distortion:	less than 0.1 per cent harmonic
Noise:	better than 70 db below 2 v
Gain:	approximately 1
Attenuation:	approximately 60 db

Circuit Description

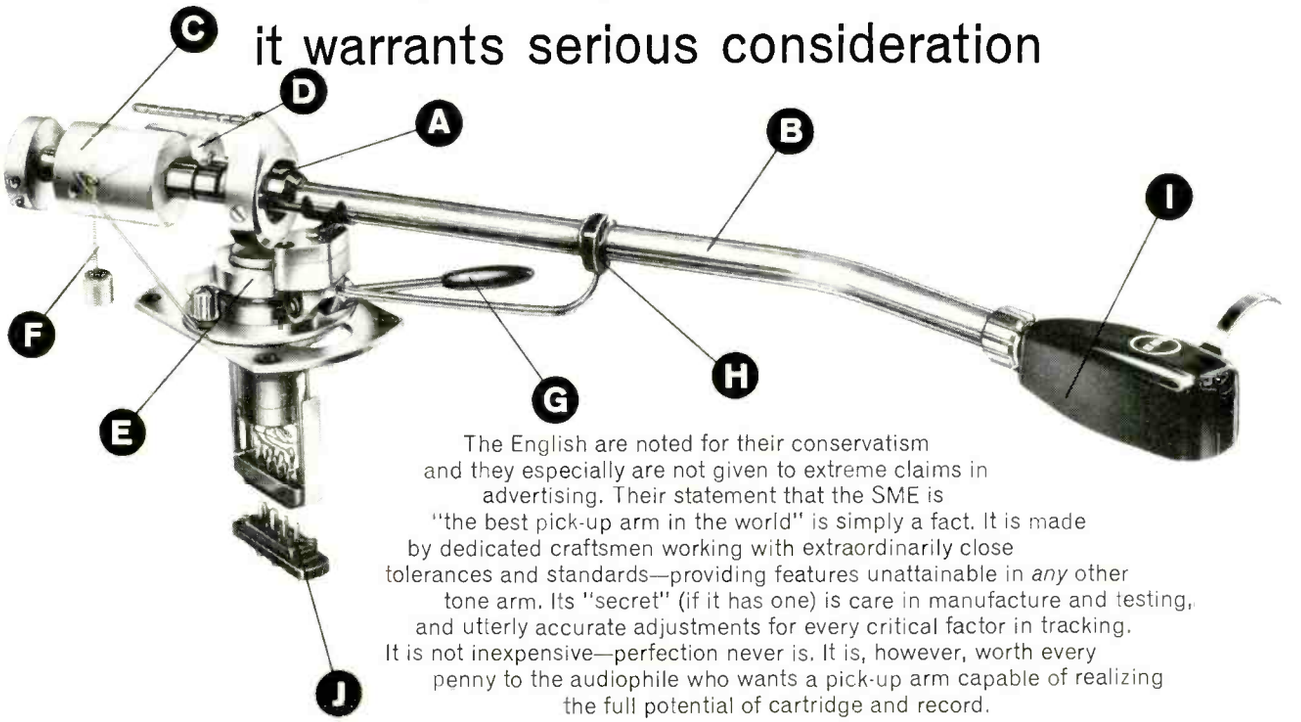
The circuit (see *Fig.* 1) is a two stage resistance coupled amplifier consisting

[1] W. G. Dilley, "A Light-Actuated Gain Control," AUDIO, September, 1962, p. 38.

when the British say

"the best pick-up arm in the world"

it warrants serious consideration



The English are noted for their conservatism and they especially are not given to extreme claims in advertising. Their statement that the SME is "the best pick-up arm in the world" is simply a fact. It is made by dedicated craftsmen working with extraordinarily close tolerances and standards—providing features unattainable in *any* other tone arm. Its "secret" (if it has one) is care in manufacture and testing, and utterly accurate adjustments for every critical factor in tracking. It is not inexpensive—perfection never is. It is, however, worth every penny to the audiophile who wants a pick-up arm capable of realizing the full potential of cartridge and record.

SHURE SME DESIGN FEATURES

A. Virtually frictionless knife-edge bearings. Pivot friction is less than 20 milligrams, horizontal and vertical!

B. Wood-lined stainless steel tube arm. Resonances are outside recorded range, of small amplitude, and damped.

C. Unique weight system statically balances arm longitudinally AND laterally.

D. Rider weight adjusts tracking force from ¼ to 5 grams, adjustable for ¼ or ½ gm. increments, as accurate as a fine stylus pressure gauge.

E. Sliding base offers alignment adjustment through 1 inch. Height is adjustable through ¾ inch. Fulfills optimum requirements of length, offset, overhang when adjusted with alignment protractor included.

F. "Anti-skating" bias adjuster counteracts tendency of the arm to move toward record center and "favor" inner groove.

G. Hydraulic lever-operated set-down for "slow-motion" feather-light lowering onto any part of the recording.

H. Nylon-jaw arm rest with stainless steel locking link.

I. International standard 4-pin socket. Cartridge shells fitted with detachable pillars and mounting screws at standard ½ inch spacing.

J. Output socket and plug provides a rigid junction for the "stiff wiring" and delicate pick-up lead, eliminating influence on free tone-arm movement.

PRICES:

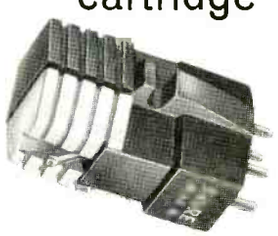
Includes one shell, arm, template, alignment protractor, hardware

MODEL 3009 for 12" recordings ..... $89.50 net

MODEL 3012 for 16" recordings ..... $99.50 net

ADDITIONAL SHELL Model A30H ..... $5.50 each

the perfect companion cartridge



The Shure M33-5, of course. With the SME, provides absolute minimum tracking force . . . *without distortion*. Incredibly transparent sound. Peak-free high end, clean lows, astoundingly natural and clear in the middle range where most other cartridges suffer serious deficiencies. 22 x 10^{-6} cm per dyne compliance. $36.50 net.

SHURE SME series 2 pick-up arm

LITERATURE: SHURE BROTHERS, INC., 222 HARTREY AVE., EVANSTON, ILLINOIS

Manufactured under U.S. patents 3,055,988; 3,077,521; 3,077,522; D193,006; D193,934; other patents pending.

Fig. 2. (Left to right), Plastic cell container, photo cell, No. 328 bulb in lamp housing, completed light-cell assembly. Dime in foreground gives relative size.

of a voltage amplifier and a cathode follower. A cadmium sulphide cell and a pilot lamp substitute for the normally used gain potentiometer in the grid circuit. The light-sensitive cell varies its resistance as varying intensities of light are impinged upon it. Thus, varying the light supply voltage varies the brilliance of the light which, in turn causes the internal resistance of the cell to vary accordingly. The resistive network in the grid circuit with the cell serves three purposes:

1. Prevents input impedance from dropping to a very low value.
2. Limits the range of grid impedance.
3. Provides improved control action (curve shape).

It should be noted that the control circuit (light and supply) is completely isolated from the grid circuit and, therefore, noiseless with respect to contact action of the control potentiometer. Also, since ordinary wire is used to couple the control potentiometer to the light, the length is limited only by the resistance of the wire.

An unusual feature of the control is the use of an a.c. voltage source to drive the control light. Since the combined response of the light and cell was rather slow, it was decided to attempt the use of a.c. and determine the degree of 60-cycle modulation present. The results were encouraging, and since some degree of shunt capacitance existed in the cell, feedback was applied to correct both the high-frequency loss and minimize the residual modulation effects of the a.c. source. Economy resulting from the ability to employ standard 6.3v a.c. filament supplies for the control source is obvious.

The power supply—see (A) of *Fig.* 1—is a voltage doubler circuit with one common filter and one additional separate filter for each channel. Although a conventional full wave rectifier circuit certainly could be employed, this circuit allows the use of a 125-v. transformer with no center tap.

Construction

In order to preclude all external light from reaching the cell, some means of housing the light and cell must be devised. The author chose to utilize the plastic container that the cell comes in for this purpose. It is tapered slightly and therefore ideally suited for wedge fitting of the cell within, and wedge fitting of itself to the chassis. A 328 pilot light, cap, and holder were selected as companion units because of their small size. The closed end of the container was enlarged to accept the light holder and the end of the colored light cap was cut off to allow the bulb to extend past the cap. The cap (with bulb installed) was then screwed into the holder from the inside of the container. Filing a screwdriver slot in the cap may aid in this process if difficulty is encountered because of the tight fit. *Figure* 2 shows the container, the cell, the cap (with bulb installed), and the completed assembly which has been painted flat black to exclude external light. Comparison of size is obtained from the dime in the foreground.

Terminal board construction is used for the amplifier portion, with each channel using one-half of each tube. *Figure* 3 shows the terminal board layout of the left and right channels from the front side. *Figure* 4 shows the same terminal boards viewed from the back side. Control assembly detail is shown in the unpainted prototype version of *Fig.* 5. The majority of the construction can be completed on the bench as a result of the terminal board approach, and makes for ease of assembly. A chassis $5 \times 7 \times 2$ in. was used with ample space remaining (see *Fig.* 6). *Figure* 7 shows the completed unit and the control plate upon which the two control potentiometers are mounted. In operation, the potentiometers are connected to the 3-terminal strip on the front of the unit. The circuit is not particularly critical, but all grid leads should, of course, be kept as short as possible. Following the suggested layout will insure a low noise (hum) unit. Since no ventilation exists within the light housing, it is recommended that the controls not be left in the minimum gain position (while the unit is "on") for extended periods of time. During normal operation, this is

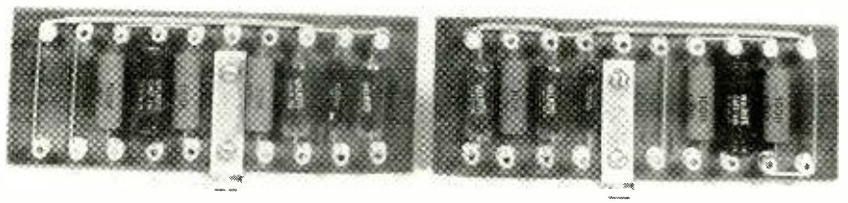


Fig. 3. Front view of (facing tube) terminal board, left channel on left.

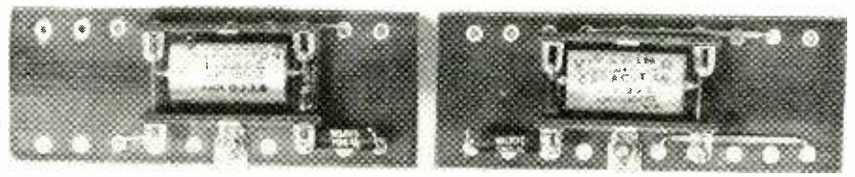


Fig. 4. Rear view of terminal board, left channel on right.

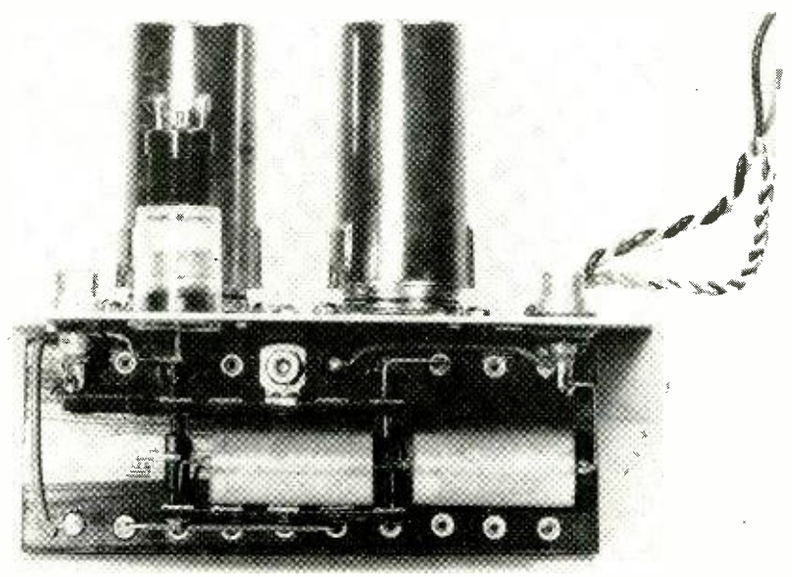


Fig. 5. Side view of experimental prototype. Unpainted version of cell-lamp control assembly shows detail of individual components in position.

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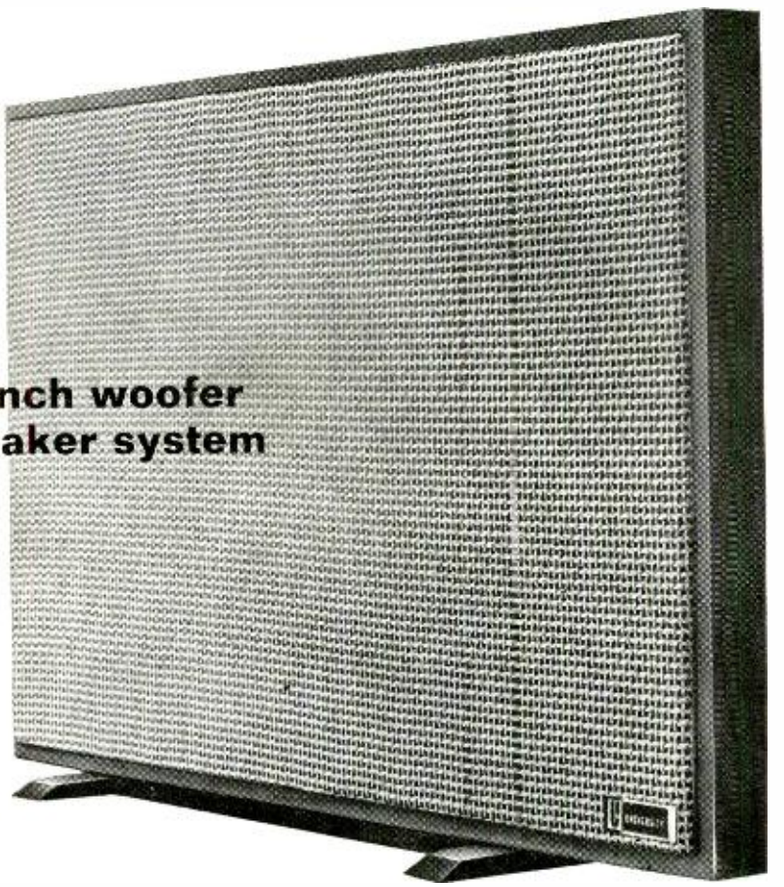

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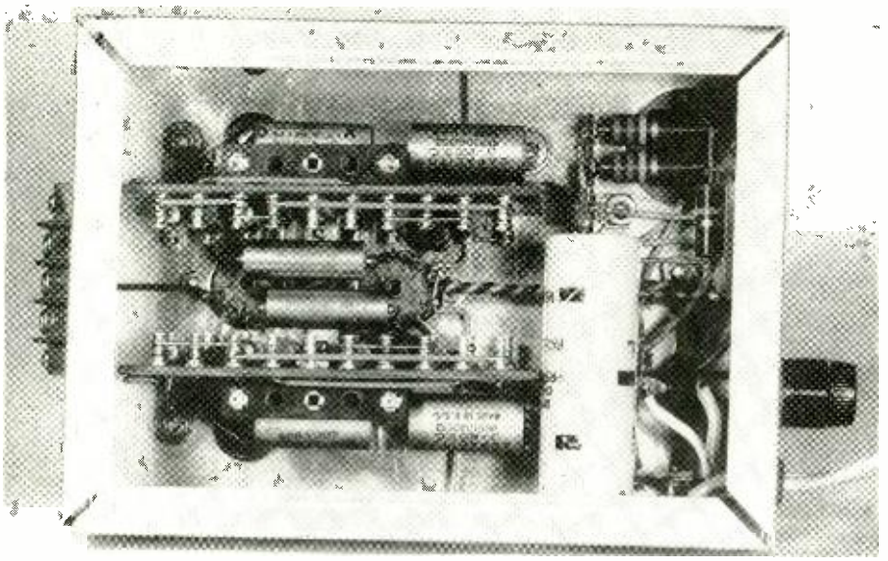

Fig. 6. Bottom view of completed remote amplifier showing component layout.

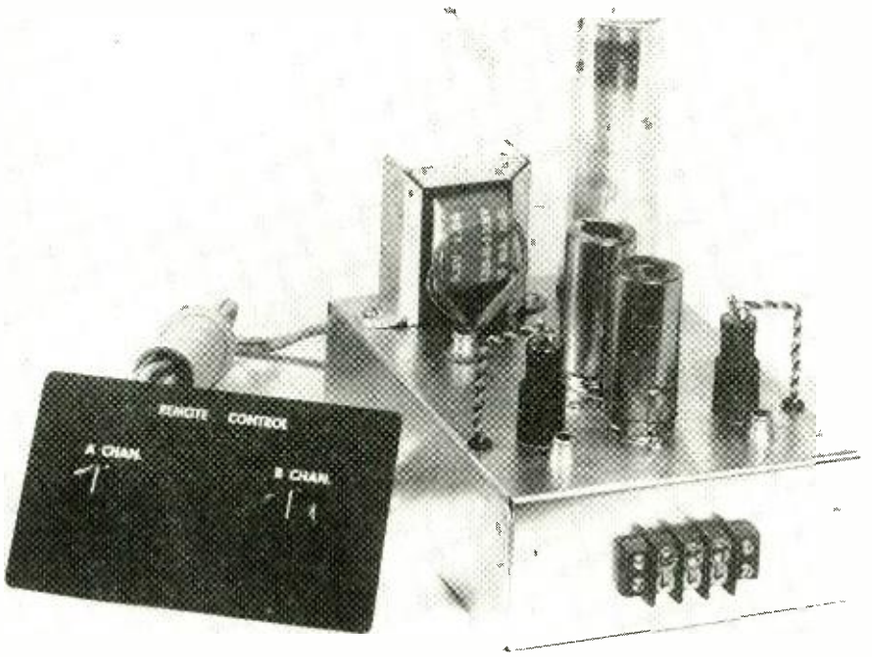

Fig. 7. Top front view of amplifier and sample control plate.

not a problem since very little heat is developed.

Performance

Tests conducted with the completed amplifier provided the following results:

Frequency response: flat from 20 cps to 30 kc

Distortion: unmeasurable (less than .05 per cent harmonic distortion, 20 and 1000 cycles at 1 volt output)

Noise (input open): total at full gain – 0.0002v

Gain: 1

Attenuation: 60 db

Attenuation Characteristics: see *Fig.* 8

Input Impedance: 230k to 335k ohms

Output Impedance: 9000 ohms

Signal-to-Noise Ratio: 80 db below 2v output

Crosstalk: 60 db down at 10 kc (1 volt output), better than 60 db down at 10 kc (2 volts output)

Operation

To place this amplifier into operation for remote controlled level and balance action, the following steps are required:

1. Locate amplifier near main amplifiers.
2. Connect existing preamplifier-control outputs to respective inputs of remote amplifier.
3. Connect outputs of remote amplifier to inputs of main power amplifiers.
4. Install two control potentiometers at suitable listening position.
5. Connect potentiometers to remote amplifier terminals with three #20 insulated wires.
6. With all equipment on and operating, adjust preamplifier volume controls for slightly louder levels than desired when remote controls are fully open.
7. Exercise full control and balance from remote control position.

This amplifier, when completed and installed, will more than justify the time and expenditure required for its construction, and should cause one to wonder how he ever managed to operate without such a necessity. Æ

PARTS LIST

F_1—¼ A Fuse
T_1—125 v at 25 mA, 6.3v, at 1 A
SR_1, SR_2—1N547
R_1, R_2—100-ohm 2w pot
R_3—12k, 2w
R_4, R_5—18k, 1w
R_6, R_7, R_8, R_{11}—560k 0.5w
R_9—50k, 0.5w
R_{10}—1200, 0.5w
R_{12}, R_{14}—100k, 0.5w
R_{13}—3300, 0.5w
C_1—40 µf, 450v
C_2, C_3, C_4, C_5—40/40/20/20/450v
C_6—0.22 µf, 300v
C_7, C_8—0.1 µf, 400v
CDS—cadmium-sulphide cell (Polaris MAJ-1)
V_1, V_2—12AU7
L_1, L_2—328 Lamp

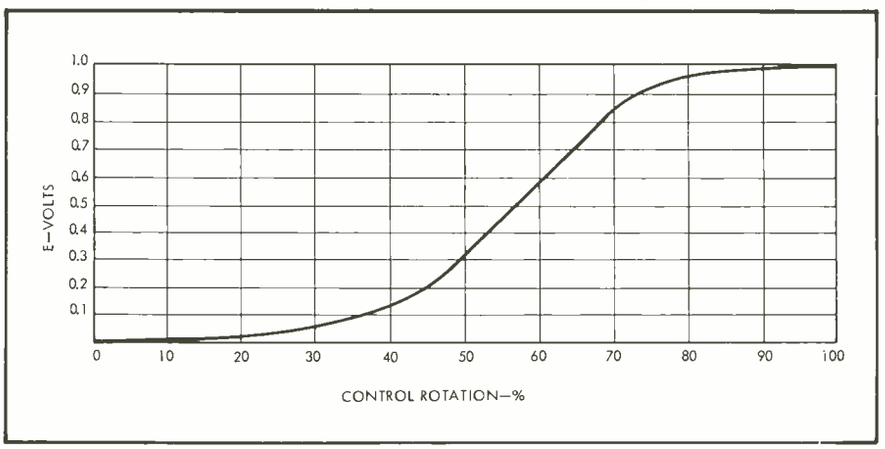

Fig. 8. Attenuation characteristics.

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The Matched Load

Maximum power transfer is not necessarily achieved by the matched load, especially in circuits such as the cathode or emitter follower.

GEORGE FLETCHER COOPER

THERE IS NO ERROR so misleading as one which is based upon truth. When the truth is easily established by simple mathematics the error may become almost inevitable. In spite of all that has been said on the subject in the past, a good deal of confusion remains in many minds about the proper load to be used with a tube or a transistor when we want to get the maximum power output. The confusion shows up most frequently nowadays in circuits which are not quite standard. The cathode follower and emitter follower are particular examples. I find that the investigation of misunderstandings is a rather valuable exercise, because in trying to see why people get the wrong answer one can often get a much deeper comprehension of the essence of the right answer.

Let us have a look at the classical textbook form. We assume that we have a generator E_o, of impedance R_o, which is feeding a load R_1. This is the circuit shown in *Fig.* 1. The voltage across the load is E_1, and

$$E_1 = E_o R_1/(R_o + R_1)$$

The current through the load is I_1, where

$$I_1 = E_o/(R_o + R_1)$$

The power which is produced in the load must be

$$P = E_1 I_1 = E_o^2 \cdot R_1/(R_o + R_1)^2 = (E_o^2/R_o)(R_o R_1)/(R_o + R_1)^2$$

We may pause for a moment, and look at *Fig* 2. This shows how the source can be regarded as a current generator, I_o, with a shunt impedance of R_o.

For this circuit we may write equations for the current through the load

$$I_1 = I_o R_o/(R_o + R_1),$$

and for the voltage across the load

$$E_1 = I_o R_o R_1/(R_o + R_1),$$

so that the power in the load is

$$P = E_1 I_1 = (I_o^2 R_o)(R_o R_1)/(R_o + R_1)^2$$

These two equations for the power are, of course, equivalent. If we make $R_o = 0$, or short-circuit the load, the current through the short-circuit must be I_o, and is easily seen to be E_o/R_o by a glance at *Fig.* 1. Equally, if we open-circuit the load the open-circuit voltage E_o is $I_o R_o$. We may therefore write $P_o = E_o^2/R_o = I_o^2 R$, and the expressions for the load power both become

$$P = P_o \cdot R_o R_1/(R_o + R_1)^2$$

Let us put $R_1/R_o = r$, and simplify the expression to

$$P/P_o = 1/(r + 2 + 1/r)$$

The term inside the brackets is fairly well known. It is plotted out in *Fig.* 3 and the graph confirms what we already know about this symmetrical expression. It has a minimum value when $r = 1$, and at the minimum we have $P = P_o/4$. This is, of course, the maximum value of P which we can get for a given value of P_o.

This is the point where the textbooks stop, often with the comment that you must match the load to the generator, make $R_1 = R_o$ (so that $r = 1$) if you want to get maximum power in the load. This must be where we begin.

First of all let us draw the curve of *Fig.* 3 in a more attractive form. If we take *10 log* P/P_o we get the power ratio in decibels, and we have

$$10 \log P/P_o = -10 \log (r + 2 + 1/r)$$
$$= -10 \log (1 + r) - 10 \log (1 + 1/r)$$

When we are well away from the matched condition we may neglect either r or $1/r$ and we see that the available power is very nearly proportional to either $1/r$ or r. By using a logarithmic scale for r we can get the pleasantly symmetrical graph of *Fig.* 4. This shows the behaviour of the power output in a way which most engineers will find rather easier to understand.

As a warning against taking the textbook rule too seriously let us see what happens if we modify our assumptions. Why should we accept the idea that E_o and I_o are fixed? Suppose that they can vary in such a way that the generator delivers constant power. The power given out by the voltage generator of *Fig.* 1 will be P_{o1}, where

$$P_{o1} = E_o^2/(R_o + R_1)$$

We then look at

$$P/P_{o1} = \frac{E_o^2 R_1}{(R_o + R_1)^2} \times \frac{R_o + R_1}{E_o^2} = \frac{R_1}{R_o + R_1}$$

This is either the efficiency of power transfer, or the ratio of load power to total power if the total power is fixed. When $R_1 = R_o$ this is ½, but as R_1 is made larger this ratio increases towards a limit of unity.

We can try the same calculations with the current generator of *Fig.* 2. Then we write

$$P_{o1} = I_o^2 R_o R_1/(R_o + R_1),$$

and arrive at

$$P/P_{o1} = R_o/(R_o + R_1).$$

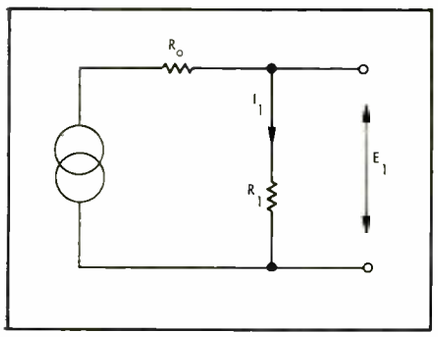

Fig. 1. A generator and its load.

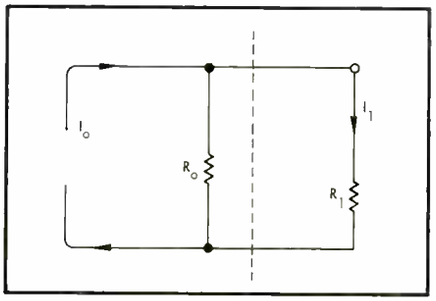

Fig. 2. The current-generator equivalent of Fig. 1.

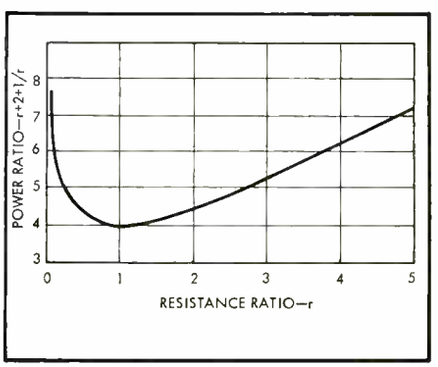

Fig. 3. Graph for the ratio of P/P_o.

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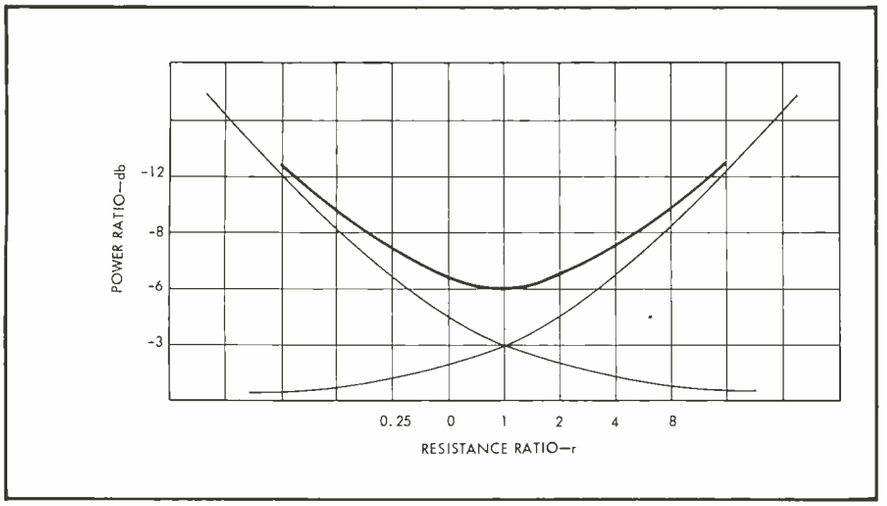


Fig. 4. Re-plot of Fig. 3.

Again we see that the matched condition gives us one-half the power in the load, but now the maximum load power, for a fixed total power, is obtained if the load is made very small.

The advantage of obtaining results of this kind, in which the conclusions we draw are in conflict with each other, is that our faith in any one of the conclusions is undermined. We find it easier to break down the barrier of habit and to think about our problem. The habit barrier is extremely strong, and rules which we learnt fairly early in the game are often fixed very firmly in our minds. We must out-flank them if we want to avoid the tradition barrier.

It is not difficult to see the limitations of the constant-power approach to our problem. We get the most efficient transfer when the load is either a short-circuit or an open-circuit, but in order to keep the total power constant under these conditions we must accept infinite values of current and voltage respectively. Now it is very easy to say that this means that we need not take too much notice of this criterion, and to dismiss it completely from our thoughts. Closer investigation shows that this is quite the wrong thing to do. Let us look at our rather simple equations again.

For the current generator we have found that

$$P/P_{oI} = R_o/(R_o + R_1) = 1/(1+r)$$

and thus $10 \log P/P_{oI} = -10 \log (1+r)$.

For the voltage generator the corresponding result is

$$10 \log P/P_{oI} = -10 \log (1 + 1/r).$$

These two results are plotted in *Fig.* 5. Both from the mathematics and from the graphs it can be seen that the constant-power generators give the two curves which, when combined (by addition in the decibel form), result in the single curve for the constant-voltage or current generator. We thus have three curves which are in some way valid. You remember the ruling in *Animal Farm:* all are equal, but some are more equal than others. I do not intend to consider whether one or another of these three curves is more valid than the others. The purpose of the discussion has been to destroy the uniqueness of *Fig.* 3.

We turn now to the output characteristics of a device, a tube or a transistor. These are shown in *Fig.* 6, which you may feel has some resemblance to the Bellman's map (*The Hunting of the Snark*), which the crew found to be a map they could all understand.

It was, as you may remember,

"A perfect and absolute blank!"

I only hope that in showing you this you do not get me confused with a well-known British Politician who has

"Only one notion for crossing the ocean

And that was to tingle his bell."

The reason why no details of the device behaviour will soon become apparent. In *Fig.* 6 we can add a line showing the maximum permitted current, assuming for the moment that this current is a constant. This means that we do not accept the need to prevent the flow of grid current in a tube as an absolute limit at this stage. We may also draw the line indicating the maximum permitted voltage. For transistors we know that this limit depends on the current flowing and the conditions of the base circuit, but here again we shall ignore these refinements. The other assumptions which we make at this stage are that the voltage and the current may each swing down to zero, but that they may not reverse. Here again you will realize that these statements are, at the best, first-order approximations.

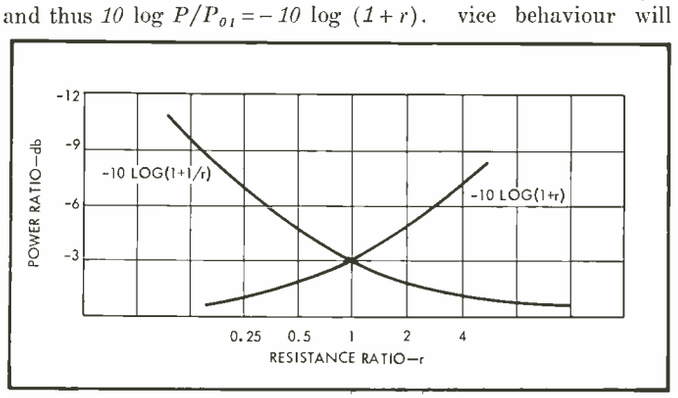


Fig. 5. The two graphs which apply to constant-power generators.

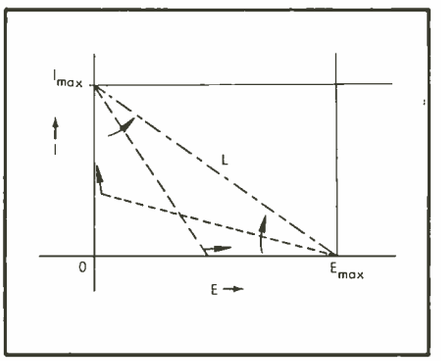


Fig. 6. A device characteristic and load lines.

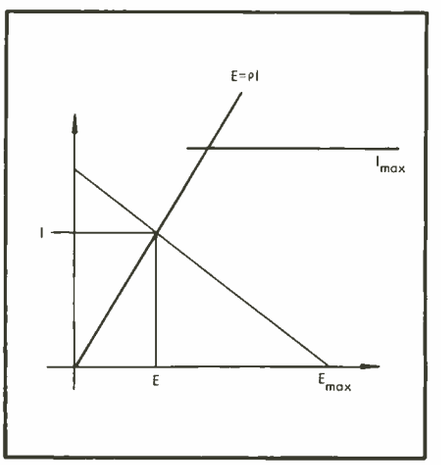
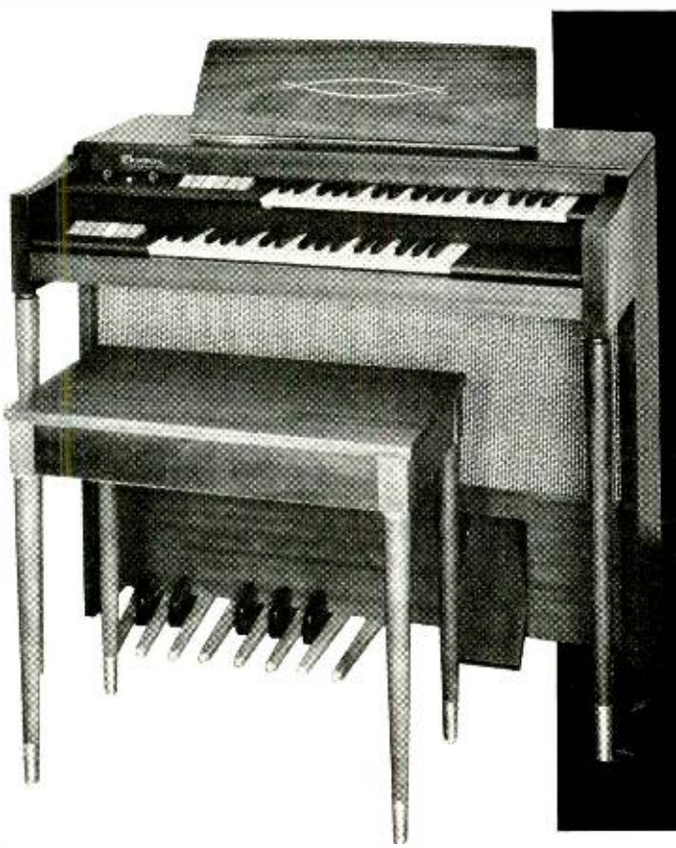


Fig. 7. Construction with a "diode line" limit.

I do not think it is difficult to see that the load line *L,* the diagonal shown in *Fig.* 6, represents the impedance which will let us take out the maximum power from this device. If we think of it as pivoted at the point $E = E_{max}$, $I = O$, we can see that when we start with a very high load impedance we can increase the output power by reducing the load impedance until we run up against the stop provided by the maximum current line. In a similar way, if we pivot the load line about $E = O$, $I = I_{max}$ and start with a low impedance the power will increase until a stop is provided by E_{max}.

Notice that this conclusion has been reached without taking any account at



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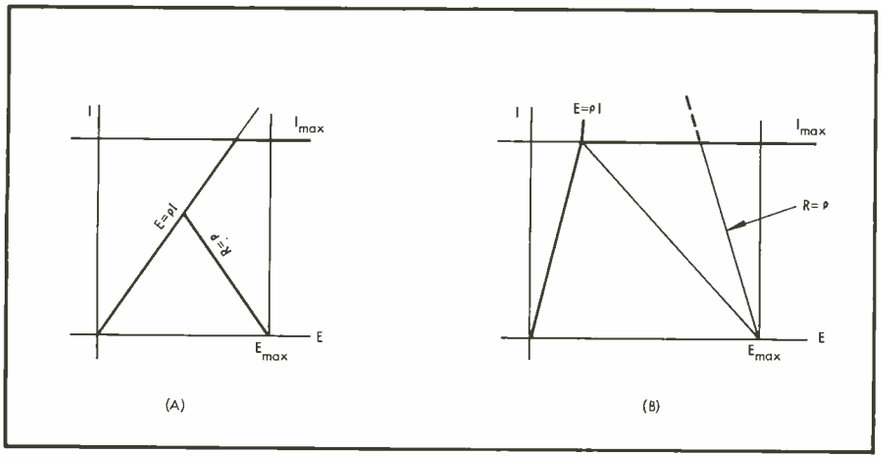

Fig. 8. The matched load is only correct if other limitations do not intervene, as they do in (B).

all of the impedance of the tube or the transistor. We do not know anything about this at all, for there is no information on the diagram, *Fig.* 6, which we have used. Frequently we find that there is another limit, that we have a power-dissipation hyperbola for $EI = P_{max}$, on our diagram. I do not want to discuss this, because it would use up space I need for other matters, but you can easily show that here again the load line does not depend on the impedance.

The chief weakness in this very simple analysis is at the low-voltage end of the load line. When we use triodes, and especially when we restrict ourselves, as we usually do, to the negative grid region so that we do not have to trouble about grid current, there is a considerable amount of the characteristic which is barred to us. We need to examine the effect of the limiting line shown in *Fig.* 7, a line corresponding to a tube impedance ρ. We retain the voltage limit E_m and the maximum current I_{max}. Suppose that we use a load of R ohms, with the load line passing through E_{max}. We know that we have

$$IR + I\rho = I(R + \rho) = E_m.$$

We know also that the quantity I^2R is a measure of the power in the load, P. I don't want to introduce sine waves and factors of ¼, which make no difference to the end result but clutter up the working. Combining these equations gives

$$P = R[E_m/(R + \rho)]^2$$
$$= (E_m^2/\rho)/(R/\rho) + 2 + (\rho/R)$$

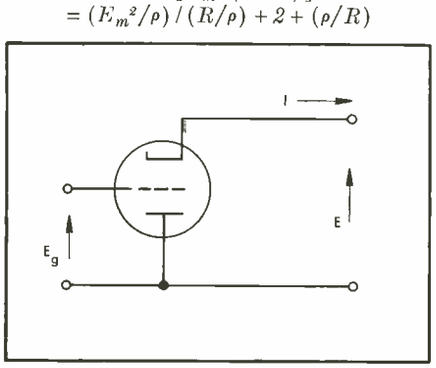

Fig. 9. The cathode follower drawn in a grounded-anode circuit.

We are free to vary R, and we have seen this kind of expression before. It will give us a maximum value of P if we make $R = \rho$. At last we have found a need to match the device to the load.

However, this is only true if we are working within the limitations of *Fig.* 7. The result shown in (A) of *Fig.* 8, the matched form, is correct, but if we get the situation shown in (B), the current limitation takes charge and we can get the most power out by increasing the load resistance until the load line falls into the corner of the characteristic.

I am sure that if you have followed the discussion with a pentode characteristic or a transistor common-emitter characteristic superimposed, by your mind, over the empty maps you will have wondered why such a non-committal treatment was being given to such a simple subject. Nowhere, however, is there any such limitation of mode of operation. The discussion has been perfectly general. The reason for this way of approaching the answer has been, as I said at the beginning, to let you, in Dr. Johnson's words, clear your minds

(Continued on page 69)

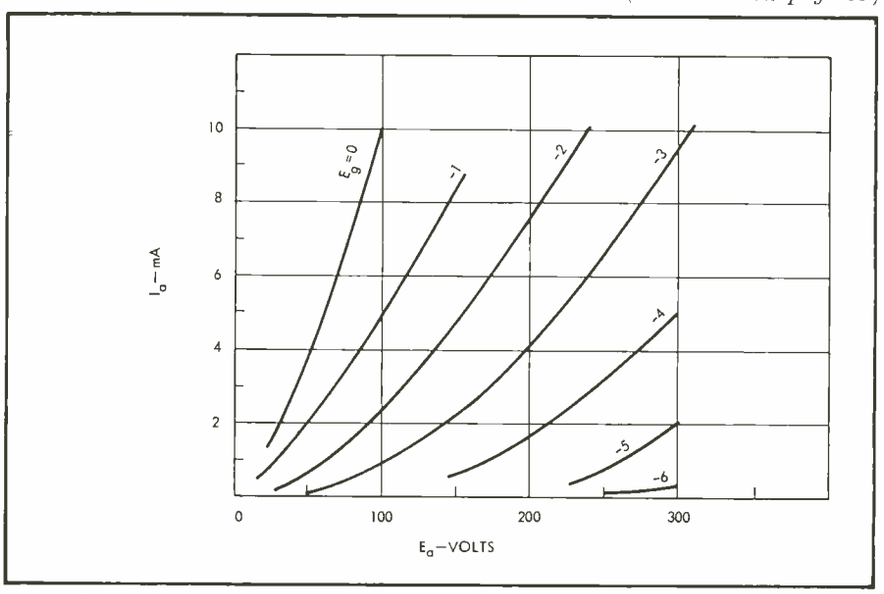

Fig. 10. Characteristics of a triode in common-cathode configuration.

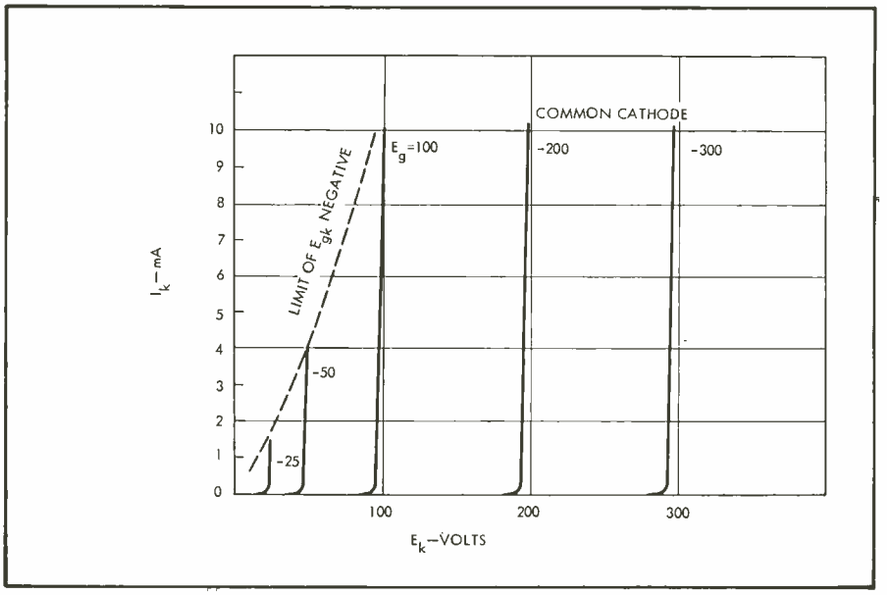

Fig. 11. Characteristics of a triode in common-anode configuration.

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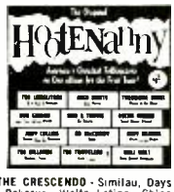

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HERMAN BURSTEIN*

(Note: To facilitate a prompt reply, please enclose a stamped, self-addressed envelope with your question.)

Compatibility of Stereo Tapes

Q. I am writing concerning a problem that I was asked about and to which I could not give an althogther satisfactory answer. This concerns playback of quarter-track stereo tape on a mono basis, by combining the outputs of the two sections of the stereo playback head. Although the head output is considerably lower than when the sections are operated independently, no other adverse effects have been noticed until recently. In the case of two particular quarter-track tapes, when played back as above, there is almost complete loss of one track and considerable distortion, although either track by itself is normal. My only explanation is that the same signal on the two tracks is sufficiently out of phase to cause the cancellation and distortion. But when the signals are taken independently from each head section and then combined in the stereo preamplifier, very little cancellation and distortion occur. So I am at a loss to give a good explanation of what is happening.

A. I believe that the reduction in level which occurs when you parallel the two tracks of a stereo tape is largely due to the combination of out-of-phase components. There are bound to be many out of phase components, particularly at the mid and high frequencies, because a given signal will not always arrive at each stereo microphone with exactly the same phase. When signals on the two tracks are exactly in phase, their combined level will be 3 db higher than either signal alone. But when the signals are exactly opposite in phase, the level will drop for more than 3 db. Since the cancellations can be much greater than the additions, the net result is a reduction in over-all level.

Your trouble with just two tapes rather than with all stereo tapes strongly suggests that in these two instances someone has taken program material essentially or completely monophonic and tried to convert them to pseudo-stereo by reversing phase on one channel, thereby obtaining a "difference" between channels. The two signals are less apt to be exactly opposite in phase as frequency rises, so that there is relatively less cancellation of the highs. That is, the highs come through better than the lows. The result is a thin, tinny sound, which is what you may be identifying as distortion.

If you fail to get the same degree of cancellation when the signals are combined at the preamp output, this appears to be due to different signal levels on each channel of the preamp. For example, if the left channel is producing 1.4 volt and the right channel is producing – 1.0 volt, combination of the two signals would still leave a substantial amount of signal voltage. Phase differences between channels—particularly if the bass and treble controls are set to different positions, or if they supply different amounts of bass and treble compensation in the same position—would also permit some signal to remain.

* 280 Twin Lane E., Wantagh, N. Y.

Differences in Tape

Q. What is the relative virtue of different brands and types of tape. By types I mean acetate or Mylar of various thicknesses. What differences, if any, are there in the dynamic range, print-through, tape hiss, and head wear? Probably half my recording will be at 3.75 ips for background music and half at 7.5 ips for more serious listening. Would you care to make any suggestions for a "best" tape or tapes for these purposes?

A. The principal advantages of Mylar concern strength and durability. Because of its greater strength, Mylar lends itself to thinner tapes, permitting more recording time on a reel of a given size, say a 7-in. reel; a 7-in. reel can normally hold 1200 feet of conventional tape (either acetate or Mylar of standard thickness), but it can accommodate 1800 feet of so-called 1-mil tape and 2400 feet of ½-mil tape, thus increasing recording time per reel either 50 or 100 per cent.

So far as I know, there aren't any major differences between acetate and Mylar where dynamic range, tape hiss, and head wear are concerned. On the other hand, certain differences can be associated with Mylar since it is a thinner tape. That is, print-through tends to be greater and high-frequency response tends to be slightly better with a thinner tape.

If economy of tape is important to you, then use either 1-mil or ½-mil tape, which means Mylar. It you plan to keep your tapes for a long time, use Mylar, which you can get in standard thickness as well as in 1-mil and in ½-mil form. If you are careful to record at normal levels you may not have troublesome print-through with one of the thinner tapes. However, you can't be sure. Moreover, print-through tends to increase with storage time, and a tape that initially seems to be free of print-through may show an appreciable amount a year later.

Fluttering Sound

Q. My tape recorder has developed a fluttering sound at all speeds. This flutter is particularly distinct on solo instruments and vocal passages. I have had the machine checked by a local serviceman and nothing was found wrong. All rubber wheels and belts were replaced and tubes checked.

A. I have had several letters like yours concerning wow and flutter in your make of tape machine. I contacted the local representative to ask if there might be some generic fault, but he merely stated that instances like yours are few. Have you cleaned and lubricated the heads, pressure pads, and all guides contacted by the tape? Have you cleaned the capstan and pinch roller? Have you made sure there is no lubricant or grease on the capstan and pinch roller? Have you made sure there is no grease on any of the belt-driven parts or rubber wheels?

Multiple Dubbing

Q. We are forming a tape club which will be equipped with two tape recorders for dubbing. We would like to provide facilities for other members bringing their own tape recorders to tap into the output of the club's machine. The limit would be about 10 outside recorders. Our tape machines have tape head, preamp, and amplifier outputs. Where would be the best place for tapping off to feed the other recorders? If we use the preamp output, would we need an extra stage of isolation for each recorder that is being fed?

A. Usually the best place to tape the playback signal is at the preamp output, resulting in best frequency response and least distortion. On the other hand, the amplifier output has the advantage of very low output impedance, which minimizes the the effect of placing about 10 loads on the signal, and minimizes the interdependence among these 10 loads. The best course, as you recognize, is to use an isolating stage—either a cathode or anode follower—between each load (tape recorder) and the preamp output.

Shipping Tapes

Q. I am presently stationed overseas, and am returning soon to the States. My problem is that I will have to turn all of my recorded tapes over to the shipping department, and I am afraid they will get erased because of someone's carelessness. I have thought of buying some metal film cans and shipping these cans in turn in a metal case. Would a plastic container be better?

A. The metal (iron or steel) container would be preferable because it provides some potection against magnetic fields produced by motors, transformers, and so on. On the other hand, if the containers are to be packed within a metal case, I don't think it matters much what type of container you use.

Tape Cleaning

Q. What can you tell me about tape cleaning? Is it necessary? Once I tried to clean a tape by running it at fast forward speed past a piece of cotton saturated with alcohol, but I completely ruined the tape. The same happened when I tried a head cleaner.

A. Tapes are not supposed to be cleaned. However, they can be lubricated. There are one or two substances specifically marketed for this purpose, and available at audio or electronic supply stores. The things to be cleaned are the tape heads and other parts contacted by the tape. Use alcohol or one of the special perparations sold for this purpose. You can also purchase lubricants intended for the tape heads and guides. **Do not apply lubricant to the capstan and pressure roller.** Æ

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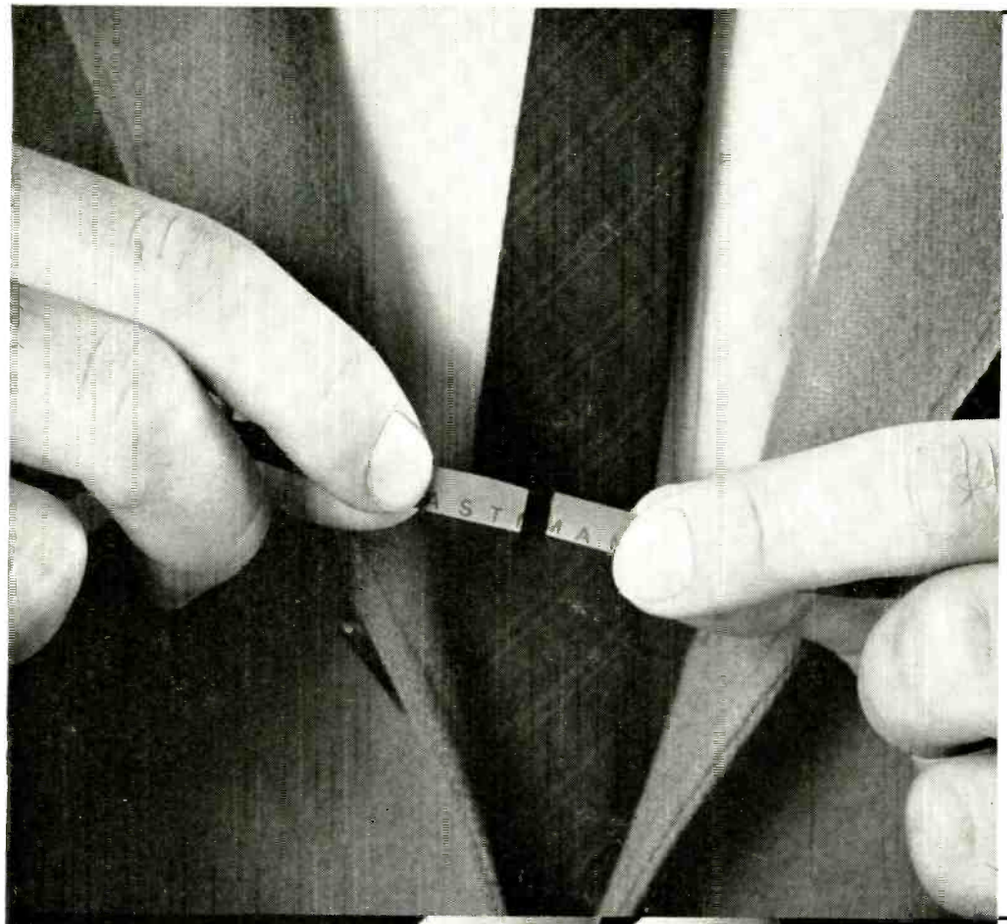

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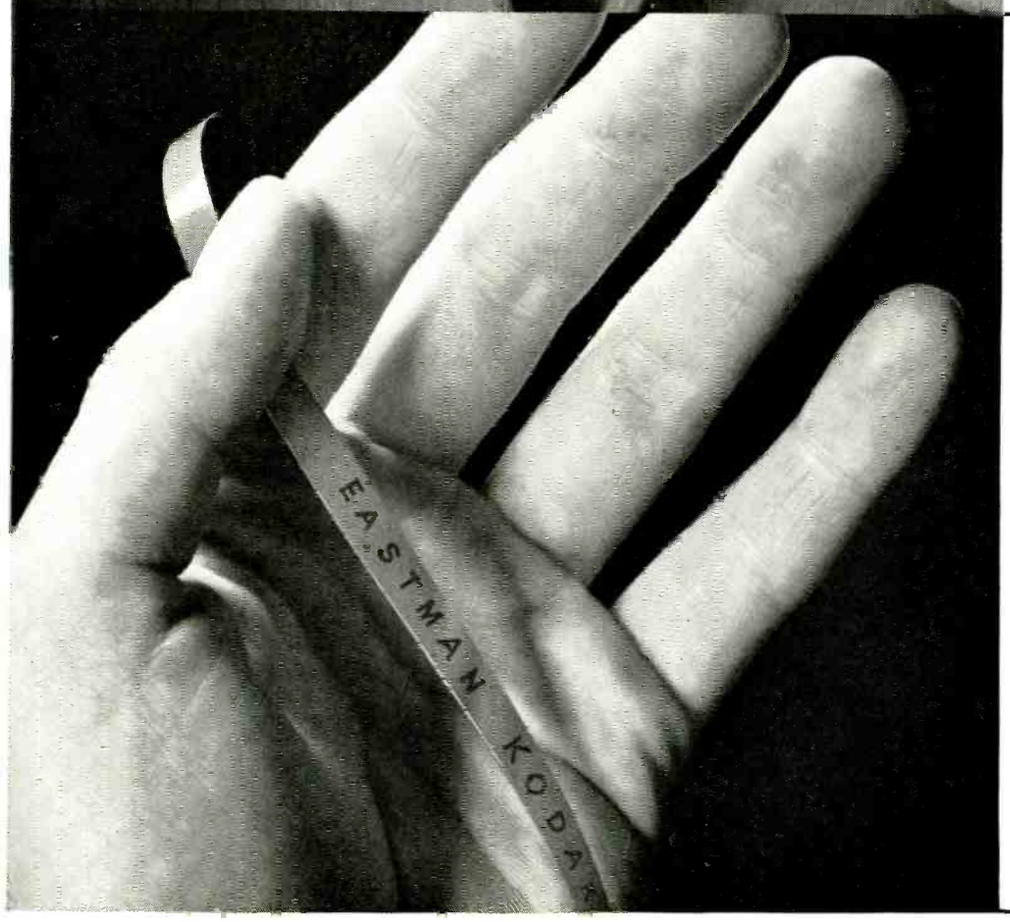

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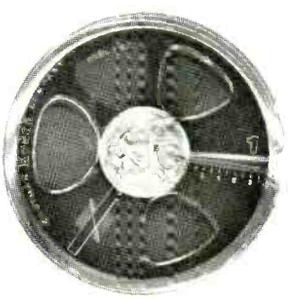

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Organs and Organ Music

In Two Parts—Part II

WINTHROP S. PIKE*

Aside from environmental effects, an electronic organ may in your home not sound quite like the pipe organ in a massive cathedral. An understanding of the stoplists of various instruments and the relationship of various stops to one another may aid in selection.

IN THE PRECEDING SECTION of this paper, I discussed the number of playing keys, manuals, pedals, and so on, required on an organ for adequate performance of a reasonable percentage of the instrument's classical repertoire. Examples were given of a few of the typical ways in which the manuals and pedals are used in playing different types of music. These are all readily demonstrable physical matters. In this section of the paper we shall tread much more dangerous ground as matters of taste, experience and judgment rather than straightforward physical necessity become involved. Certain statements will be made which are not capable of proof; they represent, of course, only the opinions of the author, a professional engineer and amateur organist.

I shall limit discussion to two-manual organs. As was pointed out previously, about 90 per cent of the literature can be played on a well designed two-manual organ. Further, this is the size most often found in a home, economic considerations alone usually ruling out anything larger.

How, then, does one choose a stoplist for a two-manual organ, or, in the case of a ready-made electronic organ, choose the model best suited to one's needs? To play a reasonable percentage of the classical literature the minimum requirements—more organ may be desirable. Less than this or a very different tonal scheme will severely limit what can be properly played on the organ.

A Minimum Two-Manual Organ should have:

1. A robust chorus of *Principal* (*Diapason* stops associated with one manual, typically the Great. Let us call this the Primary Chorus. Such a chorus should comprise *Principals* at 8′, 4′ and 2′ pitch plus, if possible, a *Mixture* stop of, say, three ranks. In a very small pipe organ a stopped flute such as a *Koppelflute, Gedact,* or *Spillflute* is often substituted for the 8′ *Principal.* The substitution does not materially harm the Primary Chorus and provides a useful accompanimental stop for solo combinations on the stops of the other manual.

2. A Secondary Chorus associated with the other manual. This chorus should probably have a somewhat more sprightly and less massive tone than the Primary Chorus but it should not be much softer. At least the 8′, 4′ 2′ pitches must be represented. If the 2′ is a *Principal,* 8′ and 4′ may be flutes.

3. A Pedal Organ which can hold its own against either manual. A minimum pedal might comprise a 16′ *Gedact,* 8′ *Principal* and 4′ *Flute.* Certainly at least these three pitches should be available. A solitary 16′ by itself just won't do.

4. As many useful solo combinations and suitable balancing accompanimental tonalities as possible. The better the design, the greater the number of components of these which will also be useful in the Primary and Secondary Choruses.

There are many other things which would be nice. One might cite a reed chorus, a celeste stop, and a solo reed stop or two to mention a few, but these are less essential.

Now how should the relative loudness of these various stops be adjusted? This is one of the most difficult problems in any organ and it is particularly critical in a small organ where maximum usefulness must be obtained from every voice. For example, it is of no use to have a solo *Oboe* stop on the Swell if there's nothing on the Great which can be used to accompany it. This may seem obvious, yet I continually encounter precisely this situation in organ after organ. Similarly, if there is too much disparity in loudness between Primary and Secondary choruses rather ludicrous contrasts will result when they are used as in the fugal example (ref. 14, pg. 22) given in Part I of this paper. It turns out that in a small organ the greatest flexibility of registration will be obtained if there are no large differences in loudness between the various stops. This principle, if followed, almost automatically leads to the greatest possible number of useful stop combinations.

A satisfactory tonal ensemble is also critically dependent on the balance between the low pitched (8′) stops and the high 4′, 2′, 1⅓′, etc.) stops of each division of an organ and on the variation (if any) of loudness and timbre throughout the compass of each individual stop. A recent paper by Pickering[20] gives an admirable treatment of these matters. The audiofan may also gain some insight into the may problems of tonal design from an excellent recorded lecture[21] by the late G. Donald Harrison. The latter gives many examples of the actual sounds of different stops and combinations as they are used in various types of music. It you don't know a *Fagotto* from a *Flugelhorn,* this as a good place to start.

Typical Stoplists

Some examples of good and bad stoplists will also help to make this subject clearer. It must be remarked, however, that while any two organists will readily agree that a specific stoplist is bad, it is much more difficult to get agreement on what is good. X, who is fresh out of the conservatory and who ignores all music between Bach and Hindemith will want one kind of organ. This organ, however, will be absolute anathema to Y, who has been warming the bench at St. Whoosit's for the last 40 years and who prefers Franck to Frescobaldi any day. But both X and Y will quite readily agree that their colleague, Z must be deaf and dumb to actually like that "thing" he plays.

To start off, Table I represents a bad stoplist. X, Y, and even Z would heartily condemn it. Though it is typical of many home "spinet" organs. I have not consciously copied it from any known make.

It isn't hard to see why this is a bad organ. First only the 8′ pitch is represented on the manuals. Second, the short manuals alone make it impossible to per-

* *101 Leabrook Lane, Princeton, N. J.*

form adequately a single one of our 100 examples[13–18]. Beyond this, however, the instrument represents the perpetuation of a common misconception about the organ. This misconception is that the organ is a sort of one man substitute for a symphony orchestra and that therefore it should be capable of duplicating the sounds of the various instruments. This is a false premise. The organ is an entirely different instrument with a well developed literature of its own. It is never at its best in trying to imitate the orchestra, and even its best imitative stops are poor substitutes indeed for real orchestral instruments.

Table II shows another stoplist having about the same number of stops as the previous one.

This little organ comprises only Flutes and Principals. Though one might think that it would therefore lack variety, the reverse is true. The provision of the many different pitches and the way in which they are assigned to the different manuals permits a wealth of interesting and varied timbres to be synthesized by properly combining appropriate registers. The full Great is the Primary Chorus, the full Positiv the Secondary. They will sound quite different. The 8′ Flutes are of different timbres, one stopped, the other (*Spitzflute*) open. There are many solo possibilities. For example, the 4′ *Koppelflute* plus the 1⅓′ *Larigot* when played an octave lower will make quite a colorful quasi-woodwind sound, and, if the organ has been properly designed, it can be accompanied by the 8′ *Gedact* on the Great. The Pedal will balance either manual by itself, or its resources may be augmented by coupling either or both manuals to it. Such an organ from one of our better builders would cost at least $10,000 if custom built as a pipe organ and would require considerable floor space, the actual amount being somewhat dependent on the height available.

X would be very happy with this little organ and would revel in its "almost ascetic restraint."[21] Y would certainly prefer it to our first example, but would grumble with reason that his beloved Franck didn't sound right on it. Such passages as *Fig.* 8 (ref. 18, pg. 6) require a solo reed stop to realize the composer's intentions adequately. Other sections of this piece require chorus reeds, a celeste stop, and 16′ manual tone. These shortcomings can easily be remedied without compromising the basic integrity of the over-all scheme if a few more stops are added.

Stops marked (P) represent the Primary Chorus; those marked (S) are the Secondary. The different distribution of timbres and pitches in the two choruses result in a pleasing but not excessive contrast between them. Ample solo combinations can be found, either with the reed stops (*Oboe, Regal*) or by synthetic tone building with the mutation stops (*Nazard, Quinte, Tierce*). The string celeste is a welcome addition for romantic music. This is the stoplist of an old organ which I have rebuilt and installed in my home.

TABLE I

A Bad Organ

Upper Manual	Lower Manual	Pedal
8′ Saxophone	8′ French Horn	Adjustable
8′ Tuba	8′ Flute	volume
8′ Violincello	8′ Diapason	control
8′ Concert Flute	8′ Oboe	only. Plays
	8′ Viola	at 16′ pitch.
	8′ Clarinet	

Two 37-note Manuals, 13-note Pedal Clavier.

TABLE II

A Good Small Organ

Great	Positiv	Pedal
8′ Gedact	8′ Spitzflute	16′ Gedact
4′ Principal	4′ Koppelflute	8′ Principal
2′ Fifteenth	2′ Principal	4′ Flute
III Mixture	1-1/3′ Larigot	

Two 61-note Manuals, 32-note Pedal. Both manuals couple to the Pedal. The Positiv couples also to the Great.

This organ is by no means the ultimate. It's stoplist has evolved as a compromise between many conflicting forces, one of the more potent of which was a slender purse. Neither X or Y would be entirely happy with it. X would want to add a *Mixture,* throw out the *Viola Celeste* and set fire to the Swell Box. Y would want at least one 8′ *Principal,* a set of chorus reeds and separate swell boxes for the two manuals. Both X and Y, however, would have to admit that acceptable performances of music of almost any period can be given on this organ with no particular difficulty. It is an eclectic organ.

Omissions—and Why

Observe, if you will, that two sacred cows dear to the misunderstanding hearts of many audiofans are not to be found in either of the two good stoplists. Neither has a 16′ stop on the manuals or a 32′ stop on the Pedal. Such stops, despite their popular appeal, simply aren't very useful. Though desirable in larger organs, they are better omitted from the small organs under consideration here. The 16′ pitch is certainly essential in the pedal but it is far less useful than the higher pitches (such as the 2′) on the manuals, a point apparently not appreciated by the manufacturers of a number of electronic organs. As for 32′ pedal stops, Barnes[23] relates an amusing incident in his excellent book "The Contemporary American Organ." It seems that a group of organists was trying out a large new organ. Someone asked to hear the lowest note (C—approximately 16 cps) of the 32′ stop. It was duly played and the listeners apparently had some difficulty in deciding whether or not they could tell when it was playing. To resolve the issue, one member of the group went into the interior of the organ and stood beside the pipe in question When asked if he could hear it, he replied, "No, but I can feel an expensive draft."

Another trap for the unwary is to be found in the elaborate, expensive and fascinating mechanical devices usually associated with larger organs to facilitate registration changes. Combination pistons, crescendo pedals, sforzando pedals, reversibles and the like are nice to have and fun to use. Of themselves, however, they make no music whatsoever. Mercifully no composer as yet has penned a "Chorale Prelude for Combons and Crescendo Pedal" or "Ricercare for Reversibles." In a small organ it is better to do without these accessories and put an equivalent amount of money into the tone-producing portions of the organ.

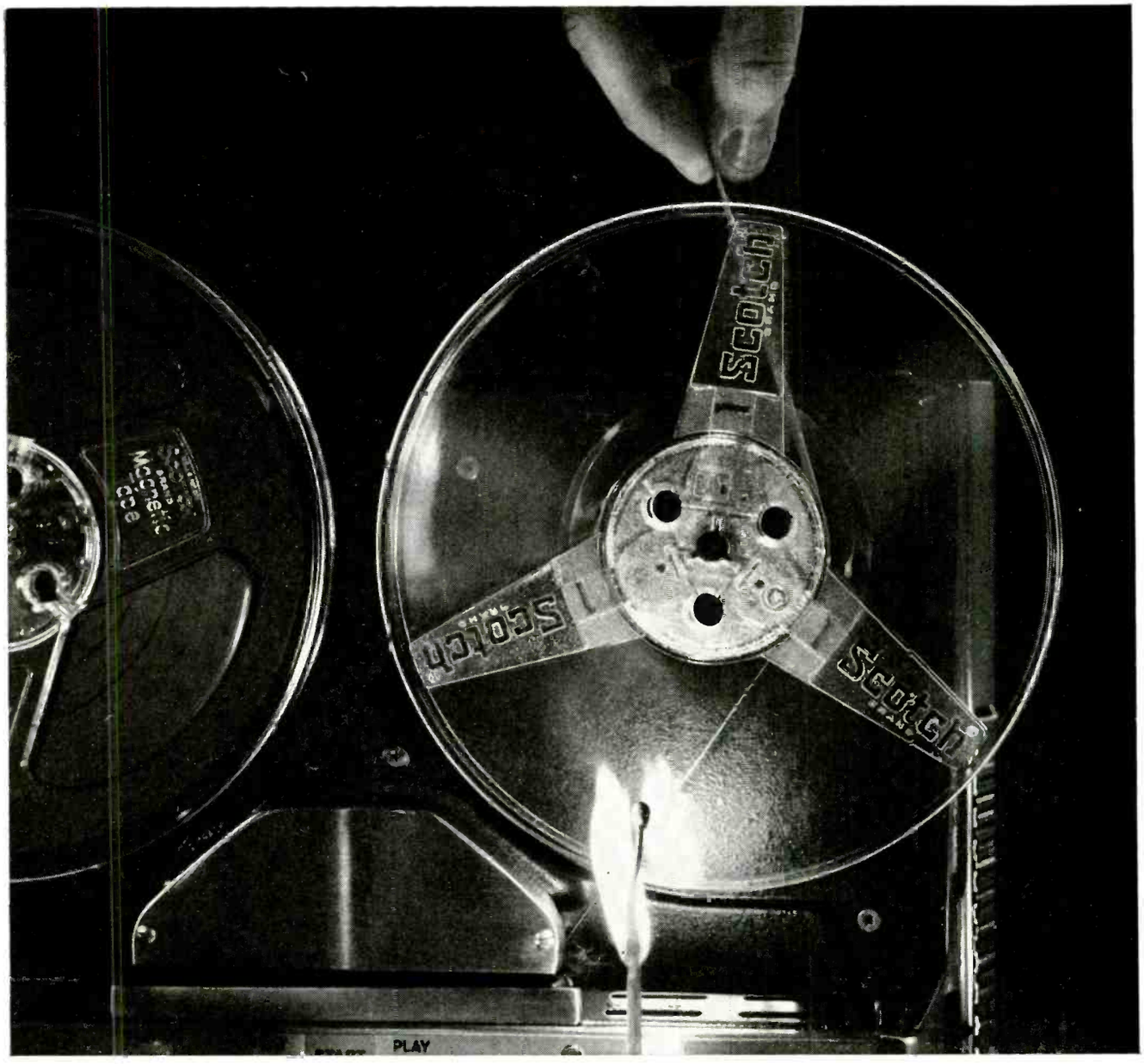
The two good stoplists which I have presented are pipe organ stoplists. You won't find their precise equivalent in any electronic organ. Economic considerations and certain different possibilities implicit only in the electronic organ usually result in somewhat different stoplists in these instruments. For example, most organs of the frequency divider type supply many more 8′ solo stops (*Oboe, Clarinet, Trumpet, English Horn,* and so on) on the manuals than are really needed. Why? Simply because

TABLE III

A Larger General Purpose Organ

Great		Swell		Pedal	
8′ Gedact	(P)	8′ Bourdon	(S)	16′ Sub Bass	
4′ Principal	(P)	8′ Viola		8′ Gedact	Unit
2′ Fifteenth	(P)	8′ Viola Celeste		4′ Flute	Flute
1-1/3′ Quinte	(P)	4′ Flute	(S)	2′ Flute	
8′ Oboe		2-2/3 Nazard		8′ Regal	Unit
		2′ Octavin	(S)	4′ Regal	Reed
		1-3/5 Tierce			
		1′ Sifflote	(S)		

Couplers: Swell to Great 16′, 8′, 4′ Great to Pedal Great to Great 4′
Swell to Swell 16′, 8′, 4′ Swell to Pedal



NEW! A tape reel that threads itself!

(even in the dark!)

Just lay recording tape inside this new reel and start your recorder. This exclusive new SCOTCH® BRAND Self-Threading Reel holds tape firmly, but gently, as recorder starts—actually threads up automatically. No hooks, no slots, no attachments—no tape fumbles. This reel does away with thread-up problems. (You wouldn't really need the light of a match to use it!) Now, this reel is offered as a take-up reel for only 39¢ in a special offer from the granddaddy of all tape-makers, 3M.

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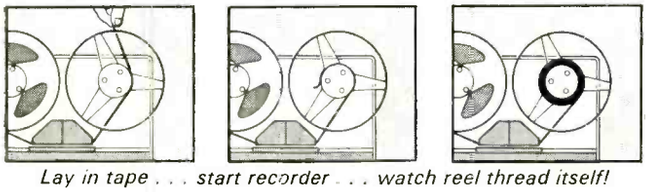

Lay in tape . . . start recorder . . . watch reel thread itself!

Magnetic Products Division 3M COMPANY

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it is inexpensive to do so and it helps sales. The generators are already there and so are the 8′ key switches—costly items. Each new 8′ stop requires merely another "formant" filter. On the other hand, adding a stop at a different pitch would require one more contact on each playing key, one more isolating resistor per key, another output bus from these switches and possibly even another amplifier stage. Though the ground rules are slightly different in the individual oscillator type of organ, similar economic "facts of life" tend to force manufacturers to design their instruments around the smallest possible number of costly oscillators to the detriment of the tonal qualities of some of these organs.

One last word of caution before we leave the subject of stoplists. One can never evaluate an organ of any type purely on the basis of its stoplist. The ear must be the final arbiter. One manufacturer's *Diapason* may well be another's *Dulciana,* such are the differences from builder to builder. Don't buy an instrument without trying it yourself, or, if you are a beginner, getting a more adept organist to go along with you and give you the benefit of his opinion. In trying an instrument, try to think in terms of how you would play a few specific pieces of different types. What stops would you use for the Primary and Secondary Choruses? What stops are available to balance that solo *Sackbut* in the Swell? Is the pedal adequate? In many cases half an hour at the console in an effort to find satisfactory registrations for a few representative pieces of music will quickly separate the men from the boys.

So you finally decide on a Zilch "Cathedralette," give the nice man your signature on that formidable looking contract and for only blank dollars a month it's yours. But wait, here in the living room it doesn't sound quite like that pipe organ around the corner at St. Whoosit's. Why? Well, by comparison with St. Whoosit's windy behemoth, your spanking new "Cathedralette" is probably deficient in one or more of the following three areas: environment, envelope control, and chorus effect. These three are of about equal importance and to some extent interdependent.

The Deficiencies

Most of the pipe organs you have heard were probably in churches or concert halls. Few such structures have acoustics as "dry" (non-reverberant) as the average living room. It has long been an axiom of the better pipe organ builders that the building is literally a part of the organ. This is no less true with an electronic organ. In a large stone church with a reverberation time of perhaps three to four seconds, almost any organ will give a satisfying sound, including most electronics. The reverberation will conceal a multitude of sins. On the other hand, when the reverberation time is less than one second, typical in a residence, the organ builder's job is much harder. Small defects of speech become glaringly apparent. The upper work will tend to sound "hard" or "screamy" and the whole ensemble will be apt to lack a satisfying "depth." An improvement can often be made by the simple expedient of moving the organ loudspeakers to the far end of the room or even into an adjacent room so that the ratio of reflected to direct sound is increased. Electronically added reverberation is another possibility.

Secondly, one of the weakest points in many electronic organs is the lack of realistic control of the manner in which the tone starts and stops when a key is depressed. One's subjective impression of a sound seems to be influenced almost as much by the envelope thereof as by the steady state harmonic structure. Unfortunately, realistic envelope control tends to be expensive. The most satisfactory approach seems to be the individual oscillator type of organ in which each oscillator is keyed on by applying supply voltage to it through a suitable RC filter. The filter time constants require to be graded over the compass of the keyboard, growing longer in the bass.

To test this premise, those who still have a workable single-track tape recorder can perform a simple experiment. It won't work with a half-track machine. Play the musical example given in *Fig.* 9 on a piano and record it on the tape recorder. To heighten the effect, play rather softly and in strict tempo with no retard in the last bar. Don't be alarmed at the awkward sounding chord progressions. Now locate the start and finish of the passage on the tape and cut the tape at these points. Turn it end for end and splice it back onto the reel. Now rewind and play the tape.

Though the result is quite striking, it is simply explained. The piano has an asymmetrical attack and decay; the attack being rapid and the decay slow. The reversal of the tape has interchanged the attacks and decays without altering the harmonic content of the piano tones. Incidentally, it has reversed the order of the chord progressions, converting an apparent sequence of harmonic nonsequiturs into a recognizable tune. What instrument does the reversed piano sound like to you?

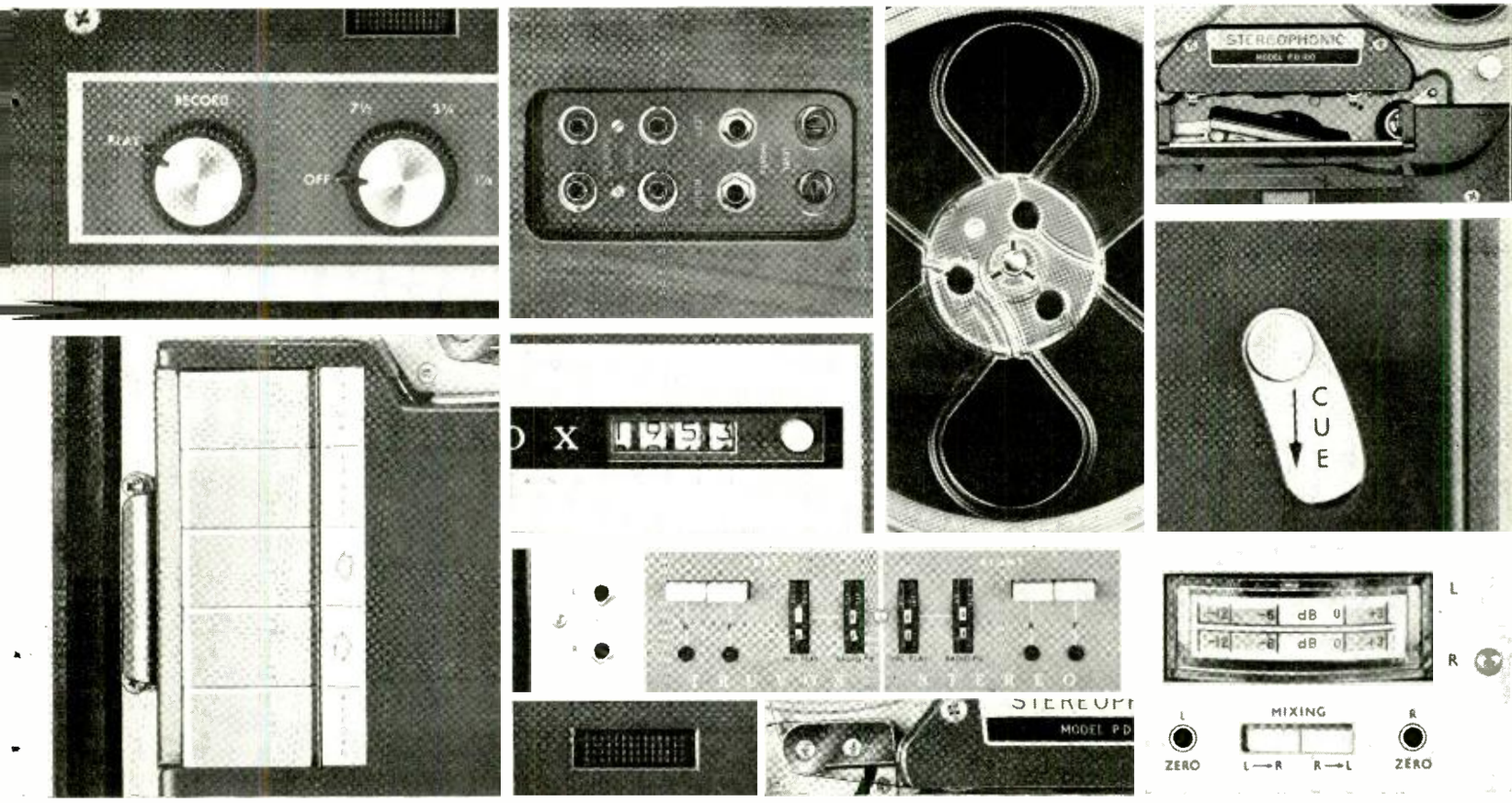
As to chorus effect, this depends simply on the number of separate sources sounding at one time. In all but the very smallest unit pipe organs, this is inevitably much larger than most electronics. Consider, for example, what happens when one plays a simple tonic chord in the key of C major comprising the C below middle C, middle C, E and G. If this is played on Organ No. 3 with all 5 of the Great stops on, no less than 20 pipes will sound. If the Swell is coupled to the Great and 5 of the Swell stops are drawn, the number of pipes will be increased to 40. If the low C is doubled on the Pedal with 5 of the Pedal stops on, 5 more pipes will be added making a grand total of 45. There will now be 45 individual sources of sound located in 45 different places in the organ chamber at 45 different distances from the player, speaking with 45 different attack times and possibly not all perfectly in tune. On either a frequency-divider or phonic-wheel type of electronic organ having the same number of stops there will effectively be only about 10 sources sounding, as the divider action or the gearing will phase-lock all the octavely related pitches. In the individual-oscillator type of electronic organ, all but the most expensive make at least some use of the unit principle so that the actual number of oscillators which would be used in this example is less easy to predict. In general, it will be intermediate between the two values given and toward the higher one.

The spatial separation between sources in the pipe organ is also missing in most electronics. Usually all the generators sound through one or two loudspeakers which are spaced close together in a cabinet. In some of the older pipe organs in which the console was attached to the front of the organ case, quite striking spatial effects were often obtained. I well remember a certain old tracker action organ in which the lowest pipes of the Great 8′ *Principal* stop were used as the show pipes in the case front. Placed just above and to either side of the music rack, they were planted alternately. That is to say, the lowest C was on the player's left, C♯ to the player's right, D to the left and so on. As one played up the scale in the bottom octave, the source of sound clearly alternated between one's right and left sides. Though this sort of thing could easily be simulated in an electronic organ, I know of no instrument which does so, though one of the best electronics uses a slowly rotating loudspeaker assembly which is somewhat helpful.

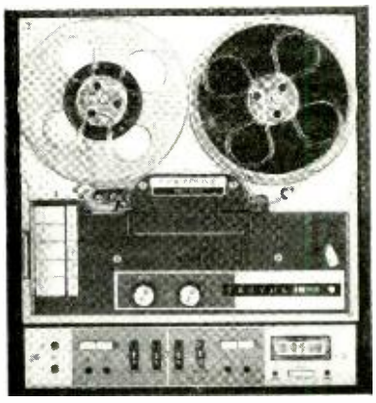
In conclusion, this paper has throughout presented one major problem—what to leave out. Much more could be said. In particular it has been difficult to achieve proper balance of emphasis of the various factors involved in organ design within the scope of so short a paper. Be that as it may, if it has helped to increase understanding of the organ and its music, it will have served its purpose.

(*Continued on page 75*)

the one outstanding feature is that it has them all



New Benjamin-Truvox PD-100



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Whether you judge this unit by these features or by the quality of its performance, there is only one conclusion you will reach: *the PD-100 stands squarely with the finest professional tape units available today.*

features: □ operates vertically or horizontally □ 3 speeds: 7½, 3¾ and 1⅞ ips □ 3 heads: 'erase', 'record', and 'playback' □ 3 motors: including Papst 'squirrel-cage' motor for capstan drive □ 6½-inch capstan flywheel □ 'record-playback' preamps with cathode-follower outputs □ transistor preamps for monitoring 'record' quality with low-impedance headphones directly from tape. □ 2 VU db-calibrated meters □ 4-digit counter with automatic zero-reset button □ 'stop-start' cueing button □ self-adjusting instantaneous 'stop' brakes □ hinged-cover giving access to tape heads with convenient splicing guide-plate built in □ automatic end-of-play and tape-break 'shut-off' □ patented 'hubloc' spindles hold reels securely when operated vertically □ function signal lights.

recording versatility: □ off-the-air tapes of FM-multiplex, mono radio or TV programs □ stereo and mono tapes from your favorite records for unlimited playback without wear to your records and stylus □ sound-on-sound □ echo, fade and mixed input effects.

and here are some hints of the quality you can expect: □ frequency response: 30 to 20,000 cycles at 7½ ips; 30 to 12,000 at 3¾; and 50 to 8,000 at 1⅞; ±3 db □ wow and flutter: less than 0.1% at 7½ ips; 0.15% at 3¾; and 0.25% at 1⅞. □ signal/noise ratio: better than 50 db □ channel separation: better than 55 db

Dimensions of the PD-100: 14¼" wide x 15⅞" deep x 7" high. Price is $399.50 (less base). At your high fidelity dealer, or write: Benjamin Electronic Sound Corp., 80 Swalm Street, Westbury, New York.

Sole U.S. Distributor for Truvox tape recorders, Miracord turntables and Elac cartridges.

BENJAMIN
TRUVOX

Suppressing Noise In Audio Systems

Practical hints for the moderately technical audiofan and novice on how to eliminate and reduce noise in high fidelity systems.

HERMAN BURSTEIN*

THE PLEASURES derived from reproduced music is greatly enhanced when the music issues from an utterly quiet background, unmarred by hiss, buzz, clicks, whooshes, whistles, snaps, pops, squeals, crackling, howling, sputtering, frying, crosstalk, and other forms of noise.[1] A surprising amount of the engineering that goes into a high fidelity component has to do with the suppression of noise.

But it isn't only the audio engineer who is involved. Preventive and remedial measures must be taken by the user and by the service technician at same time in the useful life of the component. Many remedial steps are simple enough to be taken by the user with little or no technical knowledge. This article is mainly, though not altogether, about the things you can do to supress noise.

A Tube is often the Villain

Tubes are always, and rightly, a prime suspect when noise develops. Suspicion usually focusses on the first stage of a preamplifier, power amplifier, or tape recorder—the stage where the audio signal enters. Along with the signal, noise in the first stage is passed along to and amplified by all the following stages, wherefore the first-stage tube must be the best of the lot. If you are the type of audiofan who thinks ahead, you will have in reserve two or more of the kind of tube employed in the first stage. When the need arises, you then have a choice of several tubes in striving for minimum noise. This follows the practice of a number of manufacturers, who employ "selected" tubes in order to obtain superior performance for their product.

Of course a tube beyond the first stage may be producing noise. Assuming you have a full stock of replacement tubes, the logical course is to replace tubes one at a time, working from the first stage to the last if you can identify their sequence. For some types of noise, you can identify the offending tube by tapping each one lightly with the rubber end of a pencil. If the offender is indeed a tube, it isn't always in the component that appears to be giving trouble. Witness this case history:

> A preamplifier was intermittently squealing, sputtering, and spitting. When the preamp was taken out of the audio system and the tuner was connected directly to the power amplifier, the symptoms disappeared. Seemingly the preamp was at fault. But replacement of every tube in the preamp did not help. On a hunch, tubes in the power amplifier were replaced. When one of the output tubes was reached, the preamp noise disappeared. What happened? The preamp heater was supplied d.c. by the power amplifier. The defective output tube had an intermittent near-short, not profound enough to produce noise directly in the power amplifier. But the near-short did cause sudden, slight, brief changes in the power drawn by the output tube, and these changes were transmitted via the common power supply to the preamp. To draw a parallel, think how your AM radio produces a click when you switch a light; they are both on the same power line, and the sudden current surge when the light goes on or off is reflected in the radio.

Volume Controls, Switches and Other Components

Volume controls can become nasty noise-makers. As the control wears with use, electrical contact between its elements grows imperfect, and noise is the consequence as you turn the control. Electrical contact may be so tenuous that intermittent noises occur even when the control is let alone. The same may happen with the bass, treble, and other controls, particularly if frequently used. Switches too. Special cleaning fluids that not only dissolve dirt and film but also promote electrical contact are available at audio stores and electronic supply houses, and one of these sprayed or inserted by eye-dropper into the control or switch may restore it to satisfactory operation for weeks or months. It will usually be necessary to remove a top or bottom cover from the component in question in order to get at the noisy part.

Eventually it becomes necessary to replace the part, and you have to decide whether you or a serviceman is going to do it. Generally it isn't very difficult to replace a volume control, especially if you have had a kit-building experience and therefore are adept with a soldering iron. But a switch usually presents a more complex task because of its intricate wiring. Also, the swtich is apt to be of special design obtainable only from the component manufacturer. If you attempt the replacement, before anything else be sure to draw a diagram of all leads, resistors, capacitors, and other parts connected to the item being replaced.

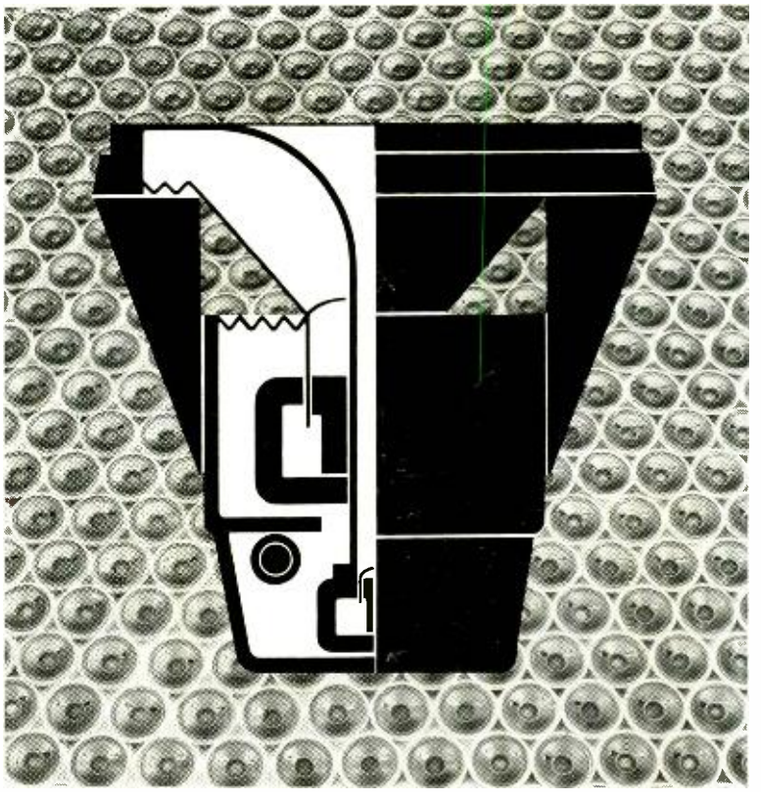
High-quality components employ special low-noise resistors in the first stage and sometimes in the second stage as well. Unfortunately, these resistors cost something like 10 to 20 times as much as the garden variety. Also unfortunately, a low-noise resistor sometimes changes its habits. The only way to test for a bad resistor is through substitution, which can be rather an expensive proposition—apart from the work involved—because truly quiet resistors cost between $1.50 and $3.00 apiece. Therefore, if you have reason to suspect that a resistor has gone bad (tubes having previously been checked out), your best bet may well be to turn the problem over to a serviceman.

On the other hand, if you are determined to have a go at reducing noise by replacing resistors yourself, and if you know your way around circuits a bit, devote your attention to the load resistors connected to the plate and cathode of the tube. Sometimes you can get satisfactory quieting from a garden variety resistor that has an excess wattage rating; for example, a 2-watt resistor in place of a conventional ½-watt one.

In your search for the cause of noise, keep an eye out for insecure connections. Loose-fitting shielded cables are one item. When leads are attached to screw

* *280 Twin Lane E., Wantagh, N. Y.*

[1] Noise of course also includes hum, but this is a large and separate subject in itself.



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Pioneer produces loudspeakers of every size, ranging from tiny 1½″ models to gigantic 32″ models. It has the largest production capacity in the world — 1,200,000 units per month. Uniformly outstanding in performance, and sturdy and reliable in durability, these speakers are also used by well over a 100 top manufacturers of electronic appliances around the world, including such world-famous names as Hitachi, Toshiba, or Sony.

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terminals, as in the case of th
tenna and the speaker, check
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more efficient the speaker,
loudly will it reproduce the
noise. As a rule, high-power
are best used with relatively inefficient speakers, while low- or medium-power amplifiers are meant for relatively efficient speakers. If you use a high-power amplifier with an efficient speaker, you risk unnecessary noise, unnecessary because you won't be using more than a fraction of the power which the amplifier can deliver, yet you will reproduce its noise to the full.

If the power amplifier is capable of much more volume than you need, and amplifier noise is therefore apparent, a solution is to connect your speaker to an impedance tap on the amplifier that is lower in value than the rated impedance of the speaker. For example, you might connect a 16-ohm speaker to the 8-ohm tap or even the 4-ohm one. An alternate but less desirable solution is to put a resistor between one of the amplifier's output taps and the speaker; the resistor should be between one and three times the speaker impedance and should be rated at 10 watts or more. However, this resistor interferes with the ability of the amplifier to "damp" the speaker, which makes for clean, tight bass reproduction instead of blurry or boomy bass.

In similar fashion, the preamplifier

ther out, you risk appreciable noise unless your antenna is a high-gain unit specifically designed for FM.

If you install the FM antenna yourself, make certain of the exact direction of each station you wish to receive. An antenna rotor may be necessary if you wish to bring in several stations at well-separated points of the compass. It is a general rule that reception improves as you increase the height of the antenna. However, this rule too has its exceptions, and it is sometimes found that, within a range of several feet, a lower location gives better results than a higher one.

The natural elements are against the antenna. Wind may loosen its members, resulting in signal loss and consequent noise in the tuner. Signal loss results from ice formation, rust on the antenna, rust at the connection to the lead-in wire, and rain. Obviously, some of these things cannot be helped, while others definitely can.

The lead-in wire, which connects the antenna to the tuner, is almost as important as the antenna. It should be as short as practicable, because every foot cuts down the signal and increases the danger of noise. Excess length should be cut off; in any case it should not be

barely hanging on to life. In a third, intermittent buzzing in the FM tuner was traced to a faulty pilot lamp in the tuner.

Accurate alignment of the FM tuner is vital for noise-free reception of distant stations (and for minimum distortion as well). This is strictly a matter for the service technician, and only a highly qualified one at that. The technician who lacks the proper equipment and experience or who attempts to align by ear can do your tuner more harm than good. If necessary, write to the manufacturer of your tuner for a recommend service agency in your locality. On the other hand, some inexpensive tuners are not susceptible to good alignment, no matter how much effort is expended on them.

If the antenna, lead-in, and tuner are all first-rate, the only deterrent to noise-free reception (distance permitting) is your failure to tune accurately to the desired station. Even though your tuner has AFC (automatic frequency control) or a wide-band detector or both, it is desirable that you tune as precisely as possible to the station, particularly if it is a distant one. Some tuners drift somewhat during the first 10 minutes or so of operation, so re-adjust the tuning after the warmup period.

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good connection
tridge and the plug-in
cartridge; clean the
from the shell, and be
shell as far as it is
the tone arm.

ng between components is not in itself a cause of noise but can be held accountable for noise attaining a higher level than it rightfully should. Take the case of a power amplifier and speaker that are mismatched in terms of the amplifier's wattage and the speaker's efficiency. The higher the wattage rating of an amplifier, the more noise it tends to produce, *everything else being equal.* (Of course, through superior design, it is possible for a high-wattage amplifier to produce even less noise than a low-wattage one, but *on the average* the high-wattage ones generate more noise than the low-wattage ones.) The more efficient the speaker, the more loudly will it reproduce the amplifier's noise. As a rule, high-power amplifiers are best used with relatively inefficient speakers, while low- or medium-power amplifiers are meant for relatively efficient speakers. If you use a high-power amplifier with an efficient speaker, you risk unnecessary noise, unnecessary because you won't be using more than a fraction of the power which the amplifier can deliver, yet you will reproduce its noise to the full.

If the power amplifier is capable of much more volume than you need, and amplifier noise is therefore apparent, a solution is to connect your speaker to an impedance tap on the amplifier that is lower in value than the rated impedance of the speaker. For example, you might connect a 16-ohm speaker to the 8-ohm tap or even the 4-ohm one. An alternate but less desirable solution is to put a resistor between one of the amplifier's output taps and the speaker; the resistor should be between one and three times the speaker impedance and should be rated at 10 watts or more. However, this resistor interferes with the ability of the amplifier to "damp" the speaker, which makes for clean, tight bass reproduction instead of blurry or boomy bass.

In similar fashion, the preamplifier may deliver too much audio signal and at the same time too much noise signal to the power amplifier. The greater the gain of the preamp, the more noise it is apt to produce. Many power amplifiers contain an input-level set that enables you to reduce the signal and noise received from the preamp. This should be used judiciously. If you turn it very far down in order to reduce noise generated by the preamp, you may require the preamp to work extra hard in order to produce enough audio signal to drive the power amplifier, resulting in appreciable distortion. As a rule, the preamp is not working too hard if you obtain moderately loud volume at about 1 o'clock or 2 o'clock setting of the preamp gain control. If you get substantial volume much before 1 o'clock, and if the power amplifier does not have an input-level set to reduce the signal, a technician can install one for you.

FM Noise

A variety of noise problems are indigenous to the FM tuner. First of all there's the problem of adequate reception which means a good antenna in fringe and sub-fringe areas, especially for noise-free reception of multiplex (stereo) programs, where the signal-to-noise is inherently worse than on mono. For stations less than 15 miles away, a good tuner generally permits you to get away with the minimum in the way of an antenna. Up to something like 25 or 30 miles, you need something better but not the ultimate. When you reach much farther out, you risk appreciable noise unless your antenna is a high-gain unit specifically designed for FM.

If you install the FM antenna yourself, make certain of the exact direction of each station you wish to receive. An antenna rotor may be necessary if you wish to bring in several stations at well-separated points of the compass. It is a general rule that reception improves as you increase the height of the antenna. However, this rule too has its exceptions, and it is sometimes found that, within a range of several feet, a lower location gives better results than a higher one.

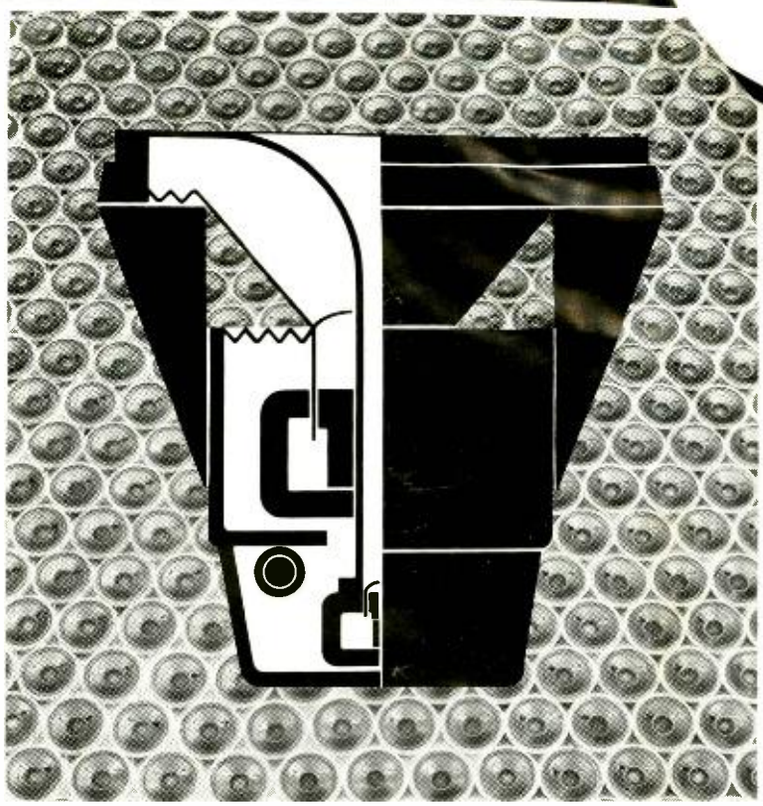
The natural elements are against the antenna. Wind may loosen its members, resulting in signal loss and consequent noise in the tuner. Signal loss results from ice formation, rust on the antenna, rust at the connection to the lead-in wire, and rain. Obviously, some of these things cannot be helped, while others definitely can.

The lead-in wire, which connects the antenna to the tuner, is almost as important as the antenna. It should be as short as practicable, because every foot cuts down the signal and increases the danger of noise. Excess length should be cut off; in any case it should not be formed into the shape of a coil. The lead-in should be kept away from metal bodies such as rain-gutters, and sharp turns should be avoided. Last and far from least, the lead-in should be suitable for FM use; usually, TV flat ribbon is correct. More than one complaint of noisy FM reception has been traced to use of lamp cord or other unsuitable wire as an antenna lead-in. Sometimes an invisible break in the lead-in impairs FM reception. This can be checked by disconnecting the lead-in from the tuner, shorting out the end that is connected to the antenna, and checking for continuity with an ohmmeter. A continuity checker can be fashioned with a little ingenuity from a flashlight battery, a bulb, and two lengths of copper wire, so arranged that the bulb lights when there is a continuous electrical path.

Passing vehicles may produce ignition noise. The answer to this problem is a good antenna mounted as high and far away from the traffic as feasible. But the lead-in may be acting as an antenna and picking up the interference. Then the lead-in should be shielded cable of a type suitable for this purpose. Refrigerators, oil burners, and other electrical devices may produce clicks and pops as they go on or off, or frying and buzzing sounds as their motors run. This requires an electrical filter across the power line, mounted at the source of the difficulty (by a qualified electrician). A little sleuthwork is sometimes necessary to locate the offender. For example, in one instance the culprit was a defective light switch. In another, it was a light bulb barely hanging on to life. In a third, intermittent buzzing in the FM tuner was traced to a faulty pilot lamp in the tuner.

Accurate alignment of the FM tuner is vital for noise-free reception of distant stations (and for minimum distortion as well). This is strictly a matter for the service technician, and only a highly qualified one at that. The technician who lacks the proper equipment and experience or who attempts to align by ear can do your tuner more harm than good. If necessary, write to the manufacturer of your tuner for a recommend service agency in your locality. On the other hand, some inexpensive tuners are not susceptible to good alignment, no matter how much effort is expended on them.

If the antenna, lead-in, and tuner are all first-rate, the only deterrent to noise-free reception (distance permitting) is your failure to tune accurately to the desired station. Even though your tuner has AFC (automatic frequency control) or a wide-band detector or both, it is desirable that you tune as precisely as possible to the station, particularly if it is a distant one. Some tuners drift somewhat during the first 10 minutes or so of operation, so re-adjust the tuning after the warmup period.



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Phono Noise

In the case of the phonograph, the principal indigenous cause of noise is apt to consist of the grit, dust, and electrical charges in the record groove. A variety of special preparations and products are available to remove these noisemakers. Some are in the form of liquids applied to the disc before playing (be sure to allow sufficient time for the disc to dry). Others are in the nature of special brushes or devices affixed to the tone arm or turntable base.

You have probably heard of individuals picking up radio stations through the metal fillings in their teeth. By a comparable process a radio station occasionally is picked up by a phono amplifier; such interference is rightly classified as noise. The cure is usually quite simple: a resistor of about 5000 to 10,000 ohms is connected between the phono input jack and the grid of the tube in the first stage of the preamp. Again, here is a situation where the individual with kit-building experience can probably handle the problem himself. Else the service technician should be able to take care of the problem in a jiffy.

When the phono system is operated at a loud level, acoustic feedback may cause a howling or roaring sound. Soundwaves produced by the speaker may cause mechanical vibration somewhere in the audio system—a tube element or part of the phono mechanism, such as the tone arm or stylus. The vibration is electronically amplified by the audio system, issues from the speaker in the form of soundwaves, which cause increased vibration, and so forth, culminating in an unnerving sound and one which is possibly destructive to the speaker. The cure may be to put greater distance between the speaker and the rest of the system, perhaps requiring the speaker to be removed from a cabinet shared with other components. If the phonograph is already in a separate cabinet, closing the cabinet door partway or completely during operation may be all that is needed to achieve the necessary acoustic separation. Mounting the phonograph base, or possibly the speaker, on a pad of foam rubber may help. Since acoustic feedback may be originating in the first (phono) stage of the preamplifier, try one or two substitute tubes here.

For proper treble response, a magnetic cartridge must be loaded with a resistor of suitable value. This value differs from one cartridge to another. Too high a value will result in a treble peak, accentuating record noise. Accordingly, it is necessary for you to ascertain whether your preamplifier provides the correct load resistance for the cartridge you happen to be using. Your audio dealer, or else the manufacturers of the components in question, can give you this information. If the value is wrong a technician can alter the load resistance in very short time.

Sometimes noise may be due to a physical malfunction that prevents the turntable from spinning truly. To illustrate:

> An audiofan complained that many of his records sounded as though scratched because once a revolution there would be the kind of familiar click attributed to a scratched disc. Also, the stylus sometimes skipped grooves. It was discovered that a small spot of gummy dirt had formed on the inside rim of the turntable, driven by a rubber idler wheel. When the wheel hit the dirt spot, once a revolution of the turntable, speed changed briefly and sharply, causing the effects described.

The Tape Recorder

The list of problems native to a particular component is especially long and varied in the case of the tape recorder. Tape heads gradually become magnetized with use, producing noise in playback and also causing noise to be recorded on the tape. Therefore it is important to demagnetize the heads periodically, say about every 8 hours. Head demagnetizers are inexpensive enough. Tape guides and other metal parts of the machine contacted by the tape should also be demagnetized.

The tape oscillator is one of the principal causes of noise, due to distortion in the waveform of the bias current supplied to the record head. You can check whether a distorted waveform is causing substantial noise as follows: Put several feet of virgin or bulk-erased tape through the recording process but with no signal input and with the recording gain control all the way down. Play back the tape. If the "recorded" portion of the tape is much noisier than the unrecorded portion, the fault is likely poor oscillator waveform. Try replacing the oscillator tube. If this doesn't help, turn the problem over to a qualified service technician.

Incomplete erasure of a previous recording is a form of noise. The fault may be yours because your previous recording was made at too high a level, so that even a normally efficient erase head cannot cope with the task. Or the erase head may be responsible in one of several ways: 1. The head may be defective; 2. oscillator current supplied to the head may be insufficient; 3. the oscillator frequency may be too high for the head to operate efficiently; 4. the erase head may be misaligned with respect to the record head, so that the gaps of the two heads don't span the same portion of the tape. If the sound remaining after "erasure" contains the full audio range, the trouble is probably due to poor alignment between gaps. By following the instructions in your service manual, you may be able to position the erase head satisfactorily. But if the remanant noise consists mainly of low frequencies, which are the hardest to erase due to their deep penetration of the tape, the cause is probably one of the others listed above and you need a service technician.

Print-through—the transfer of loud sounds from one layer of tape to adjacent layers—also comes within the category of noise. This may be due to the fact that you are recording at too high a level. It may also be due to the use of tape with an excessively thin backing.

If the tape head is positioned too high or too low, this may result in crosstalk because the signal intended for one track may overlap onto the adjacent track. Moving the head up or down is ordinarily a simple mechanical matter, but consult the service manual for your tape machine so that you may know how to determine the correct position. After the head is moved, it is necessary to adjust its azimuth alignment, that is, make sure the gap is exactly perpendicular to the long dimension of the tape. This requires a test tape.

As the tape moves past the heads a squeal may result if the tape is too dry and/or the pressure pads (usually employed in home machines) too rough. Squeal can become recorded on the tape, spoiling a valued recording. High quality tapes made by reputable firms are one answer to this problem; such tapes incorporate suitable lubricants to facilitate smooth passage of the tape. Second, you can apply a lubricant, specially made for the purpose and available at audio stores, to the heads, pressure pads, and guides, but *not* to the capstan and pressure roller. Third, you can replace the pressure pads if they appear to have lost their softness and smoothness. Moisture can be restored to a dry tape by storing it for about a day in a closed box containing a moist sponge.

While over-recording can be a cause of noise, as we have already pointed out (by making it difficult to achieve complete erasure and by increasing the susceptibility to print-through), under-recording can also be responsible for noise. It is a narrow path that the recordist must follow. Ideally, one should record at a level just low enough to avoid perceptible distortion but high enough to maintain a good signal-to-noise ratio. If you record much below the level which is permissible from the distortion viewpoint, tape hiss plus the noise produced by the playback amplifier will be unduly high compared with the recorded signal. No home tape recorder, or professional machine for that matter, has decibels to spare so far as noise is concerned. On

(*Continued on page 68*)

Quality – Economy – Dependability

QUALITY WITH POWER

FM-3 Dynatuner with automatic multiplex facility and Stereocator. Low distortion and high sensitivity. Can be completely aligned without special test equipment.

PAS-3 Famous PAS-2 preamplifier with new styling. Outperforms preamplifiers of many times higher price.

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You can pay more, but you can't buy better performance.

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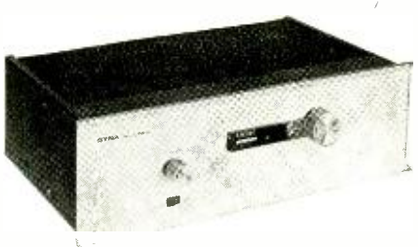

FM-3 Combination of famous FM-1 tuner and FMX-3 multiplex integrator with new decorator styling. Its deceptively simple appearance masks the fact that this unit approaches the theoretical limits for high sensitivity and low distortion. Logical simplicity of control through full automation of stereo-mono switching and uniquely simplified tuning. Exclusive Stereomatic circuit locks in and signals stereo automatically and silently. FM listening was never so enjoyable; never before so simple.

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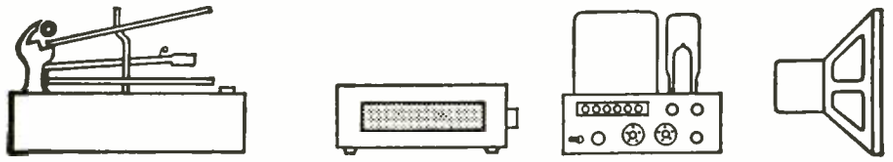


DYNAKIT STEREO 35 BASIC POWER AMPLIFIER

In spite of the hi-fi equivalent of the horsepower race attributed to the automotive industry, there are many applications where an amplifier of relatively low power becomes desirable—or even imperative. The wattage race may well be warranted, particularly when loudspeakers of low efficiency are employed, but—again comparing with the ubiquitous automobile—one doesn't need 325 horsepower to bring an armload of groceries home from the supermarket. We admit to using over a hundred watts in our living room—or at least having it available (its *use* is frowned upon in our apartment house)—but such a choice is the result of finding top quality only in the higher-powered amplifiers, at least up to now. Furthermore, in most instances, it is common for the smaller amplifiers to be complete, integrated units and not separate "basic" power amplfiers.

We have even used another dual-50 in our study-lab-workshop-office—a 11 x 13 room. The availability of a good *small* power amplifier interested us immensely.

The new Dynakit Stereo 35 is, physically, quite small, measuring 13 in. wide, 5½ in. deep, and only 4 in. high. Most of its 16-lb. weight is in transformers, since two good-sized holes are cut out of the chassis to accommodate the printed-circuit amplifier boards, each of which employs only three tubes—a 7247 and two 6BQ5's. The circuit is similar to the early Dynaco amplifiers, with a voltage amplifier direct coupled to a cathodyne phase splitter which drives the two output tubes. The 7247 is a dual triode with dissimilar sections—one being essentially half of a 12AX7 and the other essentially half of a 12AU7. The high-mu section serves as the voltage amplifier, while the low-mu section is the phase spitter. The output stage is, naturally, Ultra Linear, and output impedances of 8 and 16 ohms are provided. The plate supply derives from a simple full-wave rectifier using silicon diodes and more-than-adequate filtering. Separate heater windings are provided for the two amplifier sections, and the heaters are biased positively by some 13.5 volts, which is the operating bias on the output tubes and is obtained by a cathode resistor common to all four tubes.

Construction

Putting this kit together is a simple matter of perhaps five hours maximum. The two amplifier printed circuits are complete except for mounting the sockets for the output tubes, installing in the chassis, connecting heater leads to the output tube sockets along with the leads to the ontput transformers, and running wires to eleven solder-filled eyelets. Five other leads run between cathode terminals of the output tube sockets, between the heater terminals, and from one cathode terminal of each amplifier board to the common resistor and capacitor for bias. The remainder of the assembly is equally simple. This amplifier is an excellent example of how printed-circuit wiring can make over-all assembly a lead-pipe cinch.

Performance

In this area, the Stereo 35 does everything promised by the specifications. Frequency response is flat within ± 1 db from 8 cps to 47,000, IM distortion is 0.9 per cent at rated output (17.5 watts per channel) with both channels operating, harmonic distortion measured 0.75 per cent at the same output, and hum and noise was measured at 84 db below rated output. With each channel operating separately, output was 19.5 watts at the same distortion figures. Music power output, measured as specified by IHF standards, was 47 watts total for two channels. Remaining data of interest are: input signal for rated output, 1 volt; feedback, 20 db; damping factor, 10; channel separation (determined by feeding one volt at 1000 cps into channel 1 and measuring output from channel 2), 79 db. Square-wave response showed a very slight amount of ringing at 10,000 cps, none at 1000, and flat-top response at 50 cps, all of which is as expected, considering the remainder of the measurements.

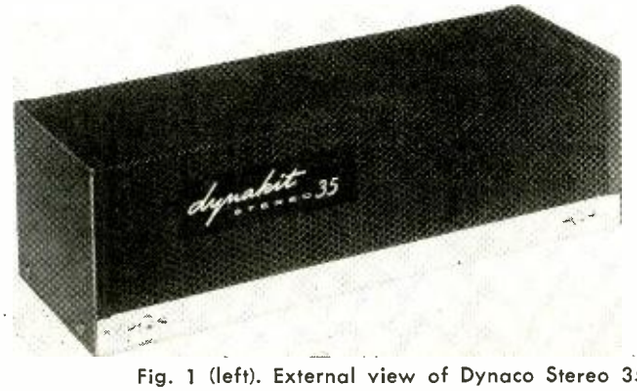
On the whole, the Stereo 35 is an exceptionally fine medium-powered amplifier which makes it possible for one to assemble a system suitable for many installations yet with all the flexibility usually available only with much more powerful systems—and by flexibility we mean making it possible to use a separate preamplifier-control unit. Within its power limitations, it is an ideal unit.

L-19

FREEMAN 660 PORTABLE TAPE RECORDER

There are many applications where the usual type of a.c. operated tape recorder just does not fill the bill—a news radio reporter cannot very well go about his rounds dragging a 500-ft. extension cord, for example. Aside from a few very expensive portable recorders, most of the other battery-operated models on the market are essentially in the "toy" class. When we first read the advertisements of the Freeman (formerly known as Citroen) 660, we felt that this was one machine which would serve the newscaster with a limited budget and at a minimum of bulk, and still provide him with field-recorded tapes which could be played immediately on studio-type equipment at a 7½-ips speed without prior dubbing. And while the large radio stations and network operations can readily afford field recorders costing as much as the top-quality home machines, the public-spirited but small station often cannot. Hence our first interest in the Freeman 660.

Our second exposure to the machine gave us still another cause for interest—playing its 7½-ips demonstration tape, the little machine seemed to be completely oblivious of whether it was right side up, upside down, on one end or the other, or even being shaken violently. And that's more than can be said about practically *any* other tape recorder. With these two points of interest, we arranged to play with one for a short while to see how good it really was.



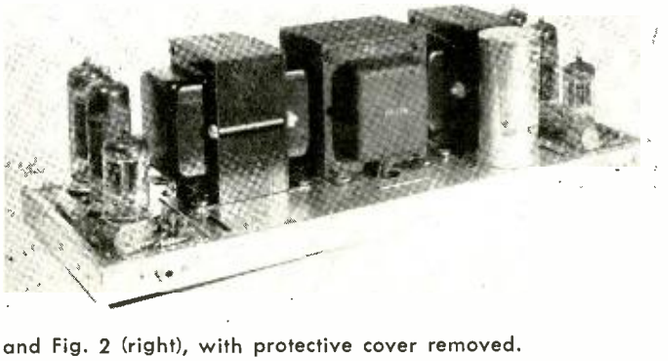


Fig. 1 (left). External view of Dynaco Stereo 35, and Fig. 2 (right), with protective cover removed.

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The JBL Energizer/Transducer raises audio reproduction to a degree of perfection and precision never before available to the home listener. You hear music re-created in all its detail, rich and splendid, life size, without hum or distortion. The Energizer/Transducer sets new standards for fully controlled bass, completely realistic mid-range, immaculate highs, and transient reproduction without equal.

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The JBL Energizer is a stereophonic all-solid-state device of scientific-instrument quality. Devoid of microphonics, generating negligible heat, it can be mounted within an acoustical enclosure. All JBL loudspeaker systems are available as Energizer/Transducers. The JBL loudspeaker system you now own can be made into an Energizer/Transducer. When ordering your matched Energizer, you need only provide your Audio Specialist with the complete model number of your system. Write for your free copy of the new Energizer/Transducer six-page brochure.

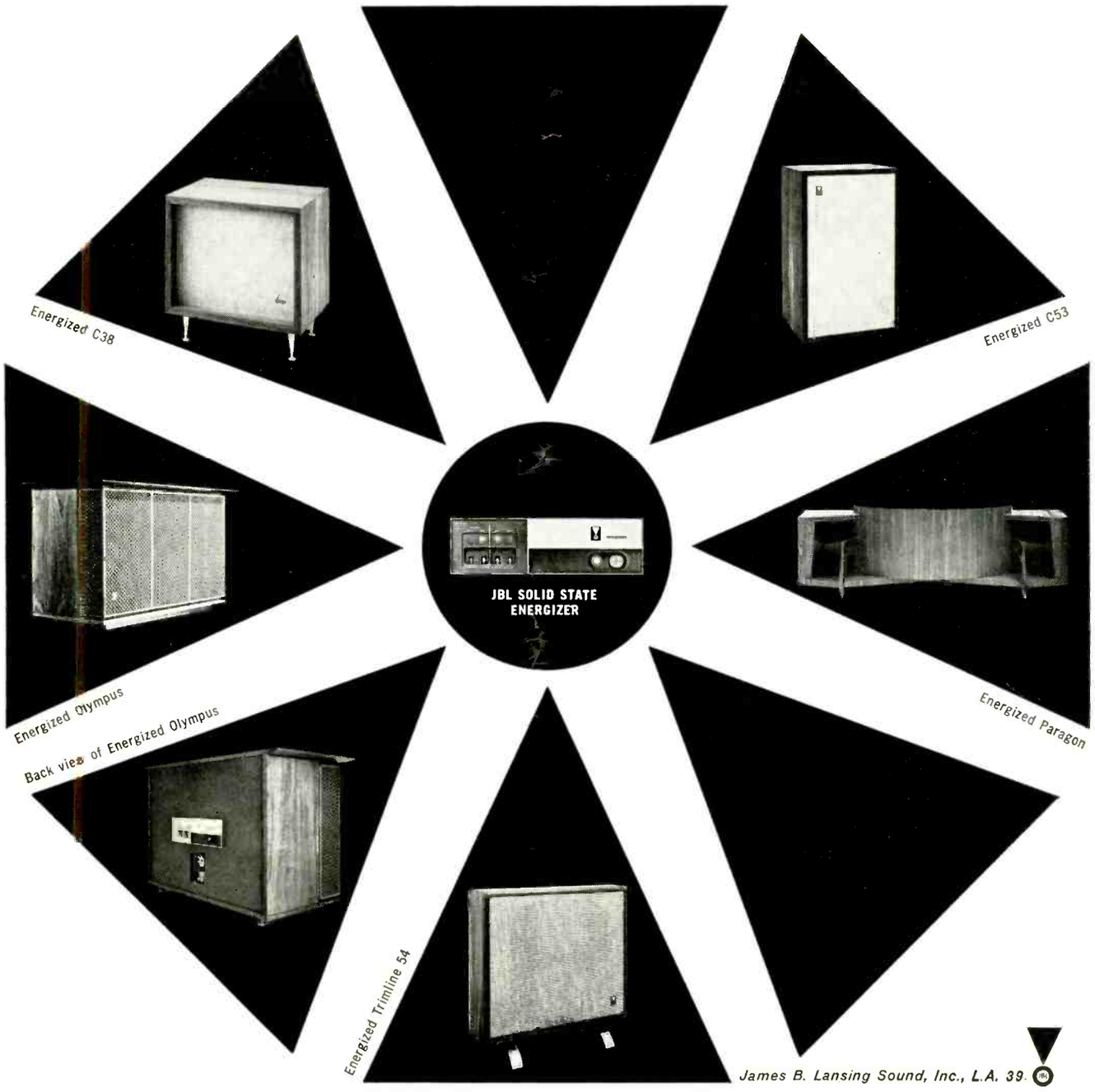


Fig. 3. The Freeman 660 portable recorder.

Description

The Freeman 660 is built in an aluminum case 7½-in. wide, 7¼-in. deep, and just under 3 in. high and it weighs 6 lbs. It accepts 3¼-in. reels, and runs at 7½ or 3¾-ips, with lower speed being made available by removing a sleeve from the capstan. A fairly simple internal change permits the machine to be used at 3¾ and 1⅞ ips, although the change is not one which should be done by the user, nor is it recommended that one should count on changing back and forth between the two pairs of speeds whenever desired. Recording is monophonic, half-track. Using the new Scotch 290 tape —especially ideal because of the extreme flexibility of the ½-mil Mylar base—the 3¼-in. reels will take 600 ft., giving a running time of 15 minutes without stopping at 7½-ips, or 30 minutes at 3¾-ips. The 15 minutes is usually adequate for field reporting work, since news clips rarely take more than a minute each.

The circuit employs 7 transistors—five in the amplifier and two in the bias oscillator, although the schematic furnished with the machine does not show the bias oscillator nor is the use of a.c. bias mentioned in any of the literature. Probably in the interest of battery economy, a.c. is used only for bias—erase is by d.c., as in most other medium-priced machines, although most of them also use d.c. for bias. In the machine tested, the bias frequency was measured at approximately 29 kc. Two small speakers are built into the case, and a meter indicates battery voltage when the control knob is in rewind or play positions, and serves as a volume indicator for recording. Six penlite-size cells are used, carried in a metal battery case, thus making it possible to carry a spare battery case for immediate replacement. Flashlight-type penlite cells are not recommended because of their short life, but the alkaline-energizer types will operate the machine for about 50 hours continuous, and mercury cells will last about 8 to 10 hours. Rechargeable nickel cadmium batteries may also be used. External jacks are provided for earphone output, microphone and radio inputs, remote control, and for an external d.c. supply from either an a.c. adapter or from a cord which plugs into the lighter socket on an automobile. The dynamic microphone furnished with the machine is fitted with an on-off switch, and the cord terminates in a double plug—one side of which plugs into the microphone jack and the other into the remote control jack (the latter is a subminiature so there can be no mistake). The carrying case has a compartment to carry microphone, earphone, cables, telephone pickup, and so on, and a spare battery case or two. The entire package is well and solidly built, with the recorder itself finished in chrome and fine black crackle.

For broadcast purposes, the response is exceptionally good when measured from a recorded signal played back on a professional playback machine, as it would be in a radio station. Frequency response measured within ±4 db from 100 to 7500 cps at 7½ ips, although there was usable response up to 15,000 cps at the top end, and down to 50 cps at the bottom. Wow and flutter measured 0.22 per cent.

Aside from its most obvious application for news-type recording, the over-all quality is such that it can record and reproduce music so that it might find application where a larger or less portable machine could not be used. In-the-field recording of such obvious material as folk or native music comes to mind, of course, as well as for entertainment at points distant from a.c. supply. On the whole, the Freeman 660 is certain to find many applications where its versatility makes it possible to use a recorder under conditions where most other machines would be impossible to use.

For use with a top-quality microphone, note the information in the description of the Sennheiser MKH-104 microphone in the October issue wherein the battery supply to the Freeman can also power the high-frequency polarization for this particular type of broadcast condenser microphone. L-20

LAFAYETTE 200-WATT TRANSISTOR STEREO POWER AMPLIFIER, MODEL LA-280

The Lafayette Model LA-280 was introduced to AUDIO readers exactly one year ago in an article by Richard S. Burwen, the designer of this unit. In that article it was pointed out that this amplifier is rather unusual in several respects aside from being all solid state. First of all it could deliver 100-watts (music power) per channel although it weighed in at a mere 35 pounds. Second, its distortion was far below any available commercial amplifier, tube or transistor. Third, its output circuit was unbalanced, thus making the second feature even more unusual. Unlike other available transistor amplifiers, the output stage utilizes germanium transistors, four for each channel. Thus, this amplifier is certainly not the usual entry in the amplifier marketplace.

The LA-280 provides input facilities for both low- and high-level inputs (0.2 and 1.5 volts), the former in anticipation of low-output transistor preamps. It also provides output facilities for 4, 8, or 16-ohm speakers, electrostatic speakers, and stereo headphones. In addition there is a d.c. power take-off socket (also in anticipation of a preamp) and two a.c. convenience outlets (one is switched). There is an input level control for each channel.

One of the pleasant surprises of the LA-280 is its relatively light weight (at least half the weight of an equivalent tube amplifier) and modest dimensions—14¾ × 8 × 9⅛. On the other hand its price of close to $300 places it in a rare category—there aren't many amplifiers that can compete with it in price. We are not quite sure whether that is a worthwhile distinction or not.

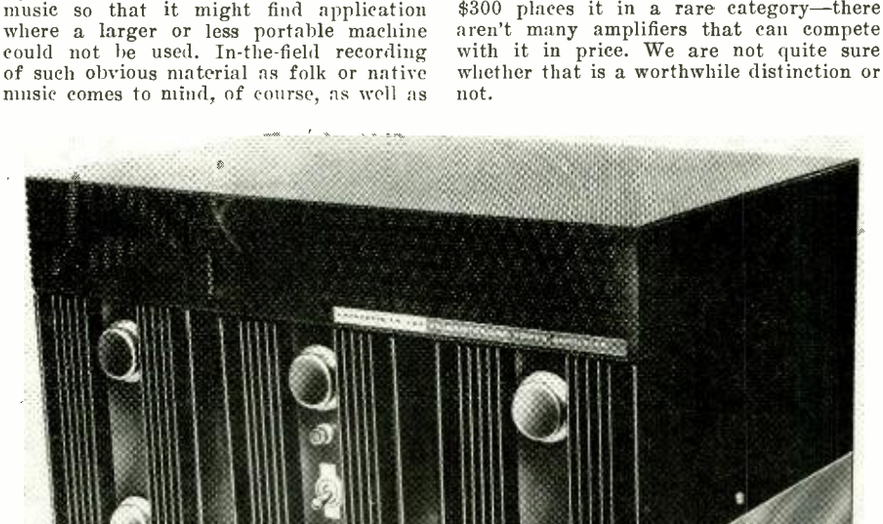


Fig. 4. Lafayette 200-watt Transistor Stereo Power Amplifier, Model LA-280.

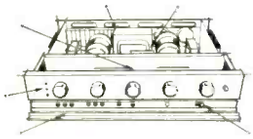
SOLID-STATE STEREO

BY HEATHKIT

NEW! Low-Cost All-Transistor, All Mode Stereo Tuner and Matching 40-Watt Stereo Amplifier

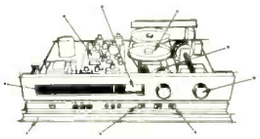
Cooler, faster operation . . . lower power consumption . . . longer life . . . and the clean, quick realism of "transistor sound." You'll enjoy all this and more with Heathkit's newest All-Transistor Stereo "Twins." Compact, low-silhouette styling magnificently fashioned in rich walnut cabinets neatly fits this handsome pair into a "proud place" in any hi-fi stereo system. Add to this extruded brushed gold-anodized aluminum front panels that serve practically to conceal secondary controls and decoratively to enhance over-all beauty. The AA-22 Amplifier provides 40 watts of continuous power at ±1 db from 15 to 30,000 cps with no fading, no faltering . . . just pure solid sound! The AJ-33 Tuner offers selection of AM, FM, or FM Stereo to please any listening preference. Check both unit's features and discover why Heathkit leads in Transistor Stereo. The price? A great value, you'll agree . . . $99.95 each!

AA-22 40-watt Transistor Stereo Amplifier, 14 lbs. $10 mo. **$99.95**



• 40 watts of power (20 per channel) • 5 stereo inputs • Speaker phase switch • Miniature indicator light for each position on mode switch • Transformerless output circuits • Brushed gold-anodized aluminum front panel conceals secondary controls • Walnut cabinetry

AJ-33 Transistor AM-FM-FM Stereo Tuner, 14 lbs. $10 mo. **$99.95**



• Stereo phase control • Automatic stereo indicator • AFC and AGC • Filtered stereo tape recorder outputs • Built-in stereo demodulator • Tuning meter • Flywheel tuning • Slide-rule dial • Prealigned FM tuner and circuit board construction • Brushed gold-anodized aluminum front panel conceals secondary controls • Walnut cabinet

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Circuit Description

As we noted, the circuit is described fully by Richard Burwen in the November, 1962, issue of AUDIO. We do not intend to waste your time by repeating his description. On the other hand you should be aware of some of the unusual features of this circuit.

We did mention that the output stage was unbalanced. By this we mean that the waveform of the output is not symmetrical. Normally this is thought of as distortion, and it would be in this case were it not for the large amount of feedback (some 70 db). Unquestionably, the effort to eliminate distortion has been quite successful judging by the results.

Another unusual feature of the circuit is the special provisions for handling a capacitive load such as an electrostatic speaker. In fact, with the special circuit provided, the amplifier seems to "like" a capacitive load—it acts better. This characteristic is a rarity for any amplifier (most will barely tolerate a capacitive load) but especially with transistor amplifiers.

The gain of the LA-280 is unusually high, 40, which is evidenced by the relatively low-level signal (0.2 volts) required to drive it to full output.

Performance

The Lafayette LA-280 is a remarkably good performer both as to measurements and listening. For example, harmonic distortion at rated output into an 8-ohm load, and at frequencies up to 10,000 cps, was so low that the only reading we could get was the residual distortion in our meter. At 20,000 cps the distortion rose to 0.25 per cent. Intermodulation distortion (60 and 7000 cps, 4:1) was just a hair over 0.3 per cent into an 8-ohm load. Frequency response was within 0.1 db from 20–20,000 cps and only 2.7 db down at 100,000 cps (at half power into 8-ohm load).

The power output must be clarified somewhat. It so happens, in most transistor amplifiers, that the load effects the output considerably. Thus we achieve 100-watts (music power) per channel into 4 ohms, 56 watts into 8 ohms, and only 33 watts into 16 ohms. Similarly, the rms output is 80 watts into 4 ohms, 49 watts into 8 ohms, and 26 watts into 16 ohms. Channel separation is 69 db at 1000 cps.

One of the greatest problems we experienced while testing this amplifier was the short duty cycle permitted. In the instruction book it states: "The amplifier will deliver rated sine-wave power (15 to 10,000 cps) for 30 seconds on, 3 minutes off. For frequencies above 10,000 cps, however, full power testing should be limited to 8 seconds." One wonders what would happen with a sustained high-frequency note.

The LA-280 is prone to the same problems that most transistor amps are heir to; it doesn't like to have its speaker terminals shorted and it requires ventilation. If either of these problems is ignored it may end up being a rather expensive oversight; very likely the entire set of output transistors will be destroyed.

In listening tests, the LA-280 performed as well as any amplifier we have had occasion to test and that is saying much—on low frequencies and transients it was just superb. A truly satisfying listening experience.

In sum the LA-280 is a very fine sounding amplifier which measures remarkably well. Whether the performance justifies the price is a problem which requires an individual answer from each prospective buyer. How much is fine sound worth to you? **L-21**

ANTRONICS ELECTRONIC FM ANTENNA, MODEL MA-44

If we had the choice of something to invent, that something would be small, comparatively inexpensive, and yet fill a real need. A unit which falls into this category is the Multitron, Model MA44, an FM antenna developed by Antronics, Inc. This

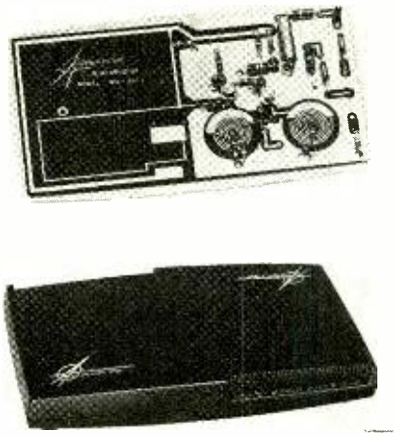

Fig. 5. Antronics Electronic Antenna, Model MA-44, open and closed views.

device should achieve wide use in installations requiring the use of an indoor FM antenna. As can be seen from the photograph of *Fig.* 5, the unit is very compact, measuring 5 by 9 by 1½ inches.

Inside the case there are six printed, tuned circuits which form the antenna proper. These circuits are designed to achieve maximum sensitivity in a cardioid pickup pattern. The signal then passes through a two-transistor amplifier into a balun which connects the device to the FM receiver. The power required to operate the device is less than two watts and is obtained from the 117-volt a.c. supply. It would seem logical to plug this device into the convenience outlet of your FM tuner so that it can be automatically turned off when not in use. Complete circuit details are shown in *Fig.* 2.

Tests which were conducted with this unit demonstrated that the Multitron has a number of advantages over the dipole usually found in indoor installations.

(*Continued on page 73*)

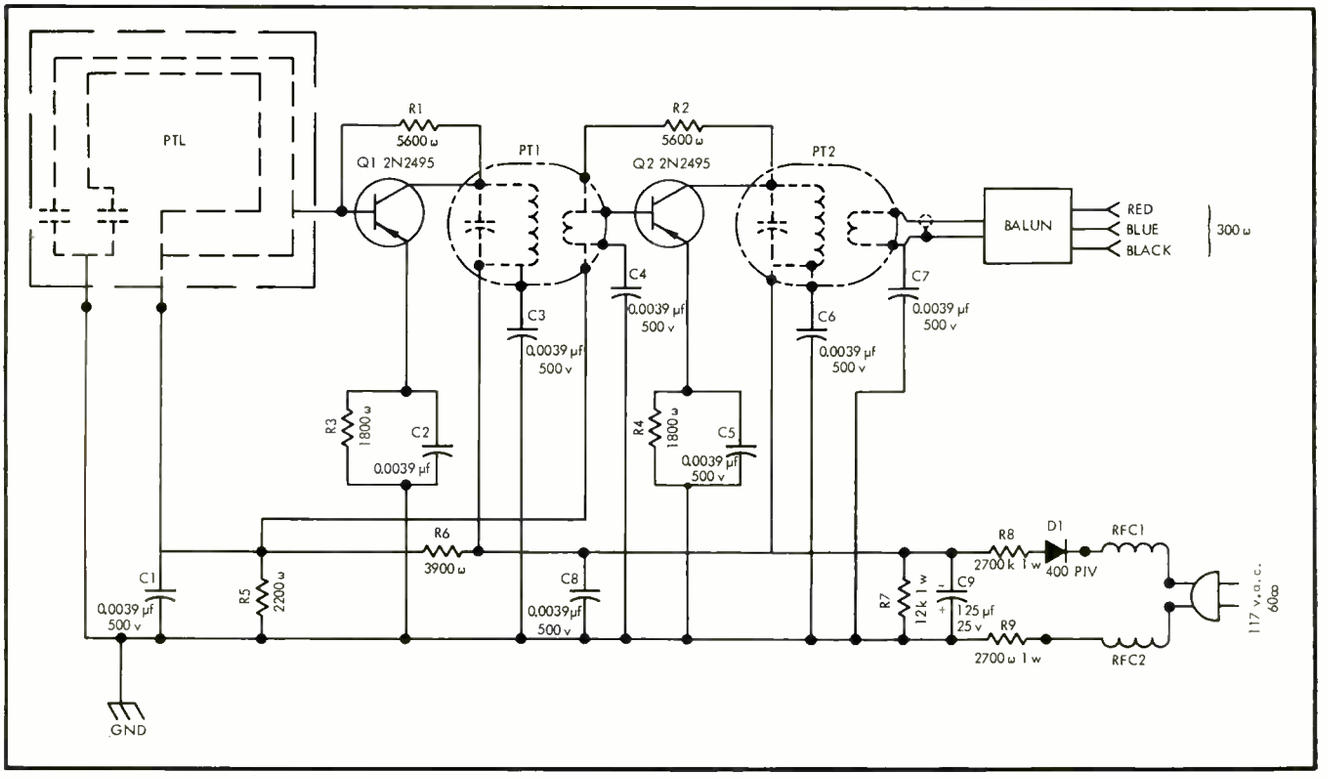

Fig. 6. Schematic of Antronics MA-44.

from

SERVICE...WITH A SMILE?

by IVAN BERGER

in the May, 1963 **HiFi/Stereo review**

HIGH-FIDELITY servicing is a headache for everyone—for the manufacturer, for the dealer, and most of all, for the consumer. Breakdowns can range from cases of subtle distortion to the smoke-billowing catastrophe, but in any of these, the repair of the component cannot be considered complete until the unit meets its original specifications. Getting such critical servicing done competently is a far bigger problem than getting a washing machine fixed—and even washer repairs are a problem these days.

There are some precautions an audiophile can take to lengthen the functional life of his system. The most important item—proper ventilation—is so simp[illegible] ause for failing[illegible]

as expensive, and even more complex."

But when components do fail, what can you do about it? If your unit fails during its warranty period —anywhere from thirty days to five years from purchase, depending on the manufacturer—your repair will be [illegible] or completely paid for by the manufacturer. (Perhaps the most generous warranty-repair service is provided by Acoustic Research, which repairs without charge any AR speaker within five years of the purchase date, and even pays shipping charges to [illegible] from the factory.) Some dealers extend or amplify the manufacturer's warranty and provide service in the dealer's own repair shop, or at his expense in a local warranty station.

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We would differ with Mr. Berger on one minor point. We don't consider our guarantee conditions "generous," but fair to all concerned. And care in manufacture keeps our repair rate very low—for some models less than one per cent.

AR speakers are $89 to $225; AR turntables are $66 and $68 (5% higher in the West and Deep South). Literature is available on request.

*If a speaker is returned and found to have no defect the owner pays freight both ways, but no other charge is made. If a returned speaker is found to be defective because of gross abuse (such as plugging into the 110V outlet), the owner is charged for both repair and freight. Of speakers returned about 4% are without defect, and 7% are judged to have been subjected to abuse.

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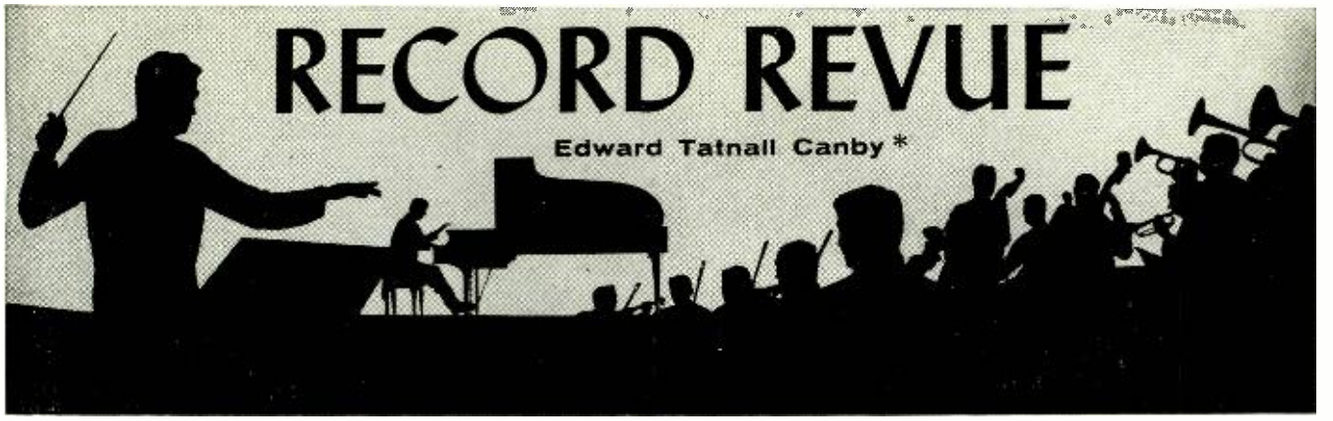

PIANISTS

Clara Haskil—Chopin: Piano Concerto No. 2, De Falla: Nights in the Gardens of Spain. Orch. des Concerts Lamoureux, Markevitch.

Philips PHS 900.034 stereo

Clara Haskil died suddenly in December Of 1960. She was, it becomes more and more apparent, the greatest woman pianist of recent times.

She was known widely for her superb Beethoven and Mozart—I have never heard her equal, as per her older Epic records released here. Now, for the first time, we have her in utterly different music. Astonishing. She's one of the most wonderful Chopin players I've ever heard—and far and away the best I know in the De Falla! Just incredible.

The lady was a wisp of a gray-haired creature, always frail in body, never a pounding virtuoso of the "big" sort. But her fingers fly like a breath of ozone, her technique is fantastic to the point of effortlessness—and her phrasing and shaping of musical lines is unearthly. For the first time, I have heard the familiar Chopin music as it ought to be and as it *must* have been played by the gentle Chopin himself, the piano notes like hovering butterflies, infinitely graceful, melodious, "weaving a magic tracery". How gross seem all the other famous performances, on all the other recordings of this over-played piece!

And the DeFalla, ordinarily a dreamy and rather over-written piece of impressionism, becomes under her fingers, and with Markevitch's lively aid, a positively glowing expression of the Spanish spirit, intensely interesting at every moment. What a superb blend of piano and orchestra (thank Philips, too, for that) and balanced to exact perfection.

I hereby enter a fervent request that Philips send us over more Haskil, in even more variety. I won't forget this one for a long time, even though my copy was pressed badly off-center, making Haskil sea-sick.

The Art of Guiomar Novaes. Vol. 1: Chopin. Vol. 2: Bach, Gluck, Brahms, Saint-Saëns, Beethoven, Purcell, Philipp, Pinto, Vuillement.

Vox PL 15.000, 15.010 mono

Vox has two photos of this Brazilian lady on its albums, one with frizzly hair looking about 21, the other with a low-down hair-do appearing more mature—perhaps 35. The liner notes by Harold Schonberg of the Times begin "Although Guiomar Novaes has been giving recitals for some fifty years. . . ." That tells a lot. Novaes is, so to speak, more important than her pictures make you think.

Vox's immediate motive in bringing out a retrospective issue of the Vox Novaes recordings, which have been appearing over many years, is perhaps not important: she has gone over to Decca. It always happens when an artist flies the coop. (Like RCA's Horowitz blast, after H. had departed to a Rival Camp.) Doesn't matter—indeed, we couldn't be more lucky. Novaes is not the stagey type; it takes a solid experience of her, like this, to bring out her truly great qualities. I'll admit that in the past, I don't remember enthusing violently over her individual efforts. Now, in the ensemble, she takes a big place.

Novaes is a masterful lady pianist of an older school. Typically so, in a pleasing way. She is clearly most at home—*very* at home—in the late Romantics; she moves onwards with impeccable taste into Debussy, but her "old music" is with blinders on.

"Authentic" is obviously a word that hasn't reached her yet; she purveys outlandishly dated (and beautifully played) monstrosity-arrangements of Gluck, Bach and other "ancient" composers, the sort of thing that wowed people at the turn of the century. Even Beethoven's dizzy little "Turkish March" is jazzed up à la Liszt, and as for Purcell, say no more. But her Chopin is fluid, easy wonderfully singing, her Liszt is whole cloth, the corny and the sublime straight from the composer.

All in all, a very great, if somewhat narrow-ranged musician here, a pianist's pianist (and piano lover's, too). Vox's collection is technically excellent in its sound, very well reprocessed from the more than twenty discs in the Vox-Novaes historical past.

Guiomar Novaes. (Chopin, Debussy, Liszt).

Decca DL 710.074 stereo.

And here is the Novaes Debussy, Liszt and Chopin in its newest format, from Decca and in stereo. It's an excellent stereo disc and the playing is most revealing of the Novaes qualities. Only a barely detectible occasional minor stiffness of finger work suggests the fifty and more years of concertizing mentioned in the Vox Novaes recordings.

The Chopin is masterful, the Debussy also, with a pleasantly Romantic (and highly authentic) overlay upon the impressionism of the DeBussy style. The Liszt is important because it is so straightforward, without apology for the finger-work frosting! The worst of Liszt is here, honestly portrayed, as in a preposterous Hungarian Rhapsody; the best is audible just as easily. Pianists of tender years, take note.

The Decca stereo piano sound is, rightly, somewhat more distant than Vox's quite intimate mono recording, to take good advantage of stereo room sound and the stereo shaping of the piano itself. In other respects, this new series can move right off as an adjunct to the Vox series, even if Vox may not be as happy as Decca over the prospect.

(On the other hand—maybe Vox will sell more of its own Novaes product. Everybody happy.)

Two Pianos, Four Hands. Luboshutz & Nemenoff. (Milhaud, Khatchaturian, Glinka, Shostakovitch, Mendelssohn).

Vanguard VSD 2128 stereo

Like Vronsky and Babin, these duo-pianists have been with us for many pleasant years and are beginning to celebrate anniversaries. This husband-wife team, after a quarter century, is surely as well coordinated into one performing unit as any team in the business.

This recording, though, isn't really very exciting. The selections are mostly pot-pourri, this and that out of their standard programming, and the two larger pieces, Milhaud's witty "Scaramouche" on one side and the Mendelssohn "Allegro Brillant" on the other, are at a disadvantage in the loose company. Neither one, I'd say, gets a top musical treatment though the performing is smooth and expert.

With higher-voltage fare, more purposefully coupled, these pianists can surely do fine things on the Vanguard label.

Beethoven: Piano Music Vol. II. (Later piano sonatas). Alfred Brendel.

Vox VBX 417 (3) mono

During the last year Vox has sent me a whole armful of enticing piano recordings by this young Alfred Brendel—he's been doing all the piano works of Beethoven, all the violin sonatas, the concerti, plus some Mozart tossed in for ample measure. I reviewed the violin sonatas with great pleasure. In desperation I can only sum up here a further general impression of this pianist, to guide you at least a bit towards a useful conclusion.

Brendel is Austrian, born in 1931, a pupil of the great Edwin Fischer (which is next to being a student of Artur Schnabel). He comes, thus, right out of the Austrian tradition and thus was able to absorb excellent style and understanding of the big Viennese masters. He is young, a bit brash for Austria—where music tends to wax stodgy more often than electric.

I found him a superb ensemble player for Austrian piano music with other instruments; I find his late-Beethoven solo sonatas not as penetrating as I had expected them to be and, indeed, somewhat disappointing. He is better, by far, at the early Beethoven (and Mozart) style of music (which includes even the Beethoven concerti). That's good enough—few pianists do early Beethoven proper reverence.

Serkin Beethoven Three Favorite Sonatas Moonlight Appassionata Pathétique.

Columbia MS 6481 stereo

(It's getting harder and harder to reinterpret today's record titles into formal language—the above is exactly as the recording is billed on its cover.)

This is the sort of solid-seller "sleeper" which doesn't ordinarily need any reviewing but I listened through, out of sheer curiosity, to see how Serkin would manage these warhorse Beethovens in a frankly warhorse-intended recording.

Well, it's interesting. He is ever the dramatic, sincere, earnest, electric musician, and not a bit less in the warhorse pieces. No tired sound, no showoff, no over-ripeness. All intensity and personality, in the name of Beethoven, not Serkin. Could't find a better warhorse disc from this point of view.

Rather irrelevantly, I did notice a thing I seem to have noticed before; Serkin's musical ear is really less good than his superbly serious, dynamic musical personality. Here, it shows, I seem to hear, in a fussy, rather staccato sort of detail work, not really as well shaped and as flowing as many another pianist can accomplish with the music. And

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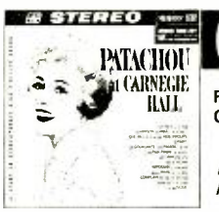
Charm!



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Ole!

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in not as much awareness of the great harmonic contrasts, part of the drama the music, as I've heard in the playing of otherwise less likeable pianists. No matter. Serkin is still likeable tops.

CHOIRS INTERNATIONAL

Palestrina: The Song of Songs (21 Motets). Prague Madrigal Choir, Venhoda.

Vanguard BGS 5059 stereo

No less than twenty-one Palestrina motets here, all on the poetic, sensuous "Song of Songs" text, the Song of Solomon. The Prague group sings them with a rather old-fashioned and quite wobbly-toned ensemble and lots of vibrato, but the essential flow of the music and its expressiveness get through, the rhythms are plastic and never march-like (as so many choirs make the old music)—which adds up to considerable musical value in this recording, aside from the seldom heard works themselves, which are very much worth performance.

The Abbey Singers—Five Centuries of Song.

Decca DL 710073 stereo

An offshoot of the New York Pro Musica, this group of five young soloists sings unaccompanied, from the Sixteenth century, the early American period and as a chaser some spicy items by Brahms, Mozart, Toch and Aaron Copland (with Irving Fine). The singing is not choral but "vocal"—in the American manner; the voices are big, opulent, highly trained and operatic in tone. But, perhaps thanks to their youth, these enormous vocal instruments are fairly well blended and their expression is both musical and stylistically knowing. A bit like playing a string quartet on saxophones—but if the saxes are good ones. . . .

Monteverdi: Messa 4 Voci (Mass for Four Voices). Gibbons: First (Short) Service. The Old North Singers, Fesperman.

Cambridge CRS 1415 stereo

This choir was organized recently to complement the fine acoustics and dignified tradition of the famous Old North Church in Boston. The group sings most expressively and with excellent pitch and general musicianship—a representation of the best in American-style church singing. The sounds, in the American manner, are full and with a good deal of vibrato, reflecting the usual increment of professional (which means opera-oratorio solo) training, but the ensemble does not suffer, even though not of the pure English choir-boy sort heard in England itself.

The Monteverdi Masses are relatively tame and full of what by now seem rather repetitious sequence figures—unusual and daring at the time, no doubt—though the music is nominally in the old unaccompanied "Palestrina" manner. Gibbons' Short Service, from about the same time, is the high Anglican choral service in English, divided in the customary antiphonal choirs, one on each side, plus solo "verse" sections set against the choral sound. Lovely pitch and good word-projection though, again, American-style rather than British.

Monteverdi: Madrigali Guerrieri (Book Eight). Soloists, Aeterna Chamber Orch. and Chorus, Frederic Waldman.

Decca DL 79417 stereo

This is a splendid recording of superb music in spite of some serious questions of vocal style in the performance.

The hitherto rarely heard works are from the last of the extraordinary Monteverdi's eight books of madrigals—which after Book Five branched out into such astonishing new explorations, that by Book Eight the madrigals-in-name were already full-fledged cantatas or semi-operas, for orchestra, solos and chorus. The selection here, from Book Eight, involves the "Madrigals of War and Love," exploring new ways to express strong feelings, both amatory and martial. Like virtually all Monteverdi, this is music, still a bit strange to our unaccustomed ears, yet it is as powerful as any ever written. It laid the foundations not only for the Baroque period (through Bach and Handel and Vivaldi) but for the whole span of modern instrumental and vocal music in the West.

Frederic Waldman is a professional old-world conductor of great good musicianship, whose only fault lies here in his willingness to use standard New York professional singers of the loud, opulent opera-oratorio type for this music, which is so utterly unsuited to them. (Probably he could think of nothing better to try, within the professional area, and if so he was quite right.) The chorus is good, if somewhat overpowering and suggestive at times of a Wagnerian ensemble. They sing with care and good musical sense, if not with much sense of the shaping of words. The vocal soloists were too much for me—an enormous rumbling basso and two very loud and forced tenors. (They may be excellent in other music—not here.)

The whole thing would benefit from a less massive, more "chamber" intimacy, as was surely intended by the composer—but the bigness of this sound, I'll admit, makes the music seem more modern and hence easier to absorb for most ears.

Monteverdi: Lagrime d'Amante al Sepolcro; Solo songs (arie, canzonette e recitativi). Petit Ensemble Vocal, Montreal, G. Little.

Vox STDL 500.910 stereo

Five French Canadian soloists perform this Monteverdi program, under their director's leadership and with his keyboard accompaniment for the solos. Side 1 contains the madrigals of the "Lament of a Lover at the Tomb of his Beloved," late works of the type, from 1609. Side 2 is solo music with "spinet"

(small harpsichord) accompaniment, light stuff in French-style verses (1632) except for a long operatic recitative, the famous "Lament of Arianna," only remaining fragment of a 1608 Monteverdi opera.

These are modern trained voices but of a less brassy, less wobbly sort than those found in the Manhattan region; in the madrigals they sing with considerable delicacy and care, with good musicianship throughout if not an

Lost but not Least

Ernst von Dohnanyi Plays Beethoven. Piano Sonatas No. 30, 31. (Also: 32 Variations in C Minor; Andante Favori in F.)

Everest 3109 stereo

Early in 1960 the original Everest made a remarkable series of recordings of this violently energetic elderly composer-pianist, then 82 years old. So energetic, indeed, that within a week or so he was dead! Listening, one can understand. Soon after, a disc of Dohnanyi's own piano pieces was issued; now the new Everest label brings us a more important release, all-Beethoven. It is a highly dramatic sort of Beethoven with additional historical interest as well as poignancy) for all who know of Dohnanyi's long-time stature in the musical world.

This release is also a hair-raising example of foot-in-mouth bungling in album production, such as I never thought I'd see! First, to my astonishment, I found two "extra" works on the disc, one of them the 32 Variations, a major Beethoven opus, though nowhere mentioned on the label: the two late Sonatas were misbanded to utter confusion, their supposed final movements being the unrelated pieces, which the company apparently didn't even know were there!

Clearly, there was nobody in the new Everest organization who had even the vaguest notion of what this music was all about.

Secondly, confirming the same, the notes on the album cover are inept to the point of absurdity—you'd better grab the album just so you can try them on your musical friends for laughs. The analyses of the Sonatas are OK—probably borrowed from a respectable source. But when the annotator takes off on his own, things happen. I read on, my eyes popping, into something about Beethoven's "lost" period. Did he really mean *"lost"*? He did.

One of the compositions, it says, "encompasses many beautiful and mornful (*sic*) themes. It is part of the strange, mystical world that we today call Beethoven's lost period."

Well I'll be! " . . . I thought. He's not serious? But he was. After something about the inevitable Heiligenstadt Testament (an early and Romantic Beethoven exercise in despondency from 1802), I read "It was during this lost period that he wrote his piano sonatas." Well, he wrote his piano sonatas during most of his lifetime (the two on the disc are from around 1820) and so it must have been quite some "lost" period.

Not "lost period", my friends, *Last* period. Merely a slight misunderstanding on the author's part. (And presumably by "pedagorical" he meant "pedagogical", or maybe allegorical or even historrical?) Beethoven, to my certain knowledge, did not "lose" any periods.

So after you've gaped and gawked, you may assign these preposterously schoolboyish notes to the nearest Lost and Found where they surely belong.

But *do* go out and buy the record itself for the music on it. It is an important and persuasive document, beautifully recorded, even if Everest doesn't know its last from a half in the ground.

(P.S. By this time there may be a new and corrected edition.)

ideal blend of tone. The solos are generally less steady, notably those of the soprano (who is ardent, even so, and speaks her Italian with fervor). Best is the excellent basso in one short number, humorous-tragic, several verses long.

Complete texts and translations are provided—the latter sometimes a bit odd. For instance, "So sweet is the torment which in my bosom stays That I live contented for cruel beautiful you."

Byrd: Mass for Five Voices; Magnificat and Nunc Dimittis from the Great Service; Ave Verum Corpus. Choir of King's College, Willcocks.

London OS 25725 stereo

Here we are in the presence of one of the choral holy of holies—the choir of King's College, Cambridge, England, singing in its own chapel.

The effect, in this all-Byrd recording, is almost to aetherial to take. The singing is *sotto voce,* often a kind of reverent musicial whisper, and the mikes give the impression of a tiny choir lost in an enormous Gothic space. That, surely, was the intention.

Choirboys, of course, sing the soprano and alto parts, with that odd, hooting intensity, breathy, without vibrato and absolutely accurate, that is the envy of other choirs the world over. The men, in these English choirs, are increasingly less "pure" in their own tone, thanks to the inevitable encroachment of the crass outside world of singing. They aren't monks, after all. And so in this choir we hear quite a bit of wobble, a brace of discreet vibratos, a bit of operatic tone, ever so carefully controlled.

Byrd was a Catholic, yet in a time of religious battling managed to hold his position in the Church of England for some fifty years. He wrote music for both churches; the Latin Mass on Side 1 is perhaps easier to make musicial sense of for us than the involved music, to English texts, of the monumental Great Service.

Josquin Després: Mass: "Hercules Dux Ferrariae". Okeghem: Three motets (voices, instruments). Ensemble Roger Blanchard.

Music Guild S-7 stereo

Though these two are among the really great early composers, these French performances aren't likely to make them easy for your listening. The Blanchard Ensemble is a group of solo voices who sing with loud, strained, unblended tone in that peculiarly nasal French manner than can be lovely in its place (and at a distance—say in "Carmen" or "Pelleas et Melisande") but tends to grate on the ears at close range; their understanding of Josquin seems to me to be marginal aud not very communicative though their earnest approach produces some persuasive moments. All in all, Josquin sounds dreadfully antique, where, when more knowledgeably sung, he can be the loveliest of composers.

Okeghem, Josquin's predecessor and an even more remote master, is done with combined instrumental and vocal forces. Though the instruments are easier to follow (and they play one very long complete motet by themselves), they suffer from rhythmic difficulties—the old music is very complex in rhythm and a rigidly superimposed, march-like beat does not help it to reveal its subtlety. A forced, mechanical playing, in spite of its earnestness.

A Choral Recital from Vittoria to Our Times. Capital University Choir (Columbus, Ohio), E. E. Snyder.

Westminster WST 17024 stereo

Here's one of those show choirs, impeccably costumed in neat curved ranks, born to perform, which are a specialty of our great country. They sing the older music—Victoria, Viadana, Lotti, Bach—with precision and gusto but their ensemble is ragged as to pitch and not very well blended. In fact, in a good many spots their tuning is worse than indifferent. Side 2 brings them more into their element, with rousing and/or moving items

from "A Mighty Fortress" and "Steal Away" and "Religion is a Fortune."

The recording was made in London, presumably on tour. Maybe they were tired out—but that's no excuse at all for singing out of tune. Matter of home training, long before the tour began.

Crawford Gates: Symphony No. 2 (Scenes from the Book of Mormon). Utah Symph., Brigham Young Univ. Choir, Gates.

Living Library (B.Y.U. Dept. of Audio-Visual Communication)

Amazing what special interests in music can produce. This is a huge piece of music (excerpts only, yet two sides' worth) for immense orchestra, organ, chorus, solos, based on inspired texts, originally composed for a Mormon pageant. The music is highly professional, written in a polished academic-modern style, performed with immense skill and plenty of enthusiasm. Every trick of the orchestral and choral trade is used, and well used. And with all this, I find the whole thing immensely dull from the musical viewpoint, though it is easy to respect the enthusiasm, the skill and effort which went into such a producion, from start to finish.

Unfortunately, high inspiration from external sources does not always guarantee high art in terms of art itself.

PORTS OF CALL

Ports of Call. (Ravel: Bolero, La Valse, Pavane. Ibert: Escales. Debussy: Clair de Lune. Chabrier: Espana.) Phila. Orch. Ormandy.

Columbia MS 6478 stereo

Darn it—this will have to stand for a hundred and fifty-odd similar Philadelphia recordings, suave, opulent, polished, played to perfection and always just a tiny trace over-ripe and under-sincere, by means of which Columbia keeps the American home filled with high-class background music.

What else can I say? Only that the Philly-Ormandy records are a mile and a half above such slick and slithery, loud-and-leathery outpourings of a similar sort from Andre Kostelanetz, Morton Gould, or even Capitol's Carmen Dragon. The Philly interpretations are *very* high class. But they always give me that tell-take trace of musical indigestion.

Sometimes a good record-full of really *bad* music will cure it quick. The Philadelphia is like Philadelphia cream cheese and honey, plus saccharine, beautifully blended to perfection. . . .

Screamers (Circus Marches) Eastman Wind Ensemble, Fennell.

Mercury SR 90314 stereo

Screamers? The lightly proficient Fennell Eastman ensemble here makes highly hi-fi noises (on three tracks, 35mm) out of highly lowbrow musical stuff. Circus music.

Take Sousa, now—these Eastman people do a bangup job there, because Sousa is good music. This stuff, though, just screams for my ear. You can have it if you like closeup circuses. And screams.

Mozart: The Four Concertos for Woodwinds and Orchestra. Bernard Garfield, fg., Wm. Kinkaid, fl., John de Lancie, ob., Anthony Gigliotti; cl., Phila. Orch., Ormandy.

Columbia SL 6451, 52 stereo

Nowadays, when "symphonic music" is no longer *the* music of musics and the symphony orchestra is finding itself a trace outdated as a whole, it is good to see the tendency towards multiple-use of its members going forward. Several of these Philly soloists—old and young—engage in other activities such as the Philadelphia Woodwind Quintet; here they appear one by one in Mozart solo concerti for each instrument—Bassoon and flute on the first disc, oboe and clarinet on the second.

Inevitably, the Philadelphia sound is stylistically (and acoustically) a bit too big for these works, composed for smaller halls and for more intimate orchestral performance. Ormandy remains, after all, a symphonic—i.e., a Nineteenth-century-type—conductor. But the suave Philly strings and the top-rate Philly solo players inevitably produce an ultra-suave sort of Mozart. Goes down easily, sounds ultra-professional.

Schubert: Trout Quintet. Beethoven: Piano Quartet Op. 16. Members Budapest Quartet, M. Horszowski, piano, J. Levine, bass.

Columbia MS 6473 stereo

"Outstanding Music Buy One Hour-long Lp! Two Chamber Music Masterpieces." Label stuck on the front of this one.

Well, if music is measured by time-elapsed, then this is a first-line bargain I guess. Just about an even hour, and aside from an occasional groove-echo (Columbia puts them in shorter discs too) and a slightly metallic violin sound, the disc is quite faultless technically.

The great "Trout" Quintet, with piano and double bass, sounds oddly tired for the usually tant Budapest. Doesn't really begin to snap until the first two long movements are done. It has the "we've played this too many times already" sound. Main trouble, I'd say, is with the crucial first violinist, Joseph Roisman, who seems more than usually tired here, slurring his notes, playing slightly off pitch and with a wiry sound. Not good. One can surely never blame a first violinist of a quartet for exhaustion—the part is implacably demanding over the years, putting far more tension upon the first fiddle than on the other men, enough to wear any anyone's psyche and technique as well.

(Of course, for all we know, this was taken at four o'clock of a long, long night session. Could be. That might do it.)

The somewhat juvenile Beethoven Opus 16, full of his early bounce and defiance within the older elegance of the Eighteenth century manner, isn't too good a contrast after the late and utterly Romantic Schubert, an enormously seasoned product. The Opus 16 would do beautifully after an early Schubert—or another early Beethoven. Here, it tends to sound brash and strident for its not very immense content. AE

ABOUT MUSIC

Harold Lawrence

Of Mikes And Men—John Cage Again

THE MAN AT THE BAR reached for the beer bottle and smashed it over the head of his neighbour, killing him instantly. The year was 1941, the place a saloon on New York's Third Avenue. Before being struck down, the victim had been dropping coins into the jukebox to play the same disc repeatedly for three hours. At the trial, the defense attorney rested his case on an unorthodox but effective courtroom demonstration: using the same jukebox and record that figured in the crime, he subjected the judge and the jury to the aural torture that had unhinged his client's mind. The judge was the first to crack; after several repeats he shouted "Stop the music!"

Times have changed. Twenty-two years later, on Third Avenue, people paid $5 a ticket to hear the same piece repeated not for three, but for nearly nineteen hours. The occasion was the last in a series of avant-garde concerts given at the Pocket Theatre. The entire concert was devoted to the first U. S. performance of a piano work by Erik Satie titled—with remarkable restraint—"Vexations." The work consists of 180 notes, lasts 80 seconds, and, according to the composer's instructions, is to be played 840 times. On September 9–10 it was.

The performance began at 6 P.M. and ended at 12:40 P.M. the following day. Twelve pianists played it and eight *New York Times* critics reviewed it; in relay teams, that is. "Whatever it was," wrote Harold C. Schonberg, "it made musical history."

Coming as it did at the end of a summer filled with neo-Dadaist concerts, "Vexations" found a public ready to take it on. New Yorkers had been regaled with two avant-garde festivals, one in Judson Hall and the other at the Pocket Theatre. The first series consisted of six concerts, featured the world's leading far-out composers and performers, and, until the Pocket Theatre's long day's journey into night, had attracted the most attention. Not all of it was favorable: "Stupefying boredom," wrote the *New York Herald Tribune* critic of the first Judson Hall concert. "The pieces go on and on—and on and on, until you're ready to crawl up the walls."

Nobody crawled up the walls during the second concert at Judson Hall, but John Cage's deafening sounds drove some twenty people out of the hall gritting their teeth. Others, however, were undaunted by the amplified noises prepared by Cage and David Tudor. In fact, they seemed to enjoy it all, and brought the composer-performer team back on stage for numerous curtain calls.

Dominating the small stage were two Steinway pianos, one behind the other. On a pair of tables between the pianos were several pieces of electronic equipment, including an Ampex tape recorder Model 601, two microphone mixers, and a Dynakit power amplifier. Someone walked over to the first piano, knelt down, tugged at the pedal box, rose and probed under the lid. Was it the piano tuner making some last-minute adjustments? No, it was David Tudor. John Cage appeared, announced, "I just want to say that the intermission will be half an hour long," and promptly disappeared behind the open lid of the second piano.

Fig. 1. Cage and Tudor at work on Ichiyanagi's "Music for Piano, No. 4."

For a while, all that the audience could see of the performers as they launched into "Music for Piano No. 4" by Toshi Ichiyanagi (a Japanese disciple of Cage), were Cage's feet and Tudor's legs and derrière.

"Music for Piano No. 4" was serene and intimate in character. Its sounds resembled those made by massaging inflated rubber balloons, tightening leather straps, twanging bass strings, and moaning softly. Eerie wails were created on the upper strings of both pianos, suggesting the image of a pair of birds floating motionless in space.

The audience was generally quiet throughout the 45-minute work, except for a brief "demonstration" in the rear of the hall. Approximately twelve minutes after the work began, the anti-Cage forces unleashed a barrage of applause and cries of "Bravo" and "Encore." The claque failed to make

Fig. 2. Members of the audience inspect Tudor's "prepared" piano.

any headway, however. The more dedicated listeners turned and glared malevolently at the noise makers, others smiled indulgently, and a few tittered. To all of this, Cage and Tudor showed no reaction, keeping a museum-like composure throughout. (*Fig.* 1)

During the intermission, members of the audience walked on stage to examine the guts of Tudor's piano; (*Fig.* 2) they were curious to learn how the pianist had prepared his instrument. But they were not allowed to remain there for long. Tudor was soon back on stage; he snapped: "My name is David Tudor. I have a lot of work to do. Please go away." Then, to ensure privacy, he drew the curtains.

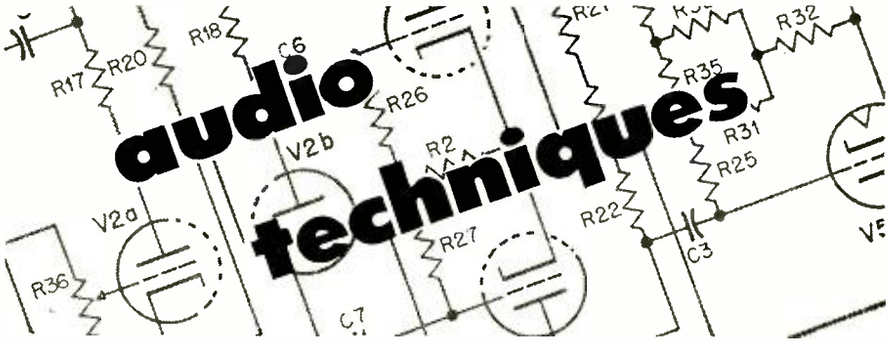
The hypnotic sounds of Ichiyanagi hardly prepared us for the next work, Cage's "Variations." Electronics played a vital role in this 45-minute succession of harsh, piercing sounds. The principal instrument was the contact microphone, several of which were used by both performers. While Tudor produced loud squeals, explosions and mammoth-gong sounds (relayed to loudspeakers placed on both sides of the stage and in the rear of the auditorium), Cage attacked a mound of gray "spaghetti" lying on the stage floor. Our ears were assaulted by loud pops and crackles as Cage began to untangle the mess of cables to which at least ten contact microphones were attached. He then fastened the small flat microphones to an ash tray, a pad of paper, a pair of eyeglasses, and his throat, using cellophane tape.

Cage was now wired for sound. Amplified to grotesque proportions were the sounds of Cage tapping his cigarette holder on the ash tray, Cage scratching a pad of paper with a pen, Cage folding and unfolding his eyeglasses, and Cage drinking water.

Just to make certain we heard the last effect clearly, Cage turned the volume control on the amplifier to maximum gain. He then moved to stage center, stared Zen-like into space, and swallowed. A ton of coal hurtled down a chute in an echo chamber. The gigantic swallow was the hit of the evening. Spectators laughed, applauded, screamed with delight. Obviously pleased with the audience's reaction, but playing it cool, Cage sat down at the keyboard, lit

(*Continued on page 67*)

Fig. 3. Cage smokes a cigarette following electronic swallow.



JOSEPH GIOVANELLI *

NOTE: *Despite the fact that this column has not appeared for some time, several of you have encouraged us to continue. Further, over the period of time since the last appearance of "Audio Techniques," a number of suggestions have been received. I believe you will find them of interest.*

If you have suggestions and ideas you would like to share with fellow readers of AUDIO, *please pass them along to me at the address shown. By so doing, you will share your knowledge and experience with thousands of readers around the world.* J.G.

Intercom Systems

My suggestion concerns ordinary intercom systems and the sometimes undesirable characteristic of permitting "eavesdropping" at the master station. A very simple inexpensive modification of the sub-stations can prevent this. The circuits are shown in *Fig.* 1 and 2. The modification consists of the addition of an SPST toggle switch and a general-purpose diode. When the switch is open, the sub-station can be called, but cannot be heard by the master, until the switch is closed.

The operation is not hard to explain: With the switch open, the forward resistance of the diode is too high to permit the master to listen in. However, when the master is calling, the heavier current that circulates "biases" the diode sufficiently to make it operate for one-half of the cycle. The result is that the call from the master comes through distorted, but nonetheless it can be heard and understood.

If the sub-station wishes to respond (or call), the toggle switch need only be closed and operation of the intercom is normal. This modification has been added with complete success to an intercom system used at our plant.

True, if my added switch is in the "off" (no eavesdrop) position, the initial call to such a substation will sound distorted. However, if any kind of conversation between the master and the substation is to ensue, someone at the substation would, of necessity, have to throw the switch to the "on" position, so that the master may also hear the sub-station.

From that moment onward, the operation of the intercom is entirely normal, just as if it had never been modified.

The only time when there might be difficulty is when the master station carries *orders* to the sub-station, orders that tolerate no reply, such as: "Jack, go to room 312, pick up a box of nails and bring it to room 519, and make it snappy!" Such a state of affairs would not give Jack any chance to answer the call, to point out that he is within earshot and eager to comply. If this is the case, the switch will, of course, never get thrown and the entire conversation will be strictly one-way, and will, indeed, be distorted (electrically and mentally). John Kellner, South Boston, Massachusetts.

* *2819 Newkirk Ave., Brooklyn 26, N. Y.*

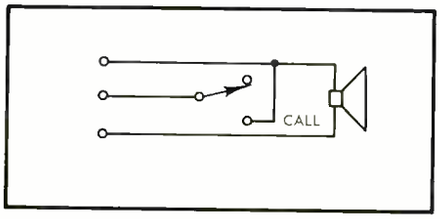


Fig. 1. Mixing circuit proposed by a reader.

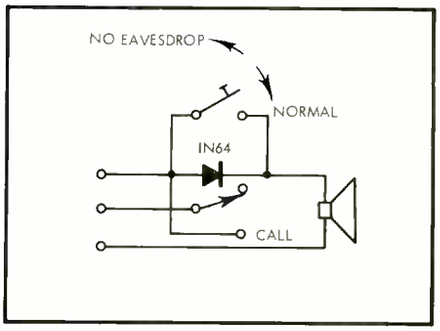


Fig. 2. Mixer for three microphones.

Speaker Wiring

I wonder how many of your readers are using lamp cord for connecting speakers to amplifiers. Lamp cord may be fine when short lengths are used but

I use about 50 feet of line between my monophonic amplifier and speaker. I recently replaced this with 14 gauge sheathed copper cable. The improvement in sound quality was amazing. Larry D. Roesler, Chicago, Illinois.

Cleaning Phonograph Records

Here is my procedure for cleaning phonograph records:

1. Thoroughly wet the record's surface with "Lektrostat Anti-Static Detergent." Spread the liquid over the entire surface of the record with the pad provided.

2. Immediately rinse with water at about body temperature. Direct a fine, hard spray from a shower hose or garden hose at the record and cover every square inch of groove with a good force at right angles to the surface of the record.

3. Dry immediately by gently blotting the record with a piece of folded linen cloth. Let any remaining moisture evaporate in the air before inserting the record into the sleeve.

4. Before playing the record with the stylus, play it at least twice with the Dust Bug. Dow Williams, Sedro Woolley, Washington.

Noise in FM Receivers

A lot of the extraneous noise heard in FM tuners results from the ability of the tuner to detect AM.

An FM tuner has minimum sensitivity to AM interference, or maximum AM rejection, when the center of the bandpass of the detector is exactly at the intermediate frequency. This frequency is usually 10.7 mc, for which the i.f. stages should be carefully peaked. In other words, the center of the straight portion of the "S" curve of the detector should be located at 10.7 mc.

Careful alignment should result not only in maximum AM rejection but also minimum audio distortion.

In experimental work with FM tuners, I have found that it is difficult to locate the center of the "S" curve properly with a 10.7-mc marker frequency on a sweep generator as the voltage amplitude of the marker signal is zero at the proper point and very small on either side of it, when the "S" curve is viewed on an oscilloscope. I have achieved a very sensitive centering of the "S" curve by using a 10.7-mc signal with amplitude modulation, using a modulating frequency of 400–1000 cps. The correct center point for the "S" curve can be easily located by adjusting the detector transformer for minimum response to the modulating frequency. An oscilloscope, a sensitive A.C. VTVM, or even an audible signal might be used. I have found an oscilloscope useful for this purpose. Joel S. Tompkins, Pittsburgh, Pennsylvania. Æ

ABOUT MUSIC

(*from page 65*)

another cigarette, tapped the ash tray, and gazed into nothing. (*Fig.* 3).

There was more drinking, more applause. Finally, as a fillip, Cage treated his public to a new sound. He began to groan. Or should I say roar, howl, and whine. It sounded like the Central Park Zoo at lunch time during a zoo-keeper's strike.

Undisturbed by Cage's swallowing and yelping, Tudor withdrew his head from the belly of his Steinway only in order to make electronic adjustments.

The performers brought their seemingly haphazard activities to an abrupt end and turned to face the enthusiastic audience. People crowded on stage to congratulate Cage and Tudor: "A magnificent evening . . . brilliant . . . superb. The swallows were fabulous!" Confessed Cage: "I've sort of grown fond of drinking water."

Someone asked Cage about the "groans." "Oh, that . . . I was reading the vowel sounds in what I had written." A glance at the paper pad revealed the following: "untangle; compose; smoke . . . listen to D. T. (David Tudor) . . . pour water, put out cigarette—drink water with mike on. . . ."

Inevitably, several people asked Cage to explain his musical philosophy. "Get my book, *Silence*, it's all in there."

It was no surprise to anyone that Cage had located the music for the Pocket Theatre's now celebrated marathon. Æ

NOISE

(*from page 50*)

occasion, a faulty record-level indicator will tell you to record at a lower level than is really necessary. Find out if this is so by making several recordings at successively higher levels and checking which of these first shows noticeable distortion. Check the corresponding position of the record-level indicator. If you have reason to believe that the record-level indicator is miscalibrated, see your serviceman.

A boggled splice is apt to produce an unpleasant thump, click, pop, or wavering sound when the spliced portion goes past the playback head. A proper splice is one where the magnetic tape is cut at a 45 deg. angle and the splicing tape is also applied at the same angle. This permits the magnetic and splicing tapes to make gradual contact with the playback head and the pressure pads (if any), avoiding splicing noise. As you probably know, the splicing tape is applied to the back (shiny side) of the magnetic tape.

Multiplex interference is a newcomer to the list of tape noises. A multiplex tuner or adapter produces a frequency of 19,000 cps plus its harmonics (multiples of 19,000 cps). One of these harmonics, if sufficiently strong, may "beat" against the tape oscillator frequency, resulting in an audible spurious signal. For example, an appreciable amount of 76,000 cps harmonic may get into a tape recorder with a bias frequency of 70,000 cps. The difference between these two frequencies is a "beat" frequency of 6000 cps, which will be recorded on the tape. Although multiplex instruments and tape recorders are taking increasing precautions against this kind of occurrence, the problem has not yet been done away with. The solution is to have a filter installed at the tuner's output or tape recorder's input. This is a task for the well qualified technician. However, filters that you can install yourself in a matter of moments are now available.

In conclusion, it should be noted that anything in the audio system that exaggerates treble response will, by the same token, exaggerate noise. Thus a cartridge or speaker with an appreciable peak in the treble range will produce more apparent noise than a smoother cartridge or speaker. Failure to set the preamp equalization controls correctly when the signal source is a magnetic cartridge or tape head, or exaggerated setting of the treble control, will emphasize noise. Use of a presence control accentuates frequencies in the general range of 3000 cps, and it is to these frequencies that the ear is most sensitive. Æ

THE MATCHED LOAD

(*from page 34*)

of cant. The desire to match is particularly strong among users of cathode followers, and, I suppose, of emitter followers.

I must say at once that there are some applications of a cathode follower for which the matched condition is ideal. When you are feeding a line which is not correctly terminated the use of a cathode follower of the same source impedance as the characteristic impedance of the line will give you a resistive source impedance at the far end of the line and there will be no response degradation due to the capacitance of the line (if the impedances were too low it would be the inductance which would cause trouble, of course). Even when the line is terminated by *about* the right impedance there are practical advantages in getting two roughly correct terminations instead of one very much more precise termination. Here, however, we are not concerned with power, but with impedance.

The match-makers tell us that we should always match a cathode follower. I think this is nonsense, and I do not regard such a device as being really a cathode follower at all. Matched, which means using a load of $1/g_m$, the feedback is only 6 db and the cathode moves half as much as the grid. Next time you see a pretty girl, try following her so that she goes two blocks while you only go one and see where it gets you.

It is very much better to use transistor terminology and to call our circuit a grounded-anode or common-anode circuit. We may draw this in the form shown in *Fig.* 9. I do not remember seeing this discussed in the textbooks and so I have just checked in one of the most widely used. It is not there, but the author does have something to say about the cathode follower and he is, I suspect, one of the main sources of the common error. If the feedback is almost complete the cathode follows the grid, and then the tube has an amplification factor of $\mu/(\mu+1)$ and an impedance of $1/g_m$. Since the impedance is low, it can drive a low load impedance. You see how he has gone round in a circle.

We must construct our own common anode characteristics. Let us take the triode characteristics shown in (A) of *Fig.* 10. These are fairly typical, although since it was necessary to draw them out they do not represent any particular tube. They are based on the 12AT7. Suppose we take $E = 100$ volts (actually -100, since it is the anode we take as reference). E_g is -100 v we shall get a current of 10 mA, and if we keep E_g *at* -100 v but change the voltage between grid and cathode to -1 volt we shall have the cathode at -99 volts and a current of 5 mA. We calculate other points down the 100-volt line of *Fig.* 10 and in this way we get the $E_g = -100$ v line shown in *Fig.* 11. We can produce similar characteristics for $E_g = -200$ v, -300 v and for intermediate values in just the same way. These are bounded by the zero-bias line of *Fig* 10, because to the left of this we shall have grid current flowing and we shall need to take account of the grid circuit impedance. The final result, shown in *Fig.* 11, shows the characteristics of a typical tube in the common-anode mode.

Although the curves are rarely shown in this form, and indeed I cannot remember seeing them before, although surely someone has put them in a book, they do give us all we expect to know about the cathode follower. We see the very low impedance at all but the lowest currents. We see that we have a voltage gain of nearly unity. We also see that the optimum load is exactly the same as the optimum load for the common-cathode mode of operation. The reason is that the boundaries of the working area are the same. This conclusion extends even to the low-voltage operation, when we match the load to the zero grid voltage impedance instead of tucking the load line into the corner. We must match our cathode follower to this impedance, under these conditions, in just the same way.

The philosophy which has been established is sufficient to tell us something more about loading devices. Some little while ago I wrote an article on split loading of transistors. The load in this kind of circuit is partly in the collector line and partly in the emitter line. We can see now, without more ado, that the optimum load, the load which will let us take out the maximum power, must still be the *diagonal load*, as we may call it. We are, however, free to fix the source impedance by choosing the split ratio. With a split load circuit we can arrange to get a matched condition and optimum power together. To save the energies of correspondents, this is just a special case of the use of negative feedback to alter the output impedance.

I am well aware that a very refined analysis will show that the load should be varied a small amount as the feedback is varied. This is, in practice, nonsense because we must work with wide tolerances anyway. I hope, however, that I have cleared up some of your ideas on matching: after all, if you knew all this, why did you read on to

The End Æ

NEW PRODUCTS

The first four new products were shown for the first time at the recent New York High Fidelity Show and were not available to be included in our Annual Product Preview in August. Where appropriate, we have indicated complete product lines.

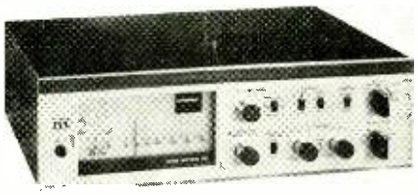
• **Professional 4-track Stereo Tape Recorder.** The Cipher Denon 800 is the first in a series of professional units to be introduced by Inter-Mark Corp. The new tape recorder and playback unit has three hysteresis-synchronous motors: one 4-pole/8-pole 2-speed motor, one fast forward motor, and one rewind motor. Tape speeds, 7½ and 3¾ ips, are extremely accurate and both fast forward and rewind can be performed rapidly (approx. 50 seconds for 1200-foot tape). The Cipher Denon 800 has a 3-head system for recording, playback, and erasing. It also

has pushbutton controls for easier operation. Other features include: automatic tape shifter device; stainless steel reel clamps; digital tape counter; plug-in head system; independent amplifier system for multiple recording, sound-on-sound, echo recording; 2 VU meters; monitor switch; and reel size transfer switch. Price is $499.00. Inter-Mark Corp., 29 West 36th St., New York 18, N. Y. Also available are Model VI stereo recorder, $275; Model VII D stereo deck, $225; Model V mono portable, $79.50; and Model I mono machine, $139.95. **L-1**

• **Solid-State Stereo Amplifier.** C/M Laboratories has entered the components field with an all solid-state power amplifier providing 50 watts per channel into 8 or 16 ohms, from 20–20,000 cps. Featuring direct-coupled circuitry and full overload protection, by means of a patented circuit, to prevent destroying output-stage transistors and loudspeakers against abnormal peaks and surges. Distortion is less than 0.05 per cent at 1000 cps up to 45 watts; IM distortion is less than 0.20 per cent at

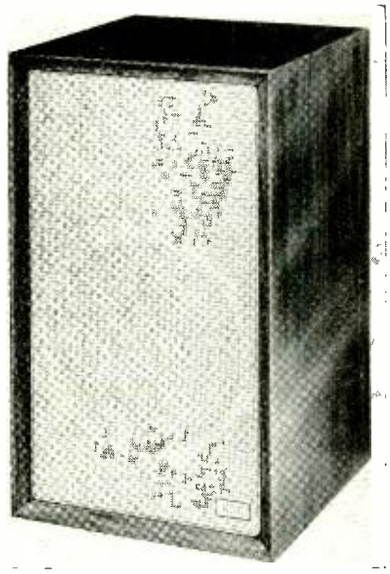
45 watts, (equivalent single frequency). The CM50-50 will tolerate capacitive loads and has a 10 microsecond recovery time and excellent transient response. Weight is only 25 lbs., about half that of the equivalent tube amplifier. Price $435.00. C/M Laboratories. 248 Canal St., Stamford, Conn. **L-2**

• **AM-FM-Stereo Receiver.** ITT has entered the consumer products field with a lineup of timers, amplifiers, and receivers. Top of the line is the SMX-800, an AM-FM-Stereo receiver which features unusually handsome styling and a complete system, except for speakers, in one



convenient package. The given specifications are quite excellent, including FM sensitivity from 1.5–11 μv, amplifier output of 40 watts per channel (music power) and harmonic distortion less than 1 per cent. As a control center it will accept inputs from a variety of sources including magnetic or ceramic cartridges, tape head, as well as from the built-in AM-FM tuner. Price $319.95. ITT, Distribution Products Div., P. O. Box 99 Lodi, N. J. Also available are the SMX-500 receiver, $264.95; SMX-100 AM-FM-Stereo tuner, $154.95; SA-720 stereo amp., $179.95. **L-3**

• **New Bookshelf Speaker Systems.** The new KSC-1 speaker system is claimed to provide realistic performance, smoothly and uniformly, over the entire audible range, from 30 to 20,000 cps, over a solid 90-deg. angle, with very low transient distortion, although comparatively low priced and small in size. The 10-in. woofer, 3½-in. mid-range, and 3½-in. tweeter are built by SEAS of Norway. They are front mounted in the cabinet with a high-quality 3-way dividing network. In addition, two controls are included for adjusting the mid- and high-frequency speakers to individual preference or room acoutics. System impedance is 8 ohms. Power handling

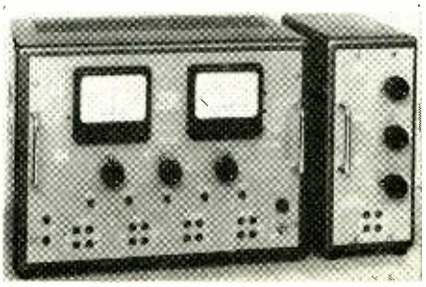


capacity is 35 watts. The beautifully built cabinet measures 12-in. wide × 12½-in. deep × 20-in. high, a convenient size that fits into any standard cabinet and operates equally well in any position. Construction is of superior grade ¾-in. lumber-core plywood, and the cabinet is totally sealed, air-tight, and is packed with sound-absorbing material. Available unfinished or in a variety of fine finishes. Price ranges from $85 for unfinished fir to $100 for oiled walnut finish. KSC Systems, Inc., P. O. Box 303, Knickerbocker Sta., N. Y. 2, N. Y. **L-4**

• **Instrument Panel Kit.** This completely self-contained panel-production kit produces permanent aluminum panels in up to four colors in twenty minutes. No graphic skills required. No dark room or other special equipment necessary. No dangerous chemicals involved in the process.

Complete operation can be performed on a table. Further information from Electro-Kits, 1544 West Mound Street, Columbus 23, Ohio. **L-5**

• **Wow and Flutter Meter.** Gotham Audio Corporation announces the availability of the EMT 420a wow and flutter meter. The equipment conforms to the new ISO recommendation 402, to the CCIR recommendations, and German standard DIN 45507. The EMT 421a high- and low-pass analysis filter is an available accessory for analysis of wow and flutter components. The EMT 420a is designed for extremely accurate measurement of frequency fluctuations of audio recording and playback equipment arising from motion incon-



sistencies. Pitch fluctuations are read on the left panel meter as peak value percentages of the 3150-cps test frequency available from an internal oscillator. Discriminator is linear over ±400 cps permitting deviation readings as great as 10 per cent. The right panel meter directly indicates drift and wow from d.c. to 0.2 cps. Terminals are provided on the front panel for external oscilloscope or pen recorder. Frequency range of unwanted modulation is measurable with: a. weighting network with 10-db rolloff per octave below 4 cps and 6 db per octave above 4 cps; b. – 3 db; and c. external filter network matching 600 ohms. Weight is approximately 36 lb. Gotham Audio Corp., 2 West 46 St., New York 36, N. Y. **L-6**

• **Tape "Reading" Instrument.** A precision instrument which makes visible the data recorded on magnetic tape without damaging the tape has been developed by the 3M Company, producer of the "Scotch" brand line of recording tapes. The "Scotch" brand magnetic tape viewer, No. 600, can be used to check recorder head alignment, track placement, pulse definition, inter-

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- Nor will you find that McIntosh amplifiers are limited to 15 seconds at full treble power as are some of today's transistor amplifiers.
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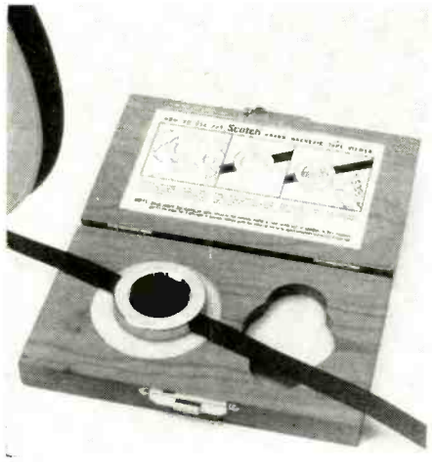
block spacing and dropout areas in computer and instrumentation work. It also can be used to examine and synchronize the audio track on video tape and the pattern of recorded sound on audible range tapes. It also will determine, easily and quickly, whether tools, heads or guides are magnetized. The viewer was under development for three years. One of the first prototypes was used to align pieces of an airplane recorder tape which provided the clue to the cause of a military



aircraft explosion. The tape had been broken and scattered over a wide area by the explosion. The viewer is a quality, but delicate instrument, which requires no exterior chemicals and no preparation to use. It costs $50, and is covered by a six-month guarantee against defective materials and workmanship. 3M Company, 2501 Hudson Road, St. Paul 19, Minn. **L-7**

• **Portable All-Band Radio.** A unique, transistorized, high fidelity portable radio that operates on five standard flashlight batteries was unveiled recently by Tandberg of America, Inc. The new product is said to be the first in a series of newly developed transistorized audio equipment to be designed and manufactured by Tandberg Radiofabrikk of Oslo, Norway, and features AM, FM, Short Wave, and Marine Band reception. The radio features a hand-rubbed teakwood cabinet and a carrystrap,

includes a 9-in. × 5-in. Tandberg speaker and weighs approximately 5.5 lbs. It also offers treble and bass controls, printed circuitry, receptacles for tape recorder and phonograph jacks, two antennas, (one for AM and the other for Marine and Short-wave reception), plus a retractable antenna for FM reception. Price is $149.50 and it is available only through authorized Tandberg tape recorder dealers. Tandberg of America, Inc., Pelham, N. Y. **L-8**

EQUIPMENT PROFILE

(*from page 56*)

First, the unit has approximately 20 db gain over the standard dipole. Even more surprising, this gain is maintained over the entire FM band. This means that a marginal signal, as received with a dipole, can be lifted to virtually complete limiting when received via the Multitron. However, if the limiting action of the tuner is poor, this improvement may not be brought about because there is some noise present within the Multitron. A tuner having limiting will remove this noise. The limiting in most FM tuners is sufficiently good that this is not a serious deficiency of the device.

Second, the conventional folded dipole is bidirectional whereas the Multitron exhibits a cardioid pattern. The rejection of signals from the rear of the Multitron contributes materially to the reduction of multipath distortion. We all know how important this can be to the reception of FM stereo.

Third, the Antronics Multitron is small and this allows it to be positioned easily for maximum signal strength. It is not easy to position a folded dipole because of its length and because of the flexibility of the ribbon from which such a dipole is made. The dipole, therefore, is usually placed on the wall and left in that position, but the Multitron can be placed on top of your equipment cabinet and positioned as required to receive a given station.

Beyond all of this, though, the Multitron is subject to all other limitations to which indoor antennas are subject. For instance, this device is not immune from reflections which can reinforce or cancel signal as people in the room walk about. If the room in which the device is located is so well shielded that virtually no signal is present, the Multitron will not bring about wonderful reception. The only cure for such problems is to erect an outdoor antenna.

To boil all of this down, we believe that in the majority of installations the Multitron will bring about a great improvement in FM reception. **L-22**

DUAL AUTOMATIC TURNTABLE, MODEL 1009

Everyone who is familiar with the predecessor of this new record-playing turntable is in for a rather delightful surprise; the Dual people have done a remarkable job in achieving improvements to an already excellent record player. In fact they have created a new, high-quality turntable which will play up to ten records automatically.

First, let us take a look at the 1009 and see what it can do. As we noted it will play up to ten same-size records automatically or it can play records one-at-a-time, manually. It will play 7-, 10-, and 12-in. records by positioning a slide switch at the proper designation. It plays any one of four speeds (16⅔, 33⅓, 45, and 78 rpm) and it can correct for speed variations of any of these speeds within a range of 6 per cent.

Speaking of ability to play records, we saw a demonstration where the 1009 tracked perfectly well with the table tilted almost to 90-deg., with warped records, and with eccentric records (center hole). Being a doubting Thomas by nature we tried it ourselves—and found that it behaved that well for us too. This means that the arm is balanced in all planes, which is a valuable characteristic for automatic turntables. But more about that anon, let us look at the parts more closely before we return to performance.

The Drive Mechanism

The 1009 utilizes a relatively high torque four-pole motor with a four-stepped shaft to drive a rubber idler at one of the desired speeds, the idler in turn contacts the inner rim of the platter. Each step of the four-stepped motor shaft is tapered, and the idler is moved up and down on the tapered step to adjust speed by rotating the speed-adjust knob.

The cycling of the arm is achieved by means of a cam, similar to the one on the 1006, which drives levers that raise and return the arm to its rest position. Motion is imparted to the plastic cam by a gear affixed to the upper end of the turntable shaft, which contacts the geared outer edge of the plastic cam. There is a "dead spot" in the plastic cam in which the table gear normally resides, thus avoiding contact while the arm is playing a record. When the automatic start switch is thrown, or the eccentric end grooves of the record are played, the plastic cam teeth engage the table gear teeth, and away the arm

Fig. 7. Dual 1009 Automatic Turntable.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

AUDIO, published Monthly at Lancaster, Pa., for October 1, 1963

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher: Charles G. McProud, 204 Front St., Mineola, N. Y.; Editor: David Saslaw, 204 Front St., Mineola, N. Y.; Managing editor: none; Business manager: Henry A. Schober, 204 Front St., Mineola, N. Y.

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue). 35,500

(Signed) HENRY A. SCHOBER, Business Manager.
Sworn to and subscribed before me this 4th day of October, 1963.

(Seal) Murray P. Wolder, Notary Public.
State of New York, No. 30-9720800. Qualified in Nassau County. Term expires March 30, 1964.

goes in cycle—onto the lead-in grooves or back to the arm rest. Of course this same plastic cam is the heart of the record-changing mechanism, essentially the same unique system employed on the Dual 1006 Custom. Basically it consists of a hollow spindle with two sets of fingers that can be retracted or extended at the proper moment in the cycle. The upper fingers are normally retracted but extend out to lift all but the bottom record of the stack up during the change cycle. When the other records are up, the bottom fingers, normally out supporting the stack, are retracted to allow the bottom record to fall to the turntable. Then, of course, the bottom fingers extend again to support the stack which is lowered when the upper fingers retract. Simple and foolproof.

The Arm and Turntable

The arm is a lightweight, modern unit which features a counterweight which is isolated from the arm by damping material, canted pivots, plastic plug-in cartridge mount, and a built-in stylus-force adjustment.

The counterweight, besides being isolated, has both a gross and fine adjustment for the balancing procedure; gross adjustment is accomplished by sliding the counterweight back and forth on its shaft (a thumb screw is used to hold it in place), and fine adjustment is achieved by rotating the weight on the fine-threaded screw on which it is mounted.

The vertical pivot consists of a hardened steel pointed shaft supported by ball bearings. Horizontal motion is supported by a pair of ball bearing units. Stylus force is set by means of a coil spring around the vertical pivot point.

The turntable itself is a seven pound casting whose shaft is rather unusual in that it is hollow and contains a bronze bearing sleeve inside it. In other words, the turntable has the bearing well while the shaft itself is mounted on the deck. For vertical thrust, the end of the turntable "well" rides on top of a ball bearing unit which is mounted at the base of the "shaft" on deck. Sounds rather complicated but it really isn't, its just hard to describe.

The turntable is balanced by a rather unusual system. About a dozen holes are drilled on the underside of the outer rim of the turntable and selected ones are filled with molten metal to balance the table. This procedure is just the reverse of the usual one wherein holes are drilled as necessary at selected points. We have no idea which procedure is better although we would imagine that the usual procedure is easier.

Performance

We have noted in the past that a turntable-arm combination must meet certain basic requirements. First of all it must turn the record at exactly the right speed. Secondly it must not introduce a signal of its own in the form of arm resonances, wow, flutter, and rumble. Third it should follow the record groove with a minimum of distortion.

Insofar as speed accuracy is concerned, the Dual 1009 has no problems since one can easily adjust the speed. We found that we were able to achieve exact speed, and maintain it. In our opinion the ability to vary speed is a real asset, especially if one is playing a mixed bag of European and American records. It seems that there are some slight variations in pitch which can be compensated for by a variation of 6 per cent in speed.

Rumble level in the 1009 is significantly better than the 1006, measuring in at 39

by NAB standards. Flutter and wow measured in at 0.2 per cent, again an improvement over its excellent predecessor. Arm reasonance was below 10 cps.

One of the claims made by the Dual people is that the 1009 will track well with a stylus force of ½ gram. This may be true but unfortunately we were unable to verify it since we do not possess a cartridge which operates well at that force. In fact we suspect that one would be hard put to find a production cartridge that will. We don't mean to imply that there are no cartridges that can operate at ½ gram; but we do believe that there are none which are at their best at that force. In any case we did operate a cartridge at a tracking force of 1 gram quite well—and that's excellent performance by any standard. We did note however that tracking force did have to be increased to handle the top of the stack of records—by about ¼–½ gram. Conversely, we could have used somewhat less on the first record. The optimum height level is about 4–5 records, and from top to bottom there was a variation of about ½ gram. (The variation could be a little less than noted because of the difficulty of making accurate and valid measurements, but we are not very far off.) While speaking of tracking, it should be noted that the arm makes no compensation for "skating," or as they say in England, "sidethrust." It's not a large problem, but nevertheless it is well known and solvable—it should be solved in the 1009.

Altogether the Dual 1009 is an extremely fine automatic turntable, certainly one of the finest. Its modest price (less than $95) and many fine features make it well worth considering if you are looking for a turntable. **L-23**

Postponed

The PROFILE on the Heathkit IM-30 Transistor Tester, announced for this issue, must of necessity be delayed until the December issue because of lack of space. It is sincerely hoped that this postponement will not inconvenience anyone, and especially the Heath Company.

LETTERS

(*from page 6*)

4. *Obsolete.* Anyone who has followed audio developments knows that this is a bunch of hogwash.

5. *Breakthrough.* I recall one manufacturer's ad, complete with movie star, which says: "——— ——— is the breakthrough you've been waiting for." How in the world does the movie star know what I've been waiting for? How come that a few months later the same star has a new breakthrough? What happened to the old one that I'd been waiting for?

6. *Monaural.* We've all agreed that "Monophonic" is the correct terminology for single-channel reproduction. So why do so many advertisers insist on using the wrong term?

7. *Four Track.* I believe that quarter track is the correct designation. Four track, to me, means four separate channels recording on four different tracks at the same time in one direction.

8. *Pre*—No one ever asks for a "prerecorded disc" in a record shop yet both blank tape and discs are available. A speaker cabinet kit that is: "pre-drilled, pre-cut and pre-sanded" would be no less convenient if they had stated that it was: "Drilled, cut, and sanded." Kraft even has "Pre-sliced Cheese." I shudder to think of using old fashioned sliced cheese.

9. *Original Sound Track Recording.* This, in the same way as "Special," implies that there must be sound track recordings on the market that are copies rather than the original. Since many of the movies are recorded in as many as six or seven tracks and that there are music tracks, dialogue tracks, sound-effect tracks, work prints, release prints, and so on, which tracks are we getting at home? Certainly not the ones made on the set.

ROBERT F. MCDONALD
11 Vista Via
Lafayette Calif.

He's Annoyed at Canby

SIR:

I generally enjoy reading Edward Tatnall Canby's columns very much. However, his comment on Gerard Hoffnung's death in the Record Revues of the May issue was not only silly, but in atrocious taste as well.

I wish Mr. Canby would apologize to the memory of the man who both inspired the Hoffnung Music Festival and delighted many with his engaging and sometimes brilliantly perceptive cartoons about musical performers and instruments.

BENJAMIN FOLKMAN
Brooklyn, New York

Canby Replies

Neither silly nor atrocious, I hope. Perhaps I could have used better phrasing, but the idea stands: having no personal acquaintance with Mr. Hoffnung, I know him strictly through the audible recordings of the Festival; for me (and for most of us) he exists, or existed, in these terms alone. The latest recording struck me as the best—therefore, Mr. Hoffnung's personality is duly enhanced. If it is a *post mortem* enhancement, then it is the more interesting: the man's work lives and grows on after him.

E. T. C.

ORGAN MUSIC

(*from page 44*)

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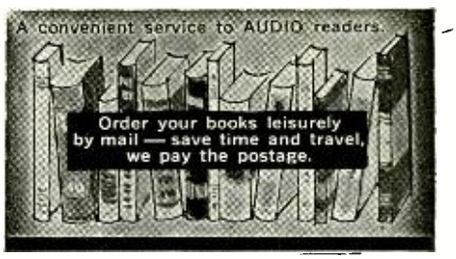

Maintaining Hi-Fi Equipment
Joseph Marshall

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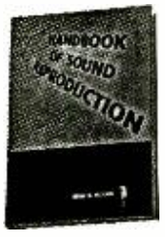

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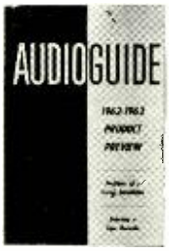

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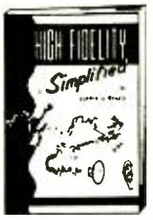

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Magazines, Inc.
12. Robert L. Eby, "Electronic Organs." Wheaton, Ill.: Van Kampen Press.
13. Louis Vierne, "Twenty-Four Pieces in Free Style." Paris: Durand et Cie.
14. J. S. Bach, "Complete Works, Vol. II." Ed. C. M. Widor and A. Schweitzer. New York: G. Schirmer.
15. J. S. Bach, "Orgelbuchlien." Ed. Riemenschneider, Philadelphia: Ditson.
16. Felix Mendelssohn, "Organ Works." Ed. Warren. New York: G. Schirmer.
17. J. Bonnet, "Historical Organ Recitals. Vol. 1." New York: G. Schirmer.
18. Cesar Franck, "Three Chorales for Organ." Ed. Barnes. New York: G. Schirmer.
19. American Guild of Organists, 630 Fifth Avenue, New York 20, New York.
20. Norman C. Pickering, Electronic simulation of organ sounds. AUDIO, June, 1963.
21. G. Donald Harrison (Narrator); Record, *"The King of Instruments Vol. I."* Available from Aeolian Skinner Organ Co., Boston 27, Mass.
22. Edward K. Dunham, "The Small Church Organ," Organ Institute Quarterly, Volume 7, Number 4, Organ Institute, Andover, Mass.
23. W. H. Barnes, "The Contemporary American Organ." Glen Rock, N. J.: J. Fischer and Bro.

AUDIO ETC

(*from page 16*)

atic; none is Caruso. I was a Baroque fiend then—Bach, Purcell, Handel, and the like. Who offers cash for those?

These poor discs, all in neat green cardboard folders, sit in vertically oriented piles, mostly in my attic. They suffer, and will continue to suffer; I'm too busy with piles of verticaly stacked new LP's to get around to giving my 78's first aid. I just hope they'll survive; I straighten them out and line them up now and then, usually finding one or two old discs "pouring" down hill from having got one edge displaced out into space. Too bad. Can't be helped. Occasionally, one of these comes in mighty handy in my broadcasts on current LP recordings. Fine comparison. I riffle through the piles until I find the one I want; or give up hunting. Best I can do.

Those singles are all electric and range from 1927 or so through 1947, the bulk, of course, solidly pre-war. (But I enjoy having some of the post-war London Deccas around, for hi-fi history.) They aren't the type for the auction people; just a heavy sentimental association for me, personally. And maybe for a batch of other collectors, unorganized and auctionless, from here to anywhere and back. We all have our favorites—how many of us have the same ones? That's what makes for a collector's item.

And so we come to the ubiquitous LP. Fourteen years already. I don't have Columbia's Number One, which should be ML 4000, but as indicated in our Anniversary issue last May, I do have a nicely representative cross section of those fourteen years, including four of the first paper-folder Columbia LP's (more were begged, borrowed and stolen), starting with ML 4002. More important, I have around many of the thousands and thousands of LP's now out of print. I particularly enjoy having on hand the outputs of dozens of small companies which blossomed in the early LP days, flourished awhile and then sadly sank into oblivion. Also the major offerings of longer-lived and more prolific has-beens

like Urania (in several corporate existences), Haydn Society (the same), Concert Hall Society; also the early products of the survivors that have now been reorganized with attendant cut-outs on vast numbers of earlier releases, such as Westminster.

Also the original (non-RIAA) versions of many a disc from Westminster and Vox now reissued, RIAA-cut and much improved in quality (especially the surfaces) at bargain low prices. I *enjoy*, I repeat, owning the inferior originals that cost more! It's interesting to have them. They're worth a lot to *me*. Probably not a red cent to anyone else. You see, I really am a born collector. But not an auction-type collector.

Did I mention the Urania LP that I listed among my ten-year samples from 1952 last May? Outfit in England wrote me asking please for a tape copy; the local record club wanted a chance to hear this priceless out-of-print performance, two works by Richard Strauss. I haven't had a chance to make a tape yet, but the story is worth repeating. The older LP records are now beginning to get themselves out of the ten-cent junk era and into the mere beginnings of a budding collector's field. What a field day we'll have when the LP really arrives, at the collectors' auctions! Look how much more you get, per copy! And look at the fi. Terrific.

In forty years, if they aren't melted down and vaporized by "the bomb," the old LP's are going to make the biggest collector's boom in record history. By that time most of the 78's will be broken, anyway. People will be selling priceless taped copies. If there's any tape.

Of course, there are still those 78 albums. They still sell at ten cents, or get given away as junk. A generation of fine music, mind you, and there isn't an album that can't be put on tape for a compact long-play performance if you don't like the weight and the fragility. My suggestion to the auction men is this: Keep on mulling through those old operatic singles—they'll do for awhile longer. But, quick, start right now buying up 78 albums; or beg them, or let people pay you to cart them away. Then, quick-like, get yourself a mailing list of tape recorder owners. You'll have to buy it most likely. Mailing lists are collector's items, too, remember. It's worth the money, just the same. Do it now.

Once we dispose of the 78 album problem, we'll move ahead and onwards to the Day of the Priceless LP. Will I be in the clover then! Alas, though, I'm a nutty collector. The more a record is worth, the more I feel I just *have* to have it for myself.

I've already decided to leave my entire collection to the wealthiest university I can locate. Æ

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FOR SALE: Harman-Kardon Citation A preamplifier, serial number 5310163, factory wired, never used. $200, prepaid. Audiophile Records, Inc., Saukville, Wisc.

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Industry Notes . . .

● **Pilot Moves to $2,000,000 Plant.** Pilot Radio Corporation recently completed a shift of its operations to a modern $2,000,000 plant in Yonkers. The 165,000-square-foot building triples the firm's manufacturing capacity in support of a major expansion program. Pilot has achieved a 65 per cent increase in sales volume in the past nine months compared to the same period last year, according to Roland J. Kalb, vice president and general manager. The company's new facility will allow for expansion and the use of modern production techniques unavailable to the growing company in its five-story Long Island City plant, which it had occupied for the past 30 years. The new plant is located on a landscaped site east of the Bronx River Parkway where New York City, Mount Vernon, and Yonkers converge.

● **Eric and Ionic Merge.** Eric Electronics Corporation of Santa Monica, California and Ionic Industries, Inc. of the same city have merged all sales and administrative activities under the personal direction of Irving Rossman, it was jointly announced today by Eric Feigl, president of Eric Electronics, and Irving Rossman, president of Ionic. Sales and administrative offices will be located at 1823 Colorado Avenue, Santa Monica and all correspondence should be directed to that address.

ADVERTISING INDEX

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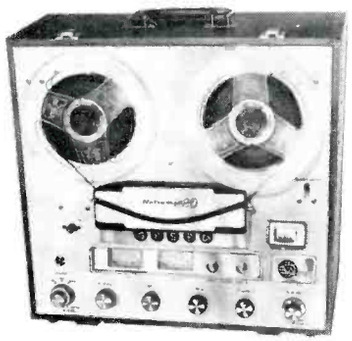

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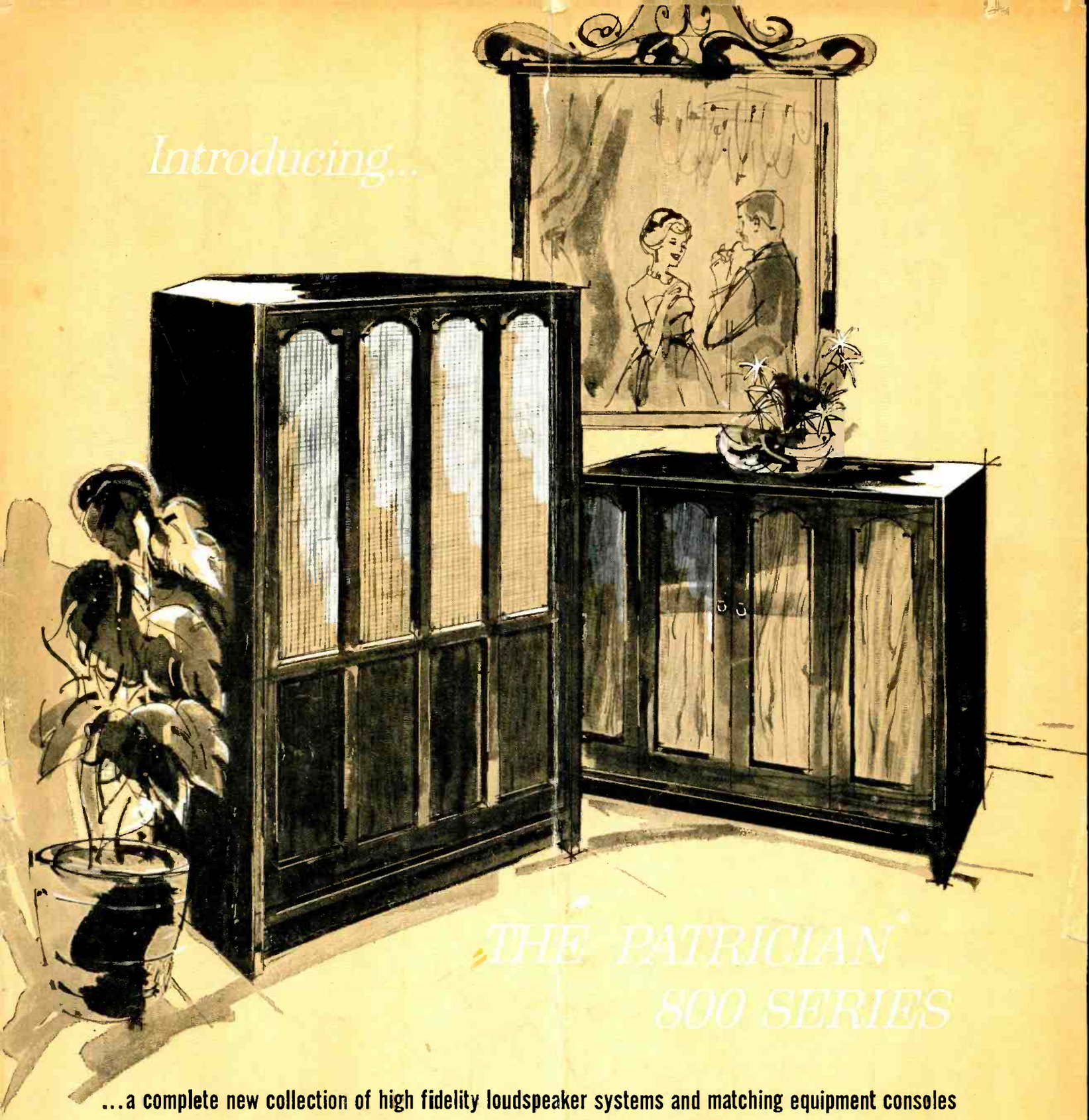

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